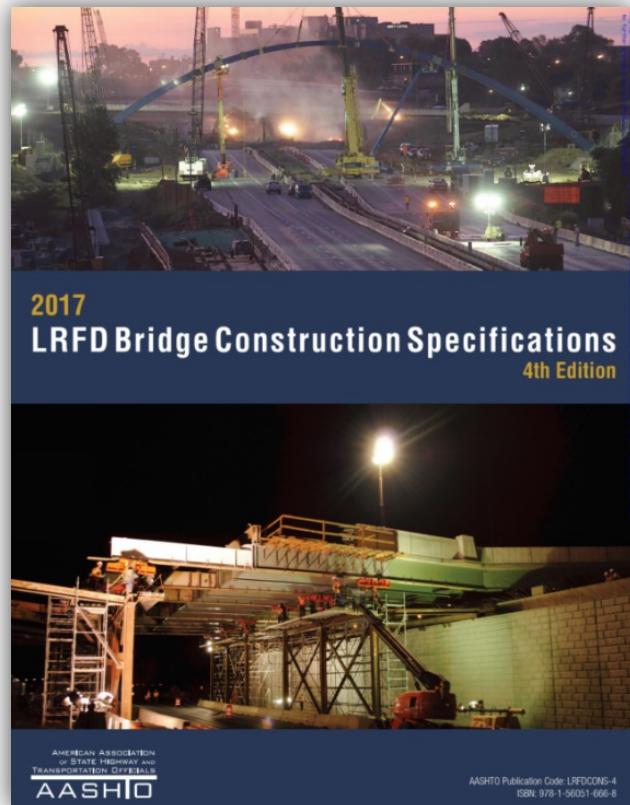


Evaluation and Updating of the AASHTO LRFD Bridge Construction Specifications

Final Report

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Technical Committee T-4 Construction

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Section 1: Introduction

This report presents the results of a study conducted by CHA Consulting, Inc. and Modjeski & Masters, Inc. that investigated the current usage and potential future changes to the document entitled *AASHTO LRFD Bridge Construction Specifications*. The basis of the study and this report is the Scope of Work Document that was part of the original solicitation for this project. Minor changes were made to the scope of work as the project progressed, based on information gathered during the early phases of the work (questionnaire). The following sections contain the results of our work. The project has progressed in collaboration with Technical Committee T-4. In some instances, our team has made recommendations on how to move forward. It is understood that the ultimate decision on the direction of the *AASHTO LRFD Bridge Construction Specifications* rests with the AASHTO Committee on Bridges and Structures.

1.1 Acronyms Used in the Report

COBS: Committee on Bridges and Structures

STA: State Transportation Agency or Department of Transportation

AASHTO LRFD BCS: AASHTO LRFD Bridge Construction Specifications

AASHTO LRFD BDS: AASHTO LRFD Bridge Design Specifications

Section 2: Questionnaire Results

A brief questionnaire was developed and sent to all 50 STAs to better understand the current usage and potential modifications to the *AASHTO LRFD Bridge Construction Specifications*. The results of the questionnaire can be found in the Appendix of this report.

The following includes the questions that were asked and a general conclusion from the responses:

Question	General Conclusions of Responses
How is the AASHTO LRFD BCS used in your construction contract administration?	The majority of states use the document to help develop their own specifications in some way. 95% of the states find some use of the document. Over 60% use the document to build their own specifications, as a reference, or for exact language in their specifications. The general conclusion is that the document has widespread use.
What sections of the AASHTO LRFD BCS are the most useful?	All sections are used by a number of states. The following sections are listed as most useful by 4 or more STAs (in descending order): <ul style="list-style-type: none">• Steel Structures (13)• Temporary Works (11)• Driven Foundation Piles (10)• Concrete Structures (9)• Drilled Shafts (9)• Bearing Devices (6)• Removal of Existing Structures (5)• Prestressing (5)• Earth-Retaining Systems (5)• Ground Anchors (4)• Bridge Deck Joint Seals (4)
What sections of the AASHTO LRFD BCS are the least useful or are not used?	The following Sections are listed as least useful by 4 or more STAs (in descending order): <ul style="list-style-type: none">• Shock Transmission Units (8)• Concrete Block and Brick Masonry (7)• Stone Masonry (7)• Aluminum Structures (5)• Steel Grid Flooring (4)• Pneumatically Applied Mortar (4)• Thermoplastic Culverts (4)
Do you find the measurement and payment section useful?	The response to this is split almost 50/50.
Do you find the material sampling, testing, and acceptance (ASTM, AWS, PTI, PCI, AISC, and other industry references) useful?	Over 80% answered yes to this question.

