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.

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

Each synthesis should report 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 surveys of transportation agencies or others concerned with the topic. Information gained from these sources is then organized into a concise document that describes current knowledge and practice.

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 a table or appendix, rather than narrative form.

2.0 THE SYNTHESIS STUDY PROCESS

Below describes the serial synthesis study process. 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 20-5, and TCRP J-7 Oversight Committees. The scope that guides the consultant's work is written by a Topic Panel at their first meeting.

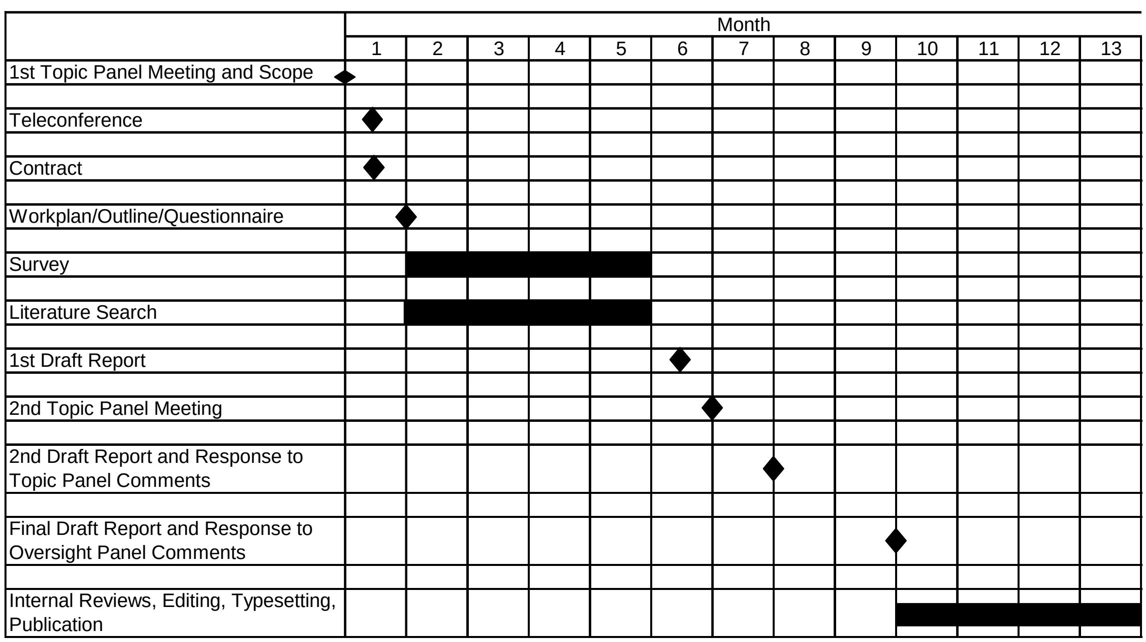

FIGURE 1 Typical ACRP/TCRP synthesis study schedule

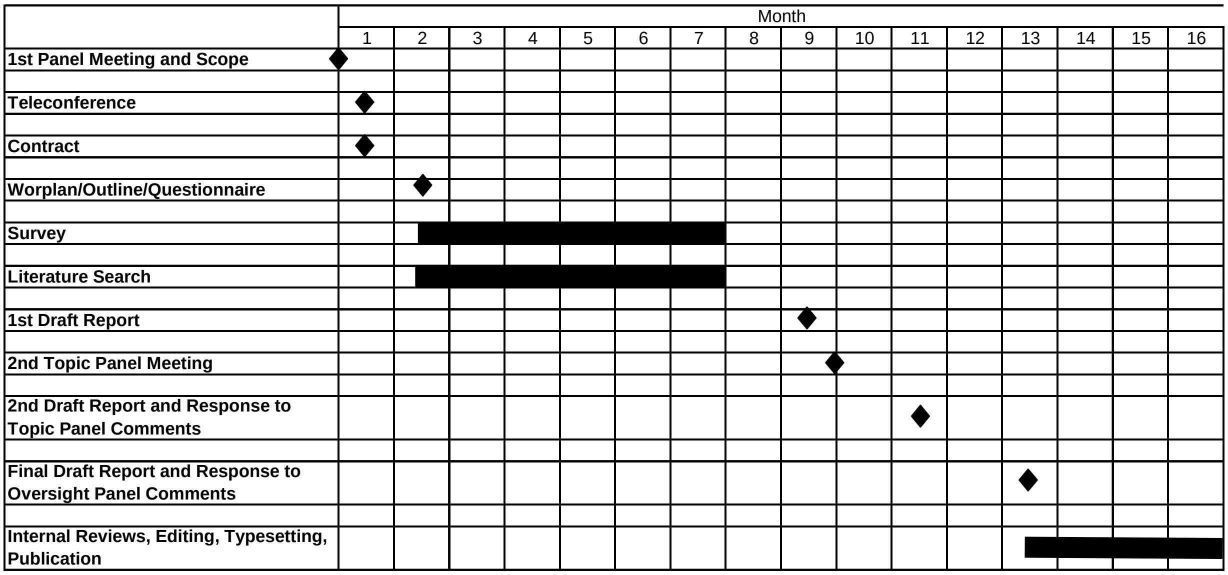

FIGURE 2 Typical NCHRP synthesis study schedule

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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, and review of the technical content of the consultant's work. Staff will forward notes from the first Topic Panel meeting, and arrange a conference call between the consultant and the project panel approximately two weeks after the first topic panel meeting. Any questions on the scope should be resolved early through discussion with the project panel and TRB staff. Informal communication between consultants and Topic Panel members is encouraged during the course of the study.

2.3 Teleconference

Staff will arrange a one-hour teleconference between the Topic Panel and consultant approximately two weeks after the consultant selection. The teleconference is designed to introduce the panel members and consultant, have the panel members offer guidance and assistance, and to 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 for staff and the consultant to solicit assistance from the panel, such as in pretesting the survey, and to confirm the schedule of deliverables and meetings.

2.4 Work Plan, Outline, and Questionnaire

Consultants prepare a draft work plan, outline, and questionnaire 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. The draft questionnaire should be prepared in a manner that balances the need for information with the need for brevity. Close-ended multiple choice questions are desirable. Open-ended questions are highly undesirable, unless there is a compelling reason otherwise.

2.5 Survey

