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 Consultants Preparing Syntheses

TRB
Transportation Research Board
National Research Council
Washington, D.C.

October 2017

1.0 OVERVIEW OF AN AIRPORT, HIGHWAY, OR TRANSIT SYNTHESIS OF PRACTICE

National Highway Cooperative Research Program *Research Results Digest 401*: Continuing Project to Synthesize Information on Highway Problems; Transit Cooperative Research Program *Research Results Digest 113*: Synthesis of Information Related to Transit Practices; Airport Cooperative Research Program *Research Results Digest 26*: Synthesis of Information Related to Airport Practices provide you with a current overview of the synthesis program (pages 1 and 2 are most helpful as an overview).

Syntheses provide additional insight on what are the “philosophy” and objectives of a synthesis. This supplements the Research Results Digests.

Each report should synthesize the state of knowledge and practice for the topic in accordance with the scope, including what belongs and what does not belong. This requires a review of pertinent literature and research, and an examination of current practice, and typically includes surveys of transportation agencies or others concerned with the topic (stakeholders). Information gained from these sources is then organized into a concise document that describes current knowledge and practice comprising a “snapshot of existing experience.”

Specific, detailed information should be available to the reader; for example, each transportation agency’s response to survey questions. Often such information is best presented in tables, charts, or appendices, rather than narrative form.

2.0 THE SYNTHESIS STUDY PROCESS

The staff assigned to the project, the responsible staff officer (RSO) will assist the consultant principal investigator (PI) in delivering a Synthesis that is consistent with TRB Standards. The typical synthesis study process is described below, however, the RSO and PI might modify or add steps and deliverables to the process in order to reach a publishable report in a timely manner Figure 1 displays a typical ACRP or TCRP synthesis study schedule. Figure 2 displays a typical NCHRP synthesis study schedule.

2.1 Scope

Topics are selected by the ACRP 11-03, NCHRP 20-05, and TCRP J-07 Oversight Committees. The scope that guides the consultant’s work is written by a Topic Panel at their first meeting.

