MANUSCRIPT SUBMISSION AND REVISION REQUIREMENTS

Manuscripts must be submitted to the journal’s Editorial Manager website. Links to the submission page can be found on the journal home page in the ASCE Library (ascelibrary.org). Any manuscript mailed or e-mailed will not be sent for review and will be returned to the author(s) with instructions for online submission.

When submitting a manuscript for an initial review, please ensure the following are completed before approving your PDF copy:

- The manuscript title, author byline, and abstract are on the first page of your manuscript text.
- All authors have separate affiliation statements. The corresponding author should be noted. An e-mail address is required for the corresponding author and encouraged for all authors.
- The manuscript is in a double-spaced, single-column format with continuous line numbering.
- All figures and tables are included.
- Initial submissions may be in Microsoft Word, LaTeX, or PDF.
- All required submission questions must be answered.
- Funding for the research must be declared accurately via the FundRef tool provided in Editorial Manager.
- Authors are encouraged to have an ORCID and supply it with the submission. More information about ORCID can be found at their website.

When submitting a revised manuscript, ensure that the following requirements are met:

- All requirements listed above for new submissions apply to revised manuscripts.
- Manuscript file is in Microsoft Word or LaTeX format (no PDF).
- Figures are uploaded as separate files and in PDF, .tif, or .eps format.
- Tables are in Microsoft Word or LaTeX.
- All permissions are uploaded with the manuscript files.
- A signed (in ink) copy of ASCE’s Authorship Originality and Copyright Transfer Agreement has been uploaded.

PREPARING THE MANUSCRIPT

LENGTH

For most ASCE journals, the maximum number of words and word-equivalents is 10,000 for technical papers, 3,500 for technical notes, and 2,000 for Discussions and Closures. The editor may waive these restrictions to encourage manuscripts on topics that cannot be treated within these limitations. To estimate the length, consult the Manuscript Sizing Worksheet.

**GENERAL FLOW OF THE PAPER**

Sections of the article should not be numbered and use word headings only. Article sections should appear in the following order:

- Title page (includes title, author byline & affiliation, abstract)
- Introduction
- Main text sections
- Conclusion
- Appendix(es)
- Acknowledgments
- Disclaimers
- Notation list
- Supplemental Data
- References

**TITLE**

Titles should be no longer than 100 characters including spaces. The title of a paper is the first “description” of a paper found via search engine. Authors should take care to ensure that the title is specific and accurately reflects the final, post–peer reviewed version of the paper. Authors should try to include relevant search terms in the title of the paper to maximize discoverability online.

Titles should not begin with “A,” “An,” “The,” “Analysis of,” “Theory of,” “On the,” “Toward,” etc. If the manuscript is part of a companion set, authors should use the title to introduce the subtitle:

Stochastic Theory for Irregular Stream Modeling. I: Flow Resistance
Stochastic Theory for Irregular Stream Modeling. II: Application

**AUTHOR BYLINES**

Under the title of the manuscript, the full name of each author and his or her affiliation and professional designation, if applicable, must be included. The following professional designations are currently acceptable for all journals: Ph.D., P.E., S.E., D.WRE, DEE, P.Eng., C.Eng., L.S., P.L.S., Dr.Tech., Dr.Eng., D.Sc., Sc.D., G.E., P.G., P.H., AICP, J.D.
Former affiliations are permissible only if an author’s affiliation has changed after a manuscript has been submitted for publication. If a coauthor has passed away, include the date of death in the affiliation line. Any manuscript submitted without a separate affiliation statement for each author will be returned to the corresponding author for correction.

Change in Author Byline

Authors are not permitted to change the byline of their paper once the manuscript has been accepted for publication by ASCE. Changing the author byline during review is possible, but is subject to the following requirements:

- If the author order is changing from the initial submission, the corresponding author must provide evidence of approval by all the authors.
- If an author is being added after the initial submission, the corresponding author must provide an explanation of the addition as well as approval by all the initial authors and approval by the author being added.
- If any authors are being deleted who were included in the initial submission, the corresponding author must provide written permission from the author(s) being deleted. Without explicit permission to remove them, those names will remain in the byline.