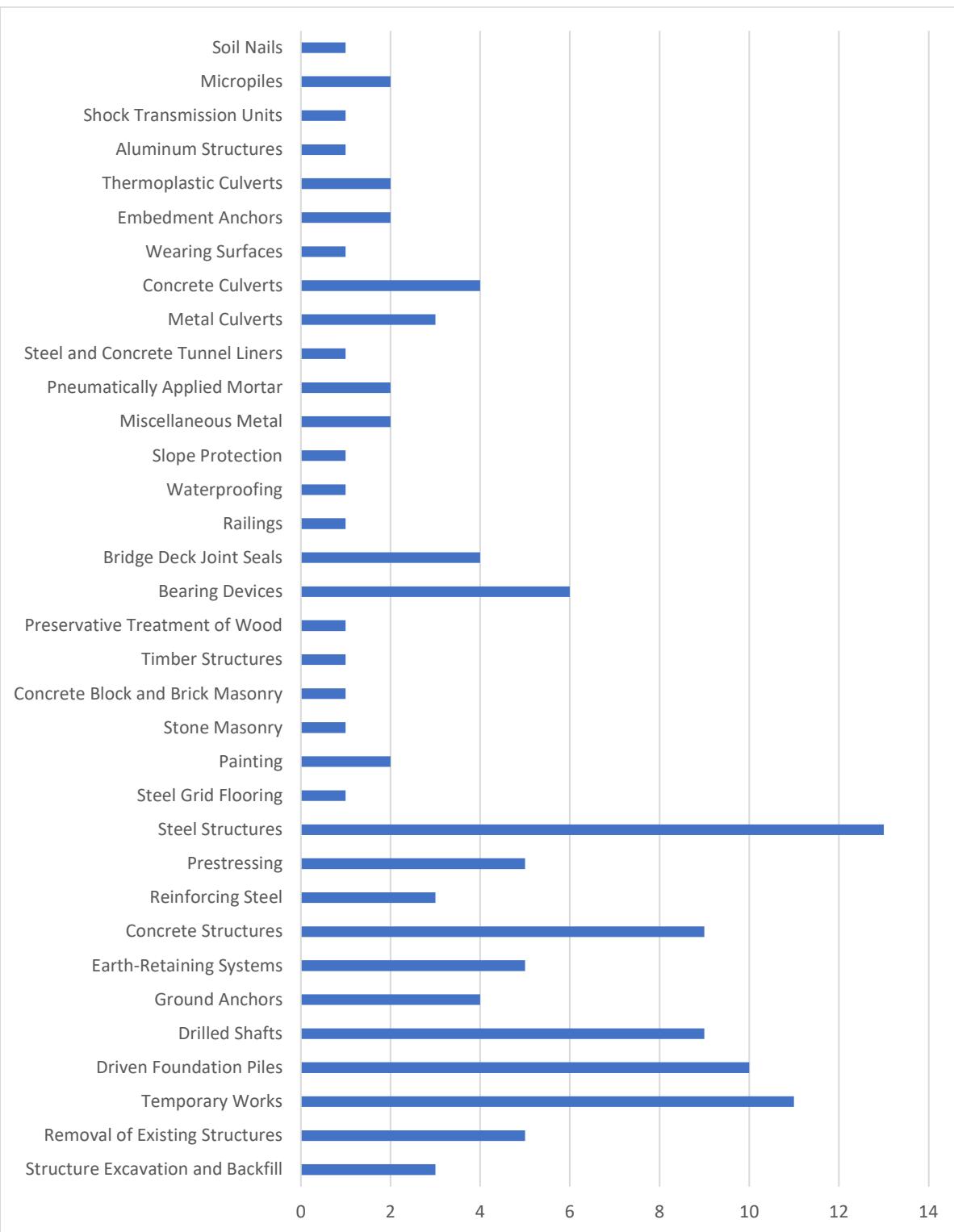
Are there areas that the AASHTO LRFD BCS doesn't currently cover that you recommend adding?	35% answered yes. There were several recommendations for additions to current sections. Several suggestions were made by multiple states on the following topics: <ul style="list-style-type: none"> • UHPC (5) • GRS-IBS (2) • Lightweight Backfill (2)
Are there areas currently covered by the AASHTO LRFD BCS that you would recommend removing?	14% answered yes. It was suggested that the least useful sections listed above could be removed.
The AASHTO LRFD BCS are currently written in a "contract language" format. Do you find this format helpful?	76% answered yes.
Would it be better to re-write these as more of a guidance document that STAs and public owners can reference when developing their own specifications?	The response to this is split almost 50/50.
Currently, the organization of the AASHTO LRFD BCS does not necessarily align with the AASHTO LRFD Bridge Design Specifications (BDS) (chapters don't align, etc.). Would you find it helpful to reorganize the AASHTO LRFD BCS so that they match up with the ASHTO LRFD BDS? For example, the AASHTO LRFD BDS currently covers drilled shaft design in Chapter 10, Section 10.8. This realignment would move drilled shaft construction guidance to Chapter 10, Section 10.8 of the AASHTO LRFD BCS.	57% answered yes. The remainder either answered no or were unsure.
Should the AASHTO LRFD BCS be modified to accommodate alternative contracting mechanisms such as Design-Build?	32% answered yes. The remainder either answered no or were unsure. This question may have been misinterpreted. The intent was to investigate the need for changes to QA/QC and the role of the contractor's design engineer vs. the owner.
Does your state have any specifications you feel should be added to supplement, or replace an existing specification in the current AASHTO LRFD BCS?	Only 11% answered yes. A few were listed: <ul style="list-style-type: none"> • Geofoam fill • GRS-IBS • Construction material transfer trucks traversing bridges • Direct tension indicators (update) • Preservation (patching, overlay and waterproofing)