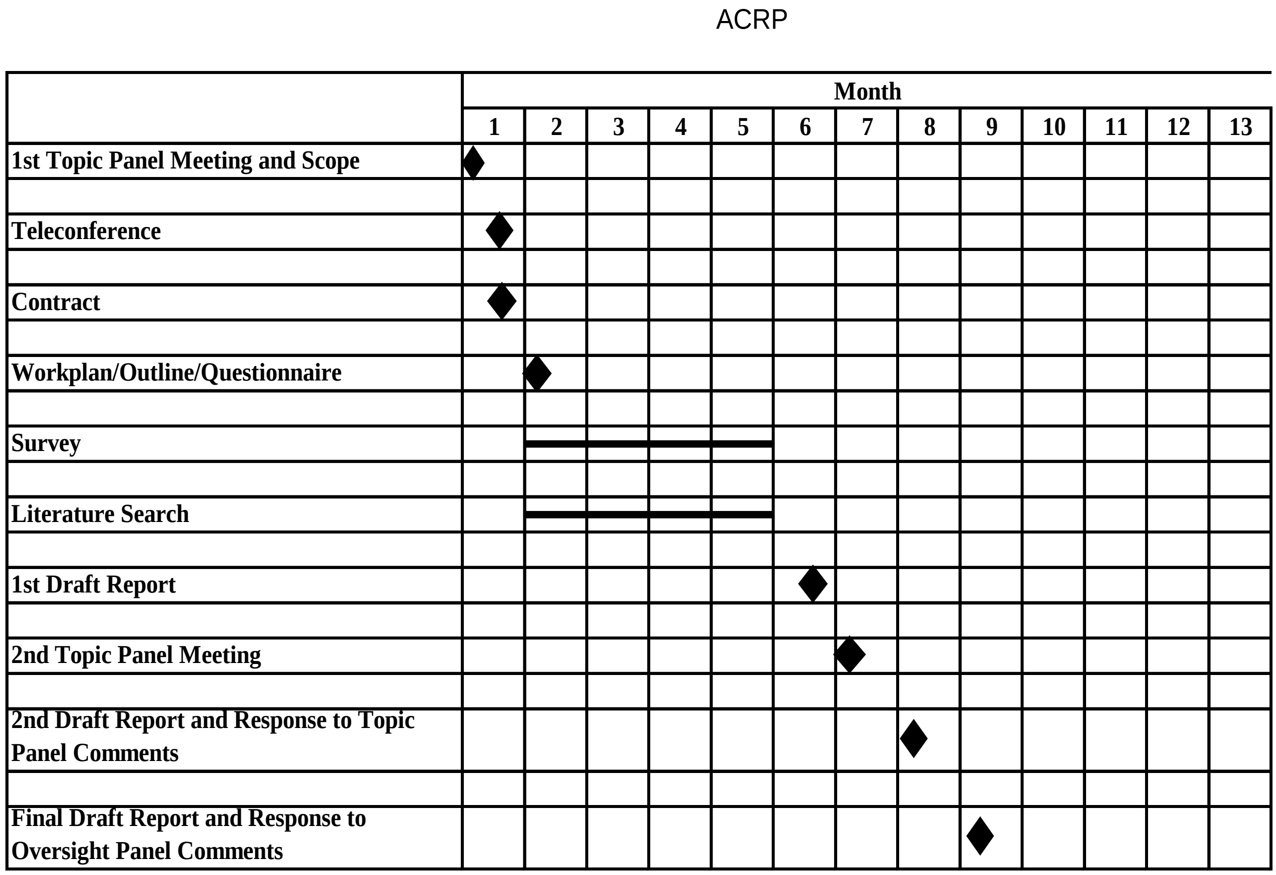

FIGURE 1 Typical ACRP/TCRP synthesis study schedule.

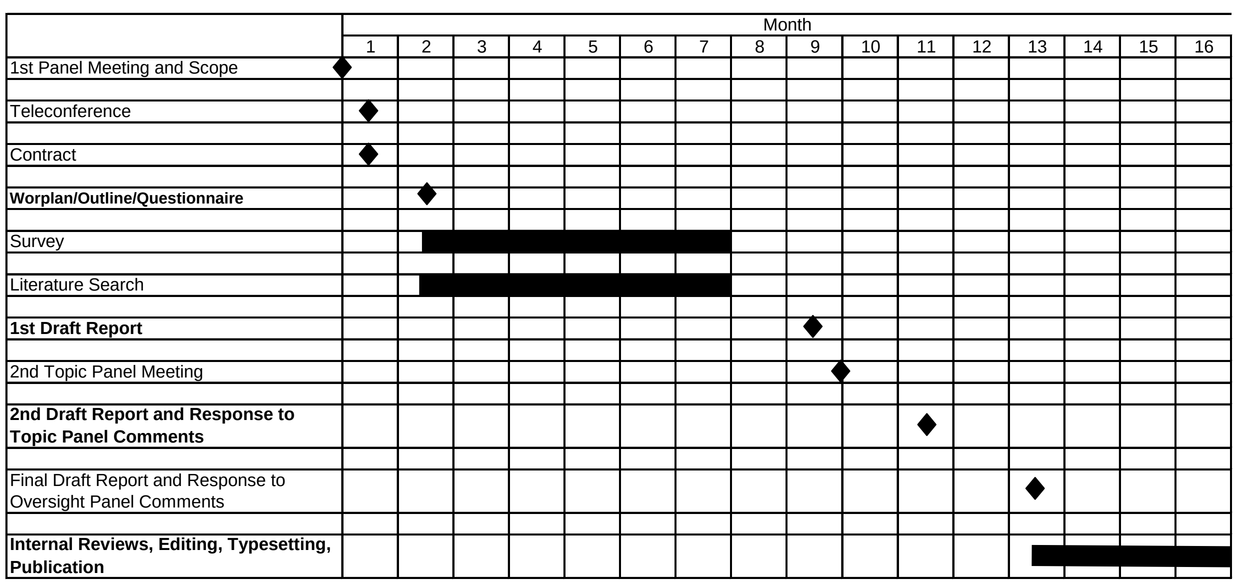

FIGURE 2 Typical NCHRP synthesis study schedule.

2.2 Topic Panel

Topic panels are selected for their expertise in the topic. They are responsible for preparation of the detailed scope of work, consultant selection, they guide and assist the consultant during the research process, pretest the survey or interview guide, review the technical content of the consultant's work, and at the end vote on the adequacy of the report for publication.

