**Technical Report Documentation Page**

|  |  |  |
| --- | --- | --- |
| **1. Report No.** | **2. Government Accession No.** | **3. Recipient’s Catalog No.** |
| IHRB Project TR-xxx [or InTrans project or pooled fund number] |  |  |
| **4. Title and Subtitle** | **5. Report Date** |
| Title of Research Report: Subtitle of Research Report | Month yyyy |
| 6. Performing Organization Code |
|  |
| **7. Author(s)** | **8. Performing Organization Report No.** |
| First Author (orcid.org/xxxx-xxxx-xxxx-xxxx), Second Author (orcid.org/xxxx-xxxx-xxxx-xxxx), and Last Author (orcid.org/xxxx-xxxx-xxxx-xxxx) [[ORCiDs](https://orcid.org/orcid-search/search) required for IHRB/Iowa DOT reports] | InTrans Project yy-xxx [last two digits of project start year, followed by three-digit Iowa DOT addendum number] |
| **9. Performing Organization Name and Address** | **10. Work Unit No. (TRAIS)** |
| Institute for Transportation [and/or InTrans center or program]Iowa State University2711 South Loop Drive, Suite 4700Ames, IA 50010-8664 |  |
| **11. Contract or Grant No.** |
|  |
| **12. Sponsoring Organization Name and Address** | **13. Type of Report and Period Covered** |
| Iowa Highway Research BoardIowa Department of Transportation800 Lincoln WayAmes, IA 50010 | Federal Highway Administration1200 New Jersey Avenue, SEWashington, DC 20590 | Final Report |
| **14. Sponsoring Agency Code** |
| If applicable, SPR or TPF number [e.g., TPF-5(238) or SPR RB09-011] |
| **15. Supplementary Notes** |
| Visit <https://intrans.iastate.edu> for color pdfs of this and other research reports. |
| **16. Abstract** |
| Provide an abstract in this space that summarizes the project’s objectives, methods, results, and significance in about 250 words or less. Note that the abstract provided here is also used to summarize the project on the Institute for Transportation website. Because the abstract will appear separate from the report, it should not contain reference citations.  |
| **17. Key Words** | **18. Distribution Statement** |
| alphabetical—lowercase—separated by em dashes | No restrictions. |
| **19. Security Classification (of this report)** | **20. Security Classification (of this page)** | **21. No. of Pages** | **22. Price** |
| Unclassified. | Unclassified. | 22 | NA |

**Form DOT F 1700.7 (8-72) Reproduction of completed page authorized**

Project Report Title: Subtitle

**Final Report**

**Month yyyy**

**Principal Investigator**

Name, Title

Affiliation [e.g., Institute for Transportation, Iowa State University]

**Co-Principal Investigator(s)**

Name, Title

Affiliation [e.g., Institute for Transportation, Iowa State University]

**Research Assistant(s)**

Name(s) [no affiliations necessary]

**Authors**

First Author, Second Author, and Last Author [omit ORCiDs; must match author list in box 7 of Technical Report Documentation Page above]

Sponsored by

Iowa Highway Research Board and
Iowa Department of Transportation

(IHRB Project TR-xxx)

Preparation of this report was financed in part

through funds provided by the Iowa Department of Transportation

through its Research Management Agreement with the

Institute for Transportation

(InTrans Project yy-xxx)

A report from

**Institute for Transportation**

**Iowa State University**

2711 South Loop Drive, Suite 4700

Ames, IA 50010-8664

Phone: 515-294-8103 / Fax: 515-294-0467

<https://intrans.iastate.edu>

TABLE OF CONTENTS

[Acknowledgments vii](#_Toc161391276)

[Basic Acknowledgments vii](#_Toc161391277)

[Acknowledgments for Transportation Pooled Fund Studies vii](#_Toc161391278)

[Acknowledgments for Projects with State Planning and Research Funding vii](#_Toc161391279)

[Executive Summary ix](#_Toc161391280)

[Using Text/Paragraph Styles in Microsoft Word 1](#_Toc161391281)