What do you think should be done with the AASHTO LRFD BCS?	51% want to keep, update, and improve it. 30% want to make it a guidance document. 8% want to sunset it. Several want to keep it simple and not expand it.
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2.1 General Conclusions Taken from the Questionnaire

1. The document does get used by a majority of STAs. The usage ranges from a reference document to a full specification. Based on this, it does not seem that archiving the document would be supported by the members of AASHTO COBS.
2. There are a number of sections that are considered useful and a number of sections that are not considered useful. This can be useful information to prioritize a re-write effort, if that direction is taken.
3. There are a few suggested specifications that could be added including UHPC, GRS-IBS and lightweight fills. It should be noted that all three of these items are covered in the construction sections of the *2018 AASHTO LRFD Guide Specifications for Accelerated Bridge Construction*. This material can be used as a starting point should a re-write be pursued.
4. The majority of responders noted they prefer the document to be in “specification format”.
5. There were several answers that were essentially split on a 50/50 basis:
 - a. Measurement and payment specification usage
 - b. Convert to guidance document
 - c. Re-organize to be consistent with the AASHTO LRFD BDS
6. The use of each section by STAs is shown in Figure 2.1-1.

Figure 2.1-1: Section Usage



Note 1: Number of STAs using each section noted in horizontal axis.

Note 2: STAs that use many sections on occasion are not listed.

Based on these responses, our team recommends the following should be considered for the future document:

1. Keep the document in construction specification format.
2. Convert the document to a guide specification (see note A).
 - a. STAs can then determine if they want to use certain provisions word for word or use the text as guidance for their own specifications.
 - b. STAs can insert their state specific materials specifications such as aggregates, concrete classes, etc.
 - c. Our team has received anecdotal information regarding problems with a “full specification” format. Apparently, the document is being used against STAs in claim cases. The claimants are using the text in the specification to their advantage in their claim to prove that a project specification is insufficient since it is not consistent with the “national standard”. Converting the specification to a guide specification could potentially help this situation, since it will only be a guidance document.
3. There still appears to be a significant benefit to having a national specification document. This can help to create uniformity of construction specification across state borders.
4. Consider re-organizing the document (see section below for several recommended options).
5. Update the document. This can be done in a “cover-to-cover” project or broken up into prioritized pieces. There are number of high priority sections noted in the responses.