Staff forwards discussion notes from the first topic panel meeting, and arranges a conference call between the consultant and the project panel. Regular informal communication between consultants and Topic Panel members is encouraged during the course of the study.

Staff communicates with selected consultant and discusses both the finalized scope of work, contracting documents needed to execute contract, and the synthesis process.

2.3 Teleconferences

Staff will have a teleconference with selected consultant to inform him/her about the selection and the Synthesis process moving forward including the *Instructions to Consultant Preparing Synthesis*.
Staff arranges a one-hour teleconference between the topic panel and consultant approximately concurrent with contract execution/project start, two to five weeks after consultant selection at first project panel meeting. The teleconference is designed to introduce the panel members and consultant, have the panel members offer guidance and assistance, and resolve any questions on the scope of work or level of effort required. In advance of the teleconference, the consultant is asked to provide questions to guide the discussion. The conference is also the time to solicit assistance from the panel and to confirm the schedule of deliverables and meetings.

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

Consultant(s) prepare a draft work plan, report outline, and survey/questionnaire, and list of proposed survey recipients for review and comment by project staff and panel members. The work plan should cite the major elements necessary to perform the work and a schedule of benchmarks by which the staff can monitor the consultant's progress. These benchmarks should conform to the contract dates. The outline should include a list of chapter titles, major headings and subheadings, and a brief description (one sentence) of what the chapter, section, or subsection will cover. In preparing these chapters the consultants should be aware of TRB standard synthesis format (as explained in Section 4.0.and should include an executive summary, literature review, survey results, case examples, etc.)

The draft questionnaire should be prepared in a manner that follows the report outline and balances the need for information with the need for brevity. Close-ended multiple choice questions are desirable unless data collection is by interview, which allows clarifying and follow-on questions. Specific procedures for the formulation, review, and distribution of survey instruments are required. Open-ended questions are undesirable unless there is a compelling reason otherwise. Questionnaires, surveys, and related materials *must* be coordinated with the project staff.

2.5 Survey

Once the work plan, outline, and survey questionnaire are approved by the topic panel, the consultant shall pretest the survey with at least three people who are typical of survey respondents before conducting the survey to the targeted population In general, a TRB staff transmittal accompanies the survey, and responses are directed to the consultant. Questionnaires are distributed electronically. TRB encourages the use of SurveyGizmo and provides consultants with guidelines and survey templates, which can be found at the following link:
http://onlinepubs.trb.org/Onlinepubs/sp/SurveyGizmoGuidelinesfortheSynthesesPrograms.doc.
Consultant should strive for 80% to 100% return rate, with 80% considered the minimum acceptable.

2.6 Literature Review

A literature review is conducted to obtain information on current knowledge, practices, and relevant research pertaining to the synthesis topic. TRB's Transportation Research Information Documentation (TRID) is an integrated database that combines the records from TRB's Transportation Research Information Services (TRIS) Database and the OECD's Joint Transport Research Centre's International Transport Research Documentation (ITRD) Database and should be helpful for this. TRID provides access to more than 1,100,000 records of transportation research worldwide. More than 207,000 records contain links to full-text documents.

The literature review should answer the question of what we know or do not know about this particular topic. A literature review is not an annotated bibliography in which you summarize briefly each article that you have reviewed. Instead, the review should contain an analysis of the relationship among compiled works.

2.7 Case Examples

Case examples effectively illustrate an agency's current practice. Agencies/sites (usually 4 or 5) may be selected for in-depth documentation of their current practices. Information is typically developed through telephone interviews, with review and approval by the interviewee before publication. Site visits are not expected nor does TRB reimburse any costs associated with site visits. The panel may provide guidance on agencies to select for case examples.

2.8 First Draft Report—Stage 2 (Second) Deliverable

The first draft of the report takes the form of a consultant report. A completed first draft is due at least two weeks prior to the second meeting of the Topic Panel. The date of this meeting is set at the first Topic Panel Meeting; <u>this is a firm date</u>. First draft reports must be complete, including summary, all report sections, conclusions, and appendices; all graphics (figures and tables) are embedded.

The staff and consultant, may set some other deliverable dates (for example, for the literature review chapter, initial conclusion, survey sample chapter, etc.)