[Types of Content within the Report Body 2](#_Toc161391282)

[Headings 2](#_Toc161391283)

[Equations 2](#_Toc161391284)

[Figures 2](#_Toc161391285)

[Tables 3](#_Toc161391286)

[References 5](#_Toc161391287)

[In-Text Citations 5](#_Toc161391288)

[References Section 5](#_Toc161391289)

[Appendix: Additional Help 9](#_Toc161391290)

[Appendix Numbering 9](#_Toc161391291)

[Contacting the InTrans Publications Group 9](#_Toc161391292)

[Additional Resources 9](#_Toc161391293)

LIST OF FIGURES

[Figure 1. Location of bridge with expansion joints 3](#_Toc152334061)

LIST OF TABLES

[Table 1. Road length by pavement serviceability 3](#_Toc152334065)

[Table 2. Distribution of bridge types in Iowa 4](#_Toc152334066)

# Acknowledgments

Acknowledgments are required in the master agreement between the Institute for Transportation and the Iowa Department of Transportation.

Acknowledgments consist of one or two paragraphs that, at minimum, recognize the project’s funding source(s). In addition, authors may use the Acknowledgments to recognize the contributions of individuals and organizations not listed on the cover page, including technical advisory committee (TAC) members, organizations or agencies that provided data or materials, and individuals who assisted with the project. Named individuals are generally listed with their affiliations but without titles such as Dr., PhD, or PE.

Sample acknowledgments for a few common cases are provided below.

## Basic Acknowledgments

The research team would like to thank the Iowa Department of Transportation (DOT) and Iowa Highway Research Board (IHRB) for sponsoring this research.

## Acknowledgments for Transportation Pooled Fund Studies

The research team would like to acknowledge the Federal Highway Administration (FHWA) for sponsoring this Transportation Pooled Fund study under TPF-5(169). The authors would also like to thank the state pooled fund department of transportation (DOT) partners for their support:

* Iowa DOT (lead state)
* Ohio DOT (ODOT)
* Pennsylvania DOT (PennDOT)
* Wisconsin DOT (WisDOT)

## Acknowledgments for Projects with State Planning and Research Funding

The research team would like to acknowledge the Iowa Department of Transportation (DOT) for sponsoring this research and the Federal Highway Administration (FHWA) for the state planning and research (SPR) funds used for this project.

# Executive Summary

An executive summary is required by certain sponsors, such as the Iowa DOT and IHRB, but may be included in any report at the author’s discretion.

Because the executive summary may be read separately from the report body, it should not contain reference citations. Abbreviations and acronyms should be defined at their first use both in the executive summary and again in the body of the report. Figures, tables, and display equations may be used with discretion.

# Using Text/Paragraph Styles in Microsoft Word

A “style” in Microsoft Word is a set of definitions for how a heading, paragraph, or other element will look, including the font and spacing.

Format the report content by applying the predefined styles included in this template document. Reports can generally be formatted using the 14 styles below:

* **Body Text1**. Applied to all text paragraphs to ensure uniform spacing and alignment.
* **Equation**. Applied to numbered equations to align the equation and its number. Add a single tab character after the equation to align the number to the right-hand margin.
* **Figure**. Applied to figure images to ensure that the image is positioned correctly and that it stays with its attribution and caption.
* **Figure Attribution**. Applied to source information or supplementary notes placed below the figure image.
* **Figure Caption**. Applied to figure captions to ensure that the figure appears in the List of Figures.
* **Heading 1**. Applied to chapter-level headings. Text styled Heading 1 is included in the Table of Contents.
* **Heading 2**. Applied to second-level headings. Text styled Heading 2 is included in the Table of Contents.
* **Heading 3**. Applied to third-level headings.
* **Heading 4**. Applied to fourth-level headings.
* **List Bullet**. Applied to bulleted lists.
* **List Number**. Applied to numbered lists.
* **Reference**. Applied to sources listed in the References section to ensure correct indentation and page breaks.
* **Table Note**. Applied to source information or supplementary notes placed below the table.
* **Table Title**. Applied to table titles to ensure that the table appears in the List of Tables.