Change in Corresponding Author

If the corresponding author is changing from the initial submission, the appropriate information must be updated in Editorial Manager, and the new corresponding author may need to register an account in the system if one does not already exist.

ABSTRACT

The abstract should be a single paragraph (150–175 words long) written in plain language and include a summary of the key conclusions of the manuscript. It should clearly state the purpose of the work, the scope of the effort, the procedures used to execute the work, and major findings. The abstract is the second most important online search discovery element, after the title. Authors should review the abstract to ensure that it accurately reflects the revised paper and should strive to include any applicable keywords that would likely be used during an online search.

Mathematics and references are not permitted in the abstract and will be removed by the copyeditors.

GENDER-SPECIFIC WORDS

Authors should avoid “he,” “she,” “his,” “her,” and “hers.” Alternatively, words such as “author,” “discusser,” “engineer,” and “researcher” should be used.

FIRST-PERSON USAGE

The use of first-person pronouns (I, we, my, our) should be avoided in technical material. The use of “the authors” or “this researcher” is preferred to first-person pronouns.
For papers with a single author, “the author” should be used to indicate actions or opinions.

Papers with multiple authors should use “the authors” to refer to collective actions or opinions.

Authors should use first-person pronouns only if absolutely necessary to avoid awkward sentence construction.

**FOOTNOTES AND ENDNOTES**

Footnotes and endnotes are not permitted in the text. Authors must incorporate any necessary information within the text of the manuscript.

*Exception* — Endnotes are only permitted for use in the *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction* and should be presented as follows:

7Idle capacity; because of delay, staff are not fully engaged in productive work for the delayed project during the delay period.

Repeated references to the same case may be stated in the text by using an endnote number. In the endnote, the author must list the case, as shown in the following:


**MATHEMATICS**

Special characters and sub/superscripts should be clearly typed. Symbols should be listed alphabetically in a section called “Notation” at the end of the manuscript (preceding the references).

Authors should take care to ensure that ambiguous characters (such as prime) and lookalike characters (lowercase “ell” and numeral one; capitalized “oh” and zero; “zee” and two; “vee” and Greek nu; and "double you" and lowercase Greek omega) are clear for the copyeditor and typesetter to identify. Unambiguous characters, such as uppercase Greek delta, need not be identified.

Dimensionless variables such as Froude (F), Mach (M), Reynolds (R), Richardson (Ri), Strouhal (S), Weber (W), Péclet (P), Prandl (Pr), and Schmidt (Sc) must be identified. These will be typeset in a different font. Identifying these in text or in a Notation list is adequate.

Subscripts, superscripts, and exponents should be identified if they are typed ambiguously, for example if superscripts have sub/superscripts, as in $y^{\text{sup}}$. When possible, set all math using Design Science MathType or Microsoft Word’s Equation Builder. Math should never be submitted as graphic files.

Matrices, tensors, and vectors should be typed either in boldface or placed consistently within brackets and italicized (e.g., $\mathbf{X}$ or $[X]$).

In text, single-level expressions must be typed as such [e.g., $1/(a + b)$], not stacked or built-up. In numbered (displayed) equations, authors must stack numerators over denominators. All displayed
equations should be numbered sequentially throughout the entire manuscript, including Appendixes. Equations should be in the body of a manuscript; complex equations in tables and figures are to be avoided, and numbered equations are never permitted in figures and tables.

**SI UNITS**

The use of *Système International (SI) units* as the primary units of measure is **mandatory**. Other units of measurement may be given in parentheses after the SI unit if the author desires. More information about SI units can be found from NIST at: [http://physics.nist.gov/cuu/Units/index.html](http://physics.nist.gov/cuu/Units/index.html).

The symbols for the base units of SI are as follows: A, cd, K, kg, m, mol, and s. For SI supplementary units, the symbols are rad and sr. The symbols for SI-derived units are Bq, C, F, Gy, H, Hz, J, 1m, 1x, N, Pa, S, Sv, T, V, W, Wb. The SI multiplying prefixes are a, c, d, f, n, p, m. Other units used with SI in civil engineering include C, day, h, ha, L, min, t, and year. Scientific notation with SI units (for example, $2.4 \times 10^6$ m) is acceptable.