Once the work plan, outline, and 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. In general, a TRB staff transmittal accompanies the survey, and responses are directed to the consultant. Most questionnaires are distributed electronically, using MSWord or Excel "Forms," TRB web survey software (SurveyGizmo), or consultant-provided web survey software. Consultant should strive for 80%–100% return rate, with 80% considered the minimum acceptable, unless agreed on by the staff.

2.6 Literature Search

A literature search is conducted to obtain information on current knowledge, practices, and relevant research pertaining to the synthesis topic. TRB's Transportation Research Information System (TRIS) may be helpful for this.

2.7 First Draft Report

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; this is a firm date. First draft reports should be complete, including executive summary, all report sections, conclusions, and appendices and all graphics embedded.

2.8 Second Topic Panel Meeting

The purpose of this second meeting is to review the first draft of the synthesis report. The consultant will 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.

2.9 Second Draft Report and Written Response to Topic Panel Comments

Within 30 days of the second topic panel meeting, the consultant delivers a second draft to respond to the review of the Topic Panel. The draft should be accompanied by a brief document of comments and responses to the panel comments. The second draft is sent by staff for concurrent review by the Topic Panel and the ACRP 11-03, NCHRP 20-5, or TCRP J-7 Oversight Committees. The second draft report should take the form of a completed consultant report with embedded graphics and appendices placed appropriately.

2.10 Final Draft and Written Response to Oversight Panel Comments

Upon receipt of written comments from the ACRP 11-03, NCHRP 20-05, or TCRP J-7 oversight panel review (usually 30 days after submittal of the second draft report and written response to topic panel comments), the consultant delivers a third and final draft and written response to oversight panel comments. The final draft responds to comments received on the second draft from the Topic Panel and the 20-5, J-7, or 11-03 oversight committees. The Consultant must provide a brief document of comments and responses, including page references, where appropriate. The final draft is prepared in accordance with the following materials.

2.11 Internal Reviews, Editing, Typesetting, and Publication

The final draft report is forwarded to The National Academies Subcommittee for National Research Council Oversight (SNO) for final review and approval. This final review ensures that no one sentence of the report can be taken out of context and used for purposes unintended by the author or TRB.