These styles have been applied throughout this template as examples.

Applying the appropriate styles to the appropriate elements will ensure the correct vertical spacing, page breaks, and visual styling throughout the report. Avoid using multiple consecutive carriage returns to position content or to create vertical spacing and page breaks. If appropriate styles are applied to headings and captions, manual formatting (e.g., bold, italics, or caps lock) is unnecessary.

# Types of Content within the Report Body

## Headings

The template document includes four heading styles. If headings are needed below the fourth level, use run-in headings, as shown in the following example:

**Fifth-Level Heading**. Headings below Heading 4 begin on the same line as the content under that heading, are styled as Body Text1, and are bolded and separated from the content text by a period.

All headings should be typed in title case, with all significant words capitalized. Note that Heading 1 style automatically uppercases the title.

## Equations

Equations are formatting using the Equation paragraph style, with the equation number in parentheses. When applying the Equation style to an equation, include a single tab character between the equation and its number to align the number to the right-hand margin.

In equation (1), an equation is formatted using the Equation paragraph style:

A = 14 (q – 1) (1)

where *A* is the first variable and *q* is the second variable.

## Figures

Use the Figure style on the image and ensure that the “Wrap Text” option for the image is set to “In Line with Text.” Avoid using tables or text boxes to group figures or to associate figures with captions.

When needed, source information and supplementary notes are placed below the figure in Figure Attribution style. Do not cite source information in the figure caption.

Use the Figure Caption style for captions. Capitalize and punctuate figure captions as shown in Figure 1, in sentence case with no final period.

See Figure 1 for an example of a correctly formatted figure image, attribution, and caption.



© Google 2014

Figure 1. Location of bridge with expansion joints

## Tables

Use the Table Title style for table titles. Capitalize and punctuate table titles as shown in Table 1, in sentence case with no final period.

When needed, source information and supplementary notes are placed below the table in Table Note style. Do not cite source information in the table title.

See Table 1 for an example of a correctly formatted table, table title, and table note.

Table 1. Road length by pavement serviceability

| County | **Pavement Serviceability** |
| --- | --- |
| **Gravel (mi)** | **Secondary (mi)** | **Interstate (mi)** |
| Cherokee County | 42 | 42 | 70 |
| O’Brien County | 24 | 24 | 6 |
| Polk County\* | 36 | 35 | 35 |

\*This is an example using the Table Note style.

Large tables with several columns may best be presented in landscape orientation. To do so, insert one section break (next page) before the table title and another after the end of the table content to create a new document section for the table. Then set the orientation of the new section to landscape. Table 2 shows an example of a landscaped table in its own section.

##

Table 2. Distribution of bridge types in Iowa

| **Element Number** | **Description** | **District 1** | **District 2** | **District 3** | **District 4** | **District 5** | **District 6** | **Total** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 38 | Reinforced concrete slab | 70 | 111 | 120 | 97 | 63 | 92 | 553 |
| 107 | Steel girder/beam | 209 | 115 | 100 | 164 | 115 | 193 | 896 |
| 109 | PS girder/beam | 404 | 264 | 202 | 258 | 323 | 361 | 1,812 |
|  | Total | 683 | 490 | 422 | 519 | 501 | 646 |  |
|  | Total state owned bridges | 838 | 649 | 625 | 686 | 623 | 911 |  |
|  | Percentage | 82% | 76% | 68% | 76% | 80% | 71% |  |
|  | Average percentage | 75% |  |  |  |  |  |  |

Source: Iowa DOT 2019

# References

InTrans prefers the author-date system for references because it provides readers with key source information cited in context within the report body.

## In-Text Citations

Cite each source in the report using the author name and publication year in parentheses. If the source is not dated, cited “n.d.” as the date. If the author is named in the text, include the year in parentheses immediately after the author name. See the examples below:

* Single author: (Jones 2015), Jones (2015)
* Single author, no date: (VTTI n.d.)
* Two authors: (Jones and Smith 2020), Jones and Smith (2020)
* Three or more authors: (Jones et al. 2019), Jones et al. (2019)

Note that author-date citations do not include a comma before the year.