2.9 Second Topic Panel Meeting

The purpose of this second meeting is to work face-to-face with the topic panel to review the first draft of the synthesis report. TRB funds travel and lodging for the consultant to attend the meeting to discuss the first draft and receive comments from the panel as well as their marked-up drafts. At the close of the second panel meeting, staff will provide the consultant with a list of principal panel comments needing attention and requiring written responses. If the panel deems it necessary, conference call(s) interim to the next deliverable will be scheduled at this time.

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

After the second topic panel meeting, the consultant delivers a second draft to respond to the topic panel review of the first draft. This draft shall be accompanied by a document of point-by-point responses to the panel comments on the first draft. This second draft is sent by staff for review by the topic panel and two members of the ACRP 11-03, NCHRP 20-05, or TCRP J-07 Oversight Committees for final panel review and ballot. This deliverable should take the form of a completed consultant report with embedded graphics and appendices placed appropriately.

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

Upon receipt of written comments from the topic panel and two members of the ACRP 11-03, NCHRP 20-05, or TCRP J-7 oversight panels, the consultant delivers a third and final draft and written response to comments.

2.12 Internal Reviews, Editing, Typesetting, and Publication

The final draft report is forwarded by the RSO to The National Academies Subcommittee for National Research Council Oversight (SNO) for final review and approval.

Following; SNO review and approval, technical editing begins. For editing and typesetting to begin, the TRB editorial staff requires a double-spaced MS Word document with all graphics removed and saved individually in separate electronic files. Appendices should be transmitted separately and the author should assume that these will be placed in the published report with no or minimal revisions, including technical editing. See Section 3.4 (below) for further guidance to the final draft.

The use of active links within a report should be noted in the final draft by the use of underlining.

3.0 SUBMITTALS/DELIVERABLES

There may be slightly different requirements for ACRP, NCHRP, and TCRP synthesis submittals. Check with your RSO about these.

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.

3.2 Stage 2—First Draft Report

The first draft report shall be a complete report in MS Word with all sections and embedded graphics submitted electronically (no footnotes). Because the report will be reviewed and commented upon by the topic panel during this stage, line numbers are required for each page of the report. Appendices do not require line numbering.

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

At the conclusion of the panel meeting where the first draft report is reviewed, a topic panel comment document will be compiled and provided to the principal investigator. The second draft report shall be a complete consultant report with all sections and embedded graphics. Line numbering is not desirable. Both the second draft report and comments and responses document shall be delivered electronically.

3.4 Stage 4—Final Deliverables

Comments from the review of the second draft are returned to the consultant for final revision. The consultant shall provide written point-by-point responses to the review comments as well as action taken, cross referenced to report pages revised. Otherwise, the response should state the reasons why revisions were not considered necessary. The final draft report shall be a complete synthesis report with all sections and embedded graphics. All final deliverables shall be delivered electronically.

For editing and typesetting to occur, the TRB editorial staff requires a double-spaced MS Word document with all graphics removed and saved individually in separate electronic files. The typesetting process will reformat the consultant report.

The final report is reviewed by the Subcommittee on NRC Oversight (SNO). The report must avoid directive words such as **best, should, must, require, recommend, etc.**

The following electronic files delivered to the RSO's e-mail address are required for the final submittal:

- Final Consultant Report with all graphics and appendices embedded, no line numbering

- Double Spaced Final Draft Report, no line numbers, no embedded graphics, no appendices
- Each graphic in a separate file
- Each appendix in a separate file
- Cover picture, color or black and white, with accompanying description and source/credit information
- Comments and responses document to Stage 3 ballot comments.

3.5 Invoices

All invoices should be sent in pdf format directly to BPM via e-mail to invoices@nas.edu The invoices are then audited by TRB business staff and sent to the RSO for approval.

4.0 ELEMENTS OF THE REPORT

Following is a discussion of the principal elements of a typical published synthesis report, ordered as they should be in the published report. **These instructions are part of the contract.** Reports 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.

4.2 Title Page

TRB staff will create the title page for all drafts. The consultant will need to provide author information (names and affiliations) for this page.

4.3 Foreword and Preface

TRB staff writes these.