**CONVERSION FACTORS FROM U.S. CUSTOMARY TO SI UNITS**

<table>
<thead>
<tr>
<th>U.S. customary unit (symbol)</th>
<th>SI unit (symbol)</th>
<th>Multiply by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acre-foot (acre/ft)</td>
<td>Cubic meters (m³)</td>
<td>$1.23 \times 10^3$</td>
</tr>
<tr>
<td>Acre (acre)</td>
<td>Hectare (ha)</td>
<td>0.405</td>
</tr>
<tr>
<td>Inch (in.)</td>
<td>Millimeter (mm)</td>
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</tr>
<tr>
<td>Kilogram force (kgf)</td>
<td>Newton (N)</td>
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<tr>
<td>Mile (mi)</td>
<td>Kilometer (km)</td>
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<tr>
<td>Pound force (lbF)</td>
<td>Newton (N)</td>
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</tr>
<tr>
<td>Pound force per square inch (psi)</td>
<td>Kilopascal (kPa)</td>
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<tr>
<td>Pound mass (lbm)</td>
<td>Kilogram (kg)</td>
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</tr>
<tr>
<td>Gallon (gal.)</td>
<td>Liter (L)</td>
<td>3.79</td>
</tr>
</tbody>
</table>

**SI PREFIXES APPLICABLE TO ENGINEERING**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Prefix</th>
<th>Symbol$^a$</th>
</tr>
</thead>
<tbody>
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<td>$10^9$</td>
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<td>G</td>
</tr>
<tr>
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</tr>
<tr>
<td>$10^{-9}$</td>
<td>Nano</td>
<td>n</td>
</tr>
</tbody>
</table>

$^a$ Unit symbols only used when preceded by a numeral.
CONCLUSIONS

At the end of the manuscript text, authors must include a set of conclusions, or summary and conclusion, in which the significant implications of the information presented in the body of the text are reviewed. Authors are encouraged to explicitly state in the conclusions how the work presented contributes to the overall body of knowledge for the profession.

ACKNOWLEDGMENTS

Acknowledgments are encouraged as a way to thank those who have contributed to the research or project but did not merit being listed as an author. The Acknowledgments should indicate what each person did to contribute to the project.

Authors can include an Acknowledgments section to recognize any advisory or financial help received. This section should appear after the Conclusions and before the references. Authors are responsible for ensuring that funding declarations match what was provided in the manuscript submission system as part of the FundRef query. Discrepancies may result in delays in publication.

NOTATION LIST

Notation lists are optional; however, authors choosing to include one should follow these guidelines:

- List all items alphabetically.
- Capital letters should precede lowercase letters.
- The Greek alphabet begins after the last letter of the English alphabet.
- Non-alphabetical symbols follow the Greek alphabet.

Notation lists should always begin with the phrase, “The following symbols are used in this paper:”; acronyms and abbreviations are not permitted in the Notation list except when they are used in equations as variables. Definitions should end with a semicolon.

Example:

**Notation**

*The following symbols are used in this paper:*

\[ A = \text{surface area of element}; \]
\[ [A] = \text{coefficient matrix}; \]
\[ a = \text{side length or radius of plate}; \]
\[ B = \text{strain-displacement matrix}; \]
\[ \{b\} = \text{augment vector}; \]
\[ E() = \text{expectation operator}; \]
\[ e = 2.718281828; \]
\[ F = \text{Froude number}; \]
\[ F_d = \text{downstream Froude number}; \]
\[ F_0 = \text{approaching Froude number}; \]
\[ g = \text{gravitational acceleration}; \]
M = Mach number; 
R = Reynolds number; 
Ri = Richardson number; 
S = Strouhal number; 
U = degree of consolidation; 
Ut = average degree of consolidation; 
u = excess pore water pressure; 
{u} = excess pore water pressure vector; 
u(t) = excess pore water pressure at any time t; 
W = Weber number; 
w = out-of-plane displacement; 
α = coefficient; 
ΔS = elemental surface area; 
Δϕ = ϕ(t + T) − ϕ(t); 
ξ = Him⁰¹/²; and 
ω = wave number.