When citing multiple sources in parentheses, separate them with commas (not semicolons). See the example below:

* (Thompson and Smith 2018, Jones et al. 2019)

The following types of sources are considered to provide sufficient reference information in the citation and are not typically included in the References section:

* Standards issued by organizations such as AASHTO, ASTM International, and ANSI. E.g., (ASTM C1967) or (AASHTO T 152).
* Legislative acts, federal regulations, and similar sources. E.g., (25 C.F.R. § 25.815).
* Personal communication. In the citation, provide the person’s name and title/affiliation, the nature of the source, and the date of communication. E.g., (Mary J. Smith, Dakota County Engineer, personal communication, May 15, 2021).

## References Section

The reference list should be in alphabetical order and include everything cited in the report and only works cited in the report. The references should be formatted consistently, and each reference should provide sufficient information for the reader to locate the source.

Reference list examples in the format preferred by InTrans are provided below.

### Books/Guides/Manuals/Reports/Tech Briefs

#### Works Published by InTrans or Its Centers/Programs

Li, C., J. Ashlock, B. Cetin, and C. Jahren. 2018. *Feasibility of Granular Road and Shoulder Recycling*. Institute for Transportation, Iowa State University, Ames, IA.

Taylor, P., P. Tikalsky, K. Wang, G. Fick, and X. Wang. 2012. *Development of Performance Properties of Ternary Mixtures: Field Demonstrations and Project Summary*. National Concrete Pavement Technology Center, Ames, IA.

#### Works Published by FHWA or Turner-Fairbank

Haber, Z. B., I. De la Varga, B. A. Graybeal, B. Nakashoji, and R. El-Helou. 2018. *Properties and Behavior of UHPC-Class Materials*. FHWA-HRT-18-036. Federal Highway Administration, Turner-Fairbank Highway Research Center, McLean, VA.

Taylor, P., and X. Wang. 2015. *Best Practices for Jointed Concrete Pavements/Materials-Related Distress*. Federal Highway Administration, Washington, DC.

#### Works Published by NCHRP and SHRP2

McGhee, K. H. 2004. *NCHRP Synthesis 334:* *Automated Pavement Distress Collection Techniques*. National Cooperative Highway Research Program, Washington, DC.

Shane, J. S., K. Strong, D. Gransberg, and D. Jeong. 2015. *SHRP2 Report S2-R10-RW-2: Guide to Project Management Strategies for Complex Projects*. Second Strategic Highway Research Program, Washington, DC.

#### Works Published by Other Publishers

Hawkins, N., O. Smadi, and S. Knickerbocker. 2016. *Evaluation of Pavement Markings on Challenging Surfaces*. Minnesota Department of Transportation, St. Paul, MN.

Kosmatka, S., and M. L. Wilson. 2016. *Design and Control of Concrete Mixtures*. 16th Edition. Portland Cement Association, Skokie, IL.

Taylor, P. 2014. *Curing Concrete*. 1st Edition. CRC Press, Boca Raton, FL.

### Parts of a Book or Manual

Harrington, D., and G. Fick. 2014. Chapter 2. Evaluating pavements and selecting solutions. *Guide to Concrete Overlays.* Third Edition. National Concrete Pavement Technology Center, Iowa State University, Ames, IA.

### Periodicals/Journals/Magazines

Jalali, F., and A. Vargas-Nordcbeck. 2021. Life-extending benefit of chip sealing for pavement preservation. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 2675, No. 6, pp. 104–116.

Yang, S., A. Alhasan, H. Ceylan, S. Kim, and B. Yang. 2022. Accuracy assessment of light detection and ranging system measurements for jointed concrete pavement surface geometry. *Road Materials and Pavement Design*, Vol. 24, No. 7, pp. 1695–1711.