4.4 Table of Contents

The table of contents should show chapter and appendix titles and level one (or “A”) headings and page numbers, except for the final manuscript, for which page numbers are not necessary. Contents pages should be included with all drafts reports.

4.5 Summary

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

- No more than four pages (1,700 to 2,100 words)
- No headings
- No text boxes
- 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:

- The background and objectives of the synthesis.
- Major findings of the synthesis—One or two paragraphs describing the major findings. The opening paragraphs should be concise and to the point, written with direct and straightforward sentences. The first sentence is an opportunity to capture the reader’s immediate attention. A

good summary does not simply restate the scope of work, but will paraphrase, summarize, and incorporate information from the work itself.

- 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 response rate as a percentage)?
- Major conclusions (in brief)—should be concise and to the point; drawing from, but not repeating, the analytic "Conclusions" section (see Section 4.8).
- Suggestions for future research, if applicable—What are the gaps in knowledge identified in this Synthesis and what can be done to fill the gaps and remove barriers to implementation of promising methods or practices?

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 description of the survey process.

4.7 Intermediate Chapters

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

4.8 Conclusions and Further Research

The conclusion chapter of a synthesis, probably the second most widely read section of the report, is intended to portray the current state of practice through a technical assessment of the facts and information presented in the preceding chapters. Conclusions must be well supported and documented in the report. 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 report author; however, such practices should not be presented as "best" practices or "recommended" practices.

1. A brief reiteration of the background and objective of the synthesis—no more than two or three sentences to place the information in context.
2. Summary of the findings from the previous chapters—no more than two or three sentences for each chapter. The report author has conscientiously grounded his/her findings in the project survey responses, literature review, and interviews and does not recommend particular practices except as recommended by others.
3. Statements of barriers to widespread implementation of promising methods or practices—should be presented as observations or conclusions, not as recommendations.
4. Further research—should be limited to statements of the important knowledge gaps identified in the synthesis study and suggested research that could fill those gaps.

No new information should be presented in the conclusions.

4.9 References

Consultants 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 report 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

Non-standard abbreviations and/or acronyms should be provided in a list that will follow the Glossary. Any abbreviation or acronym that is used three times or more in the body of the text should be included. A list of standard abbreviations that can be used without definition in a report can be found on the inside back cover of any Synthesis or Cooperative Research Program report.

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, for example:

> **APPENDIX A**
> **Survey Questionnaire**

and be specifically mentioned in the main body of the text. Provide a list of appendix titles with the draft report. Appendices follow the References (or Bibliography, Glossary). Appendices of substantial length may be considered as a web-only portion(s) of the document.

For Synthesis reports with surveys, make Appendix A the survey questionnaire and Appendix B the list of survey respondents.

5.0 REPORT STYLE GUIDE

The current edition of Webster's *Third New International Dictionary* (2002) and the 16th Edition of the *Chicago Manual of Style* (2010) (and the Chicago Manual of Style Online: http://www.chicagomanualofstyle.org/home.html) are the preferred reference sources for spelling, capitalization, and compound words.

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 there are more than six authors/editors for any one citation, cite the first author and et al. (e.g., Smith, J.Y., et al.).
- 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

    1. 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).
    2. The italicization of titles follows the rules for printed publications and documents.
    3. The uniform resource locator (URL) identifies the location of the source on the Internet. Case should be preserved because it may be significant. Include "http://" if given.
    4. 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.
    5. 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.

Ogden, K.W., *Safer Roads: A Guide to Road Safety Engineering,* Ashgate, Brookfield, Vt., 1996, 536 pp.

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.

Jaraiedi, M., R.W. Plummer, and M.S. Aber, "Incentive/Disincentive Guidelines for Highway Construction Contracts," *Journal of Construction Engineering and Management*, Vol. 121, No. 1, Mar. 1995, pp. 112–120.

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.

New Jersey Pavement Rating System to Determine Resurfacing Priorities, New Jersey Department of Transportation, Trenton, Feb. 1986.

Jeffers, J.P., et al., *Audit Stewardship and Oversight of Large and Innovatively Funded Projects in Europe*, Report FHWA-PL-07-001, Federal Highway Administration, Washington, D.C., 2006, 60 pp.