APPENDICES

Appendices can be used to record details and data that are of secondary importance or are needed to support assertions in the text. The main body of the text must contain references to all Appendices. Any tables or figures in Appendices should be numbered sequentially, following the numbering of these elements in the text. Appendices must contain some text, and need to be more than just figures and/or tables. Appendices containing forms or questionnaires should be submitted as Supplemental Data instead.

SUPPLEMENTAL MATERIALS

Supplemental Data is considered to be data too large to be submitted comfortably for print publication (e.g., movie files, audio files, animated .gifs, 3D rendering files) as well as color figures, data tables, and text (e.g., Appendices) that serve to enhance the article, but are not considered vital to support the science presented in the article. A complete understanding of the article does not depend upon viewing or hearing the Supplemental Data.

Supplemental Data must be submitted for inclusion in the online version of any ASCE journal via Editorial Manager at the time of submission.

Decisions about whether to include Supplemental Data will be made by the relevant journal editor as part of the article acceptance process. Supplemental Data files will be posted online as supplied. They will not be checked for accuracy, copyedited, typeset, or proofread. The responsibility for scientific accuracy and file functionality remains with the authors. A disclaimer will be displayed to this effect with any supplemental materials published online. ASCE does not provide technical support for the creation of supplemental materials.
ASCE will only publish Supplemental Data subject to full copyright clearance. This means that if the content of the file is not original to the author, then the author will be responsible for clearing all permissions prior to publication. The author will be required to provide written copies of permissions and details of the correct copyright acknowledgment. If the content of the file is original to the author, then it will be covered by the same Copyright Transfer Agreement as the rest of the article.

Supplemental Data must be briefly described in the manuscript with direct reference to each item, such as Figure S1, Table S1, Protocol S1, Audio S1, and Video S1 (numbering should always start at 1, since these elements will be numbered independently from those that will appear in the printed version of the article). Text within the supplemental materials, such as legends, footnotes, and protocols, must follow journal style. Links to websites other than a permanent public repository are not an acceptable alternative because they are not permanent archives.

When an author submits supplemental materials along with a manuscript, the author must include a section entitled “Supplemental Data” (#1 heading) within the manuscript. This section should be placed immediately before the References section. This section should only contain a direct list of what is included in the supplemental materials, and where those materials can be found online. Descriptions of the supplemental materials should not be included here. An example of appropriate text for this section is “Figs. S1–S22 are available online in the ASCE Library (ascelibrary.org).”

**General Guidelines for all Supplemental Data**

At this time, ASCE has not specified a maximum file size for submission; however authors are strongly encouraged to adhere to the following guidelines during file preparation:

- The acceptable file formats outlined above are playable using standard media players such as QuickTime and Windows Media Player. Media players should be used to check file properties and image/sound quality prior to submission. For video submissions, fonts, lines, and image details should be of sufficient size and weight to be visible when played at half size.
- Attention should be paid to the file size to make download time reasonable because streaming formats are not acceptable for submission at this time. A recommended target size for each multimedia file is 3–5 MB.
- Authors are encouraged to use one of the accepted compression codecs to minimize file sizes.
- Animations must be formatted into a standard video file (except for some animated .gif files, as noted above).

**Supplemental Video Submissions**

Peer reviewed video submitted to ASCE is accepted in the form of a digital video file. Acceptable file formats include QuickTime Non-Streaming (.qt or .mov), .mpg, and .dv. The preferred formats are .mov and .mpg. Details about each of these file formats are outlined below. Videos created using non-standard codecs are not acceptable. Animations must be formatted into a standard video file. Brief animations of 10 frames or fewer may be formatted as an animated .gif file. All videos should include a text caption, following the same guidelines as those used for figure captions.
Video files should be named [filename.xxx]. For example, the file for the article’s first supplemental video would be called “Video S1.mpg.”