Concurrent with 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 without change, including technical editing.

3.0 SUBMITTALS

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

3.1 Stage 1—Workplan, 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 consultant report with all sections, embedded graphics, and submitted electronically. 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 second panel meeting where the first draft report is reviewed, a topic panel comment document will be compiled and provided to the principal investigator. This document will contain bolded comments from topic panel members that require documented responses by the consultant. 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 Draft Report

At the conclusion of the ACRP 11-03, TCRP J-7, or NCHRP 20-05 oversight panel review, a panel comment document will be provided to the principal investigator. Comments from oversight panelists require documented responses by the consultant. The final draft report shall be a complete consultant report with all sections and embedded graphics. Line numbering is inadvisable. Both the final draft report and comments and responses document shall be delivered electronically.

In order 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 to the two-column format.

The following electronic files delivered to the project manager'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 number, no graphics, no appendices
- Each graphic in a separate file
- Each appendix in a separate file
- Cover picture, black and white, with note releasing for use
- Comments and responses document to Oversight Panel review (ACRP 11-03 synthesis oversight panel)

- Final Invoice (include bonus for on-time delivery if applicable)

3.5 Invoices
Send all invoices electronically to the project manager for processing and tracking.

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 covers, including picture credit.

4.2 Title Page
TRB staff will create the title page for all drafts. The consultant should provide author information 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.

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. The summary should include in brief the main points of the full text, including the conclusions. A brief description of the survey response rate should be included.

4.6 Introduction or Background Chapter
The first chapter should provide brief, relevant background; define terms; and 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. The first chapter should also include a description of the survey process.

4.7 Intermediate Chapters
Begin each chapter on a new page.

4.8 Conclusions and Recommendations for Further Research
The final chapter of a synthesis report should normally be titled "Conclusions." Conclusions summarize 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 or conclusion rather than a recommendation. Recommendations for needed research are permissible. 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).

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 references listed in alphabetical order. Do not use footnotes in the text: cite all such information within the text or references. A reference style guide is shown below.

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 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 Appendixes

Appendixes are used to present material that supplements the information given in the text, but that cannot be conveniently inserted into the text. Appendixes 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 appendixes 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. Appendixes follow the References (or Bibliography).

5.0 REPORT STYLE GUIDE

The current edition of Webster’s *Third New International Dictionary* (2002) and the 15th Edition of the *Chicago Manual of Style* (2003) are the preferred reference sources for spelling, capitalization, and compound words.

5.1 Headings

The use of headings and subheadings in each chapter 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 should 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 three and four heads, but not levels one and two.

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, 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 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 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).

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, National Research Council, 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:
"Selecting the Right Team for Your Project," BPR OnLine Learning Center, Quality Leadership Learning Center, Loveland, Colo., 1998 [Online]. Available: http://www.prosci.com [July 24, 1998].

5.4 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 list of table titles with the draft report.
- Tables will be placed as close to their initial callout as possible.
- When a dash (—) 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.

5.5 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.

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. 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.

5.6 Copyright Permission

To reproduce any copyrighted materials (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 Reference 32. Copyright 1983 American Institute of Physics."

For a figure, the acknowledgment should read: Photo (or graphic) courtesy of . . . (e.g., Arizona Department of Transportation).
For a table, reprinted without change, the acknowledgment should read: *Source*: . . . (e.g., *Source*: Houston METRO).

5.7 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 ten (e.g., five bridges, two departments) and use Arabic numerals for numbers 11 and greater.
- 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.

5.8 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).

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.

5.9 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.

5.10 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

AC	asphalt concrete
ADA	Americans with Disabilities Act
DOT	department of transportation
ft	foot
g	gram
GIS	geographic information system
GPS	global positioning system
HOV	high-occupancy vehicle
h	hour
in.	inch
IT	information technology
ITS	Intelligent Transportation System
km	kilometer
kW	kilowatt
L	liter
lb	pound
LCC	life-cycle cost
LRT	light-rail transit
mg	milligram
mi	mile
min	minute
mL	milliliter
PCC	portland cement concrete
PVC	polyvinyl chloride
RFP	Request for Proposal
QC	quality control
s	second
yd	yard