Hugo, F. and A.L.E. Martin, *Synthesis of Highway Practice 325: Significant Findings from Full-Scale Pavement Testing*, Transportation Research Board of the National Academies, Washington, D.C., 2004, 201 pp.

Asphalt Institute, *Thickness Design—Asphalt Pavements for Highways and Streets*, Manual Series No. 1, Lexington, Ky., Sep. 1981.

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).

State of Tennessee, Public Law 699, Tennessee Code Annotated, Title 4, Chapter 11, July 1, 1988.

MANUAL, GUIDE:

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

Utah State Department of Highways, *Manual of Instructions, Part 8: Materials*, Utah State Department of Transportation, Salt Lake City, 1966.

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:

McCormick, C., "Planning for the Big Event: Making Passengers Feel Welcome and Comfortable Is Paramount. All Else Follows," *Centerlines*, Oct. 2009, pp. 68–73 [Online]. Available: http://www.nxtbook.com/nxtbooks/naylor/ACIQ0309/index.php?startid=68#/68.

"QualServe Fact Sheet," QualServe, 2011 [Online]. Available: http://www.awwa.org/files/QualServe/FactSheet/QualServefact%20sheet2011.pdf [accessed Aug. 6, 2012].

Federal Highway Administration (FHWA), *HSIP Assessment Toolbox*, FHWA, Washington, D.C., 2010 [Online]. Available: http://safety.fhwa.dot.gov/hsip/resources/fhwasa10017/peer.cfm [accessed Dec. 12, 2012].

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 footnotes, if necessary.

- For editing and typesetting, submit each table on a separate page, apart from the text material.
- Column heads cannot be repeated or 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 after title or denote source as footnote).
- Notes may be added when the information pertains to the entire table.
- Include a separate list of table titles with the draft report.
- 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 footnote (e.g., missing data, data not available).
- Use superscript numbers for footnoting material in any part of the table. Footnotes 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 black and white printing.

- Do not embed artwork with text files (provide separate files for each piece).
- (Half-tones) Submit at 300 dpi at a minimum size of 3 in. x 3 in.
    - (Line art) Scan at 1200 dpi (dots per inch/pixels per inch) at a minimum of 3 in. x 3 in.

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-sentence, 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 part of the figure caption [e.g., FIGURE 1 Warren truss bridge (Carr and Black 1999) or FIGURE 30 Neoprene boot (*Courtesy*: Indiana DOT).].
- 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) and a full one-column figure is 20 picas (3.25 in. and 8.25 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
- 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 be replaced by cross-hatching or other distinctive markings.

Provide the best available copy for any illustrations in the synthesis. Duplicates will not reproduce as well as glossy prints or computer-generated line art and are generally not acceptable. High-resolution digital artwork is also acceptable. Include a complete set of prints (copies) with any digital figures submitted. Graphs, pie charts, or other artwork with shading must be suitable for black and white printing. Duplicate prints with shading will not reproduce well. Illustrations with several gradations of shading 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. Identify each figure by writing the synthesis topic number and figure number outside of the figure plane. Include a separate list of all figure captions with the draft report. Figures submitted in color will be reproduced as such in the web version of the report.

5.7 Vendors

Vendors should *not* be cited by name in the report 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

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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 (e.g., 5 feet, 18%). 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,

$$X^2 + Y^2 = Z^2 \quad (1)$$

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).

All letters or symbols that might be confused with any other (e.g., circles, "ohs," zeros, ones, and "els") should be marked at first use.

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.

5.11 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 Conclusions 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 level one (A) and two (B) headings, except table titles and figure captions.
- 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).

Common Abbreviations/Acronyms

AADT	average annual daily traffic
ADA	Americans with Disabilities Act
BRT	bus rapid transit
DOT	department of transportation
ESAL	equivalent single-axle load
GIS	geographic information system

GPS	global positioning system
HEV	hybrid electric vehicle
HOV	high-occupancy vehicle
in.	inch
IT	information technology
ITS	Intelligent Transportation System
km	kilometer
L	liter
LOS	level of service; level of significance
lb	pound
LCC	life-cycle cost
LRT	light-rail transit
mi	mile
mph	miles per hour
MPO	metropolitan planning organization
PCC	portland cement concrete
PPP	public–private partnership
QC	quality control
vph	vehicles per hour