The following file formats are acceptable for video:

**ACCEPTABLE ARCHIVAL VIDEO FILE FORMATS**

- QuickTime Non-Streaming (.avi, .qt or .mov)
  - 24 Bit (Millions) Color
  - Video Compressor/Codec
    - Uncompressed/None
    - Animation
    - Motion JPEG (MJPEG)
    - DV – NTSC
    - DV – PAL
  - Audio
    - 48,000 samples per second
    - 16 bit
    - Uncompressed/PCM
    - Stereo or Mono

- MPEG
  - Video Compressor/Codec
    - MPEG2 (.mpg)
    - MPEG4 (.mpg or .mp4)
  - Video data rate 6Mbs or greater
  - Audio
    - 48,000 samples per second
    - 16 Bit
    - Uncompressed (PCM) or MPEG Audio at 224Kbs or greater

- DV (.dv)
  - DV NTSC
  - DV PAL

**NTSC VIDEO PARAMETERS**

- Image size (H:V) 720:480 pixels
- Frame Rate 29.97 frames per second

**PAL VIDEO PARAMETERS**

- Image size (H:V) 720:576 pixels
- Frame Rate 25 frames per second

**Supplemental Audio Submissions**

Audio files may also be submitted to ASCE. Acceptable file formats include .pcm, .wav, .aif, and .mp3 at 128 Kbs or greater. Audio files should be named [filename.xxx]. For example, the file for the article’s first supplemental audio item would be called “Audio S1.wav.”
The following formats are acceptable for audio files:

- PCM, WAV, AIFF, MP3 (at 128 Kbs or greater)
- Audio Parameters
  - 44,100 or 48,000 samples per second
  - 16 Bit
  - Stereo or Mono

**Supplemental Figure Submissions**

All supplemental figures must include a figure caption, and all supplemental figures must be consecutively numbered. Supplemental figures should be submitted together in a single PDF file that contains the caption directly below the figure. **NOTE:** This statement does not apply to animated .gif files. Each figure should be formatted to fit on a single page. Figures that contain multiple parts should also be formatted to fit on a single page, whenever possible.

**Supplemental Text Submissions**

Acceptable file formats for supplemental text files (including supplemental Appendixes) are .txt and PDF. Proprietary file formats such as .doc, .docx, and .wpd are not acceptable.

**Descriptive and Metadata Elements**

When submitted, information about the media file will be requested. A caption or description of the media file content (similar to a typical figure caption) will be required, and metadata (outlined in the table below) will be optional.

Following are the metadata elements:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caption/Description</td>
<td>Textual caption/description of media object content. <strong>Required.</strong></td>
</tr>
<tr>
<td>Type</td>
<td>The nature or genre of media content, such as video or audio. <strong>Optional.</strong></td>
</tr>
<tr>
<td>Format</td>
<td>Media filetype description, such as Quicktime, AVI, DV, MPEG, PCM, or WAV.  <strong>Optional.</strong></td>
</tr>
<tr>
<td>Duration</td>
<td>The duration of media object playing time (in seconds). Applicable to video or audio media. <strong>Optional.</strong></td>
</tr>
<tr>
<td>Frame size</td>
<td>For video only (not still images): Video image size (height x width, in pixels). <strong>Optional.</strong></td>
</tr>
<tr>
<td>Producer</td>
<td>Information about the software used to create the media object. It should include software name and version (e.g. Adobe Premiere Elements v. 2.0). <strong>Optional.</strong></td>
</tr>
</tbody>
</table>
REFERENCES

ASCE uses the author-date method for in-text references, whereby the source reads as the last names of the authors, then the year (e.g., Smith 2004 or Smith and Jones 2004). A References section must be included that lists all references alphabetically by last name of the first author. References must be published works only. Exceptions to this rule are theses, dissertations, and “in press” articles, all of which are allowed in the References list. References cited in text that are not found in the reference list will be deleted but queried by the copyeditor. Likewise, all references included in the References section must be cited in the text.

Examples of reference formatting are below.

Books — If a whole book is used (or pages here and there throughout the book), page numbers need not be given. If no author is listed, titles should be alphabetized. If a specific chapter is being used, the chapter title and inclusive page numbers should be included. Reports must include the full institution name and location.


Building Codes and Provisions — Building codes, provisions, and standards should be listed alphabetically by the name of the promulgating institution. If a title and code number are given, the title should be in quotes, and the code number in italics; if only a title is given, the title should be in italics.