### Papers Presented at Meetings/Conferences

Guo, F., C. T. Jahren, and Y. Turkan. 2015. Electronic document management systems for transportation construction industry. 5th International/11th Construction Specialty Conference, June 8–10, Vancouver, BC.

Heikkilä, R., and M. Jaakkola. 2006. Automation of road construction – The state of the art in Europe. 23rd International Symposium on Automation and Robotics in Construction (ISARC), October 3–5, Tokyo, Japan.

### Proceedings

Carlson, J., L. Sutter, K. Peterson, T. and Van Dam. 2005. An update on application of a flat-bed scanner for performing ASTM C457. *Proceedings of the 27th International Conference on Cement Microscopy*, Victoria, BC, pp. 304–316.

Mitchell, P. W. 1980. The concepts defining the rate of swell of expansive soils. *Proceedings of the 4th International Conference on Expansive Soils,* Denver, CO, Vol. 1, pp. 106–116.

### Theses and Dissertations

Wells, S. A. 2006. Early-age response of jointed plain concrete pavements to environmental loads. MS thesis. University of Pittsburgh, Pittsburgh, PA.

Sen, S. 2015. Impact of pavements on the urban heat island. PhD dissertation. University of Illinois at Urbana-Champaign, IL.

### Online and Electronic Sources and Software

FHWA. 2019. Safety. Rural Fatalities. Federal Highway Administration. <https://safety.fhwa.dot.gov/local_rural/rural_fatal.cfm>.

Qualtrics [software]. 2019. Qualtrics, Provo, UT.

VTTI. 2019. InSight Data Access Website: SHRP2 Naturalistic Driving Study. Version 3.2.1. Virginia Tech Transportation Institute. <https://insight.shrp2nds.us/>.

# Appendix: Additional Help

## Appendix Numbering

Each appendix should begin on an odd-numbered page.

If the report includes two or more appendices, designate them Appendix A, Appendix B, etc. If the report includes only one appendix, it may simply be referred to as “the appendix.”

When appendices are lettered, tables, figures, and equations may be numbered A.1, A.2… B.1, B.2, etc. It is also acceptable to continue the numbering sequence from the report body.

## Contacting the InTrans Publications Group

To initiate an editing project with the InTrans Publications group, submit a Communications Request at <https://intrans.iastate.edu/communications-project-request/>. For questions or additional information, contact the InTrans Publications group via email at intranspubs@iastate.edu.

## Additional Resources

Be sure to follow the latest guidelines and/or instructions from the sponsor or publisher.

The following style sheet, based largely on *The* *Chicago Manual of Style* (<https://www.chicagomanualofstyle.org/>), outlines some of the key editorial conventions used by InTrans Publications staff.