Electronic Materials —

CD-ROM—The section, chapter, and page numbers should be provided if available:


Website—The following elements should be included: author’s name (if known); year of publication or last revision (if available); full title of the document, in quotation marks; title of the complete work (if applicable), in italics; full web address, enclosed within angle brackets; and date of the visit (if
applicable), in parentheses. If the Web page shows no year of publication, the year of the visit may be used in its place.


Journal Articles — The standard format for a paper published in a U.S. journal is as follows:


ASCE Journals — ASCE no longer uses page numbers and has adopted a new format for its references (including those older papers that still contain page numbers). Use the following style for citation to an ASCE journal:

Authors. (Year of initial publication). “Title of paper.” Journal abbr., DOI, CID/page range.


ASCE Committee/Technical Reports — ASCE committees, task forces, etc. publish reports, proposed codes and standards, commentaries on codes and standards, and so on. The committee is the author.


Foreign Journals — Authors may want to give an English translation of a non-English-language title. Some non-English-language journals also have titles and abstracts in English, with the research papers being in the foreign language.


The original title should not be included if the language uses an alphabet other than Latin (Cyrillic, CJK, etc.).

In-Press Articles — Articles that are “in press” (i.e., those that have been accepted but have not yet been published) may be included in the References list. Include the year of acceptance, if possible, or the current year as follows:

Maps — The following style is used for maps:


Newspaper Articles — The article author (if known), year in parentheses, title of the article in quotes, name of the newspaper in italics, and section/page numbers (if applicable) should be included for article citations:


Proceedings — The location of a conference or symposium is required only if it is part of the title or proceedings. The name and location of the publisher is required. If there is no “publisher,” the name of the location of the sponsor are required. The name of the sponsor is sometimes part of the title of a conference proceeding. Editor name(s) and volume number should be included if available.


Unpublished Material — ASCE does not permit unpublished material to be included in the References list. It may be cited in the text in the following forms:

...other researchers (Orton et al., unpublished data, 1992)...

In some cases (A. W. Pinter, personal communication, 1979)...

Working papers and submitted papers are considered unpublished and should be cited in the text as follows:

(B. Smith, “[title of paper],” working paper, Salk Institute, Pittsburgh, Pennsylvania)

(B. Smith, “[title of paper],” submitted, Salk Institute, Pittsburgh, Pennsylvania)

Unpublished reports should be cited in text according to one of the following formats:

(author name(s), name of report, presented at ___, 2012)

(author name(s), name of report, unpublished report)
A paper that has been presented at a conference or meeting but is otherwise unpublished should be cited as an “unpublished report”:

... in Chang and McTavish (unpublished report, 1991)...

## TABLES

Tables should be either grouped at the end of the manuscript after the References section or uploaded as separate files. Tables should be numbered in sequential order (i.e., Table 1, Table 2, etc). Every table must be called out in the text in sequential order. For example, Table 3 should not be called out before Table 1—this will require the copyeditor to renumber the tables and move them. All callouts must match the tables provided.

### Table Format

- **Title**: Table titles begin with the boldface “Table,” followed by a boldface Arabic number and a period. Example: Table 1. Ultimate Rotations at the Joint Interfaces and Beam Ends
- All tables should be typed with clear columns.
- Vertical rules should not be used in tables. Horizontal rules are used to offset column headings at the top of the table and footnotes (if any) at the bottom of the table and to separate major sections.
- All columns must have a heading. Each table should have only one set of column headings at the top of the table. Using additional column headings within the body of the table should be avoided.
- **Footnotes**: A general footnote should be used to convey any information that pertains to the table as a whole and should precede any lettered footnotes. The general footnote should start with “Note:”. Example: Note: Δy = notional yield displacement; Δu = axial shortening at peak load; Δf = axial shortening at the failure load; λ = deformability factor; η = displacement ductility factor.
- Lettered footnotes should follow the general footnote (if there is one). Lowercase superscript letters should be used, and all lettered footnotes must be cited within the table (footnotes are not permitted on the table title):
  - Length of compression zone.
  - Flexural shear strength of the masonry panel.
  - Based on Smith et al. (2009).
- Photographs, sketches, line art, or other graphic elements are not permitted in tables. Any table that includes graphics must be treated and numbered as a figure.
- Highlighting and shading are also not permitted and will not be reproduced in print. Boldface font should be used for emphasis sparingly.
- Equations are allowed in the table body, but should be avoided if possible. Numbered equations are never allowed in tables.
- Tables should not be submitted in multiple parts (Table 1a, 1b, etc.). Tables with multiple parts should either be combined into one table or split into separate tables.
Table 1. Holocene Sites Used to Develop VS-Based CRR Chart

<table>
<thead>
<tr>
<th>Site</th>
<th>Test type</th>
<th>Critical layer depth (m)</th>
<th>$V_p$ (m/s)</th>
</tr>
</thead>
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<tr>
<td>Hanshin Expressway $^a$</td>
<td>SL</td>
<td>2.1–5.3</td>
<td>900</td>
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<tr>
<td>Kobe-Nishinomlya Expressway</td>
<td>SL</td>
<td>4.4–10.5</td>
<td>1,540</td>
</tr>
<tr>
<td>Owi Island</td>
<td>DH</td>
<td>4.5–7.8</td>
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<td>United States</td>
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<td>Coyote Creek $^a$</td>
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</tr>
<tr>
<td>Marina District School $^a$</td>
<td>CH</td>
<td>2.7–4.3</td>
<td>1,360</td>
</tr>
<tr>
<td>Bay Bridge Toll Plaza $^a$</td>
<td>CH</td>
<td>5.0–7.5</td>
<td>1,540</td>
</tr>
</tbody>
</table>

Note: CH = crosshole; DH = downhole; SH = suspension logger.

$^a$Sites of historic liquefaction occurrence.

Table 2. True Stress-Strain Data for FEA

<table>
<thead>
<tr>
<th>Point</th>
<th>1.5-mm G450 sheet steel</th>
<th>3.0-mm G450 sheet steel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>True strain ($10^{-3}$)</td>
<td>Plastic strain ($10^{-3}$)</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>3.02</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>19.8</td>
<td>16.8</td>
</tr>
<tr>
<td>4</td>
<td>41.9</td>
<td>38.9</td>
</tr>
<tr>
<td>5</td>
<td>144</td>
<td>141</td>
</tr>
<tr>
<td>6</td>
<td>1,000</td>
<td>997</td>
</tr>
</tbody>
</table>

Table 3. Geometric Properties of Subassemblage Specimens

<table>
<thead>
<tr>
<th>Test specimen $^a$</th>
<th>Position of curtailment (mm)</th>
<th>Longitudinal reinforcement $^b$</th>
<th>Bottom bars at the middle joints $^c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1-0.90</td>
<td>1,000</td>
<td>2T10 (0.90%) 2T10 (0.49%)</td>
<td>Continuous</td>
</tr>
<tr>
<td>S2-0.73</td>
<td>925</td>
<td>3T10 (0.73%) 2T10 (0.49%)</td>
<td>Lap splice</td>
</tr>
<tr>
<td>S3-1.24</td>
<td>1,000</td>
<td>3T13 (1.24%) 2T13 (0.49%)</td>
<td>Lap splice</td>
</tr>
<tr>
<td>S4-1.24</td>
<td>1,000</td>
<td>3T13 (1.24%) 2T13 (0.82%)</td>
<td>Continuous</td>
</tr>
</tbody>
</table>

Note: The beam sections are 150 mm wide and 250 mm deep for all specimens (i.e., $b = 150$ mm and $h = 250$ mm); the concrete cover thickness is 20 mm for all specimens; total net span $L = 2L_n + 250$ (mm); and test results of Specimens S1 and S2 are shown in Yu and Tan (2011). NA = not available.

$^a$The seismic detailing in terms of the arrangement of the stirrups is indicated by S.

$^b$Reinforcement ratio in brackets is calculated by $A_s/bd$, where $b = 150$ mm and $d = 215$ mm; the A-A and B-B sections are given in Fig. 1.

$^c$The lap-splice lengths for the bottom bars of Specimens S3 and S6 are 410 and 530 mm, respectively. The lap-spliced position is through the middle joint.
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