| **Topic** | **Usage Guidelines** | **Examples** |
| --- | --- | --- |
| abbreviationsfor state DOTs  | Spell out and define DOT names at first occurrence and abbreviate subsequent occurrences. | Iowa Department of Transportation (Iowa DOT)Kentucky Transportation Cabinet (KYTC)Minnesota Department of Transportation (MnDOT)Nebraska Department of Transportation (NDOT) |
| Use the name and abbreviation listed on each DOT’s website. |
| commas | In lists, a serial/Oxford comma always precedes the conjunction (*and* or *or*) before the last item. | Monday, Tuesday, and WednesdayConstruction, materials, and repair and rehabilitation |
| A comma usually follows an introductory phrase or dependent clause at the beginning of a sentence. | To estimate traffic volumes, the research team…Due to the high temperature, it was decided… |
| When a conjunction (e.g., *and*, *but*, *so*) joins independent clauses, a comma usually precedes the conjunction. | Cores were extracted from the pavements, and measurements were taken to determine strength. |
| Include commas in numerals four or more digits long. | 1,308 miles or 6,432,233 units |
| data | *Data* is treated as a plural noun. | These data are… |
| e.g. and i.e. | The abbreviation *e.g.* means *for example*.  | routine activities, e.g., roadside maintenance, surface repair, and drainage maintenance |
| The abbreviation *i.e.* means *that is* or *in other words*.  | problematic sections, i.e., sections where frequent maintenance is needed |
| Never use *etc.* at the end of a list that begins with *e.g.* | several phenomena (e.g., one, two, three) |
| em dash (—) | An em dash sets off an amplifying or explanatory element. | The two problematic samples—Alden 4 and Bowser 6—were further analyzed. |
| en dash (–) | An en dash may be used in tables to express numerical ranges but should not be used similarly in body text. | 56–62 [in a table]56 to 62 [in body text] |
| foreign words and phrases | Foreign words, phrases, and abbreviations familiar to readers are not italicized if used in an English context.  | in situ, in vitro, a prioriet al., i.e., etc. |
| hyphen (-) | Number + abbreviated unit = not hyphenated | a 3 ft high wall |
| Number + percentage = not hyphenated | a 10 percent increase |
| Spelled-out number + noun = hyphenated before, open after | a three-foot-high object, an object three feet high |
| Noun + noun or adjective + noun = hyphenated before when ambiguous, open after | truck-traffic level, level of truck trafficfield-ready equipment, equipment is field ready |
| Adverb (ending in -ly) + noun = not hyphenated | an extremely high rate |
| Retain the hyphen when the second part of a hyphenated expression is omitted in a series. | a five-, seven-, or eight-day curing period |
| lists | Do not introduce a list with a colon unless the introductory material is an independent clause (i.e., complete sentence). | Distresses included excessive wear, discoloration, and severe cracking. Three distresses were noted: excessive wear, discoloration, and severe cracking. |
| Items in a run-in list are generally separated by commas. If any items require internal commas, all items are separated by semicolons. | The signs were red, orange, and yellow.The signs were red and white; orange, black, and white; and yellow and black. |
| If a run-in list is numbered, use numerals in parentheses. | The items included (1) first, (2) next, and (3) last. |
| numbers | Spell out only single-digit numbers (one through nine) and use numerals for whole numbers 10 and above. | three, 15 |
| If a mix of single- and double-digit numbers is used in close proximity, generally use numerals for all.  | anywhere from 3 to 15 items.  |
| Always spell out a number that begins a sentence. | Nineteen states responded to the survey.  |
| ordinals | Ordinals (e.g., first, second) are usually spelled out. | first, second, third |
| If ordinal numerals are used, do not use superscripts. | 1st, 2nd, 3rd [not 1st, 2nd, 3rd] |
| percent | Percentages can be expressed using either the word *percent* or the percent symbol (%), as long as usage is consistent. | 10 to 20 percent or 10% to 20% [but not both formats in the same report] |
| quotes | Quotation marks indicate a direct quote or usage that differs from the generally accepted meaning. Technical terminology is generally not quoted.  | Dowel bars in a concrete paving slab create a “disturbance” in the pavement profile. |
| Periods and commas are placed within quotation marks; all other punctuation is placed outside of quotation marks. | As noted by Smith et al. (2018), “the smoother the pavement, the better the performance.” |
| time | Use numerals (with zeros for even hours) to express exact times. Abbreviate a.m. or p.m. with periods. | 8:00 a.m. to 1:00 p.m. |
| *state* or *county* | Spell out state names in body text. Abbreviations may be used in tables where appropriate.  | New Jersey [not NJ] |
| Capitalize the word *State* or *County* after a state or county name and when used as a part of the name. | The one county visited was Polk County.  |
| When preceding the name, *state* is left lowercase in entities below the national level. | The project was completed in the state of Iowa.  |
| symbols, units | If an abbreviation or symbol is used as a unit of measure, the quantity is always expressed by a numeral. | 55 mph, 5 in., 3 cm |
| For two or more quantities, the unit is repeated if it is closed up to the number but not if it is separated. | 35% to 50%, 2°F to 6°F20 to 30 miles, 10 to 15 ft |
| Units used with numerals are generally abbreviated.  | 3 in., 1 ft, 7 ft2, 4 yd3 |
| Some symbols (e.g., > or ~) are more readable as words. | more than [>] four, approximately [~] four |