Note A: There are three common types of documents that are used by AASHTO and industry organizations. The following is a description of each, as they would apply in the context of a construction specification:

- *Specification*: A document written in specification language format that is intended to be adopted in whole as part of contract documents.
- *Guide Specification*: A document written in specification format that MAY be adopted in whole or in part as part of contract documents.
- *Guideline*: A document written to provide reference material that can be used to develop contract specifications; not intended to be directly copied into contract documents.

Section 3: Review of the Existing AASHTO LRFD Bridge Construction Specifications

As defined in the project scope, our team performed an independent review of the *2017 AASHTO LRFD Bridge Construction Specifications, 4th Edition*. The purpose of the review was to gain an understanding of the current status of the specifications, looking into the following aspects:

1. Level of Detail
2. Consistency with Current Industry and State Specifications
3. Format
4. References
5. Commentary

This review was not a word-by-word review nor did it include reference checks, in accordance with the project scope of work. This review can best be described as a page turn review using the significant experience of the team to identify the current state of the specifications.

3.1 General Observations

The following sections contain general observations from our review.

Level of Detail

The level of detail in each specification section is not consistent. Some specifications are very well written and very thorough. Unfortunately, the well written specifications are more the exception, than the rule. Many specifications are lacking an adequate level of detail.

Consistency with Current Industry and State Specifications

Most of the specifications are not current with industry standards. There are a few that are generally up to date. For example, the modular expansion joint specification is thorough, including the requirements for fatigue testing for prequalification.

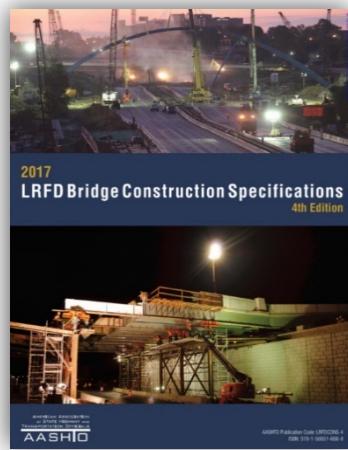
Format

There is no consistency of format between each specification. Generally, the specifications do consistently follow industry standards for specifications format, including:

1. Description
2. References
3. Materials
4. Construction Methods
5. Measurement and Payment

References

In general, the references appear to be dated. Many sections do not have references that are newer than 1996, which is approximately when the current specifications were converted to LRFD format. This is a potential indication of how old each specification is. In a number of cases, the reviewer was aware of more recent research and industry documents that are not



referenced. For example, the post-tensioning industry has made significant improvements to grouting of post-tensioning systems. The specifications do not have reference to current industry documents that are widely used and recommended.

Commentary

There is very little commentary in most sections. This could be an indication that there have been very few changes to the document since the conversion to LRFD format. We have found that commentary can at times be just as important as the provisions. A good example of the use of commentary in a construction specification is the *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction*. Figure 3.5-1 displays a portion of the construction specifications for Ultra-High Performance Concrete. In this example, the commentary is more voluminous than the provisions, but gives background and information on the need for the provision.

Figure 3.5-1: Example of the Use of Commentary in a Construction Specification

10.4.5.3—Formwork for UHPC	C10.4.5.3
Formwork that will be in contact with the UHPC shall have a non-absorbing finish. Formwork shall be properly sealed in order to contain the fluidity of UHPC mixes.	Fresh UHPC is a fluid, self-consolidating material that contains little or no coarse aggregate. Because of these features, the formwork used to contain the material requires tighter control than the formwork used for conventional concrete. UHPC also places higher pressures against the formwork compared with conventional concretes.
Pours that are not flat shall be retained through the use of top forms.	Success or failure of UHPC placement is directly related to Contractor and construction inspector attentiveness to ensuring that the formwork is properly sealed and capable of resisting the hydrostatic pressures from the UHPC in the unhardened state. The formwork should be nearly leak proof under the application of water.
Forms shall be constructed to allow a slight overfilling of the connection and may include features to provide a slight pressure head on the pour after it is placed.	UHPC is a self-leveling material that will not normally set on a grade before initial set. Even roadway cross slopes have proven to be problematic when placing UHPC in deck joints. Top forms combined with placement "chimneys" have proven to be successful methods for properly placing UHPC.
	As is common with fluid materials cast into enclosed spaces, trapped air must be provided an exit so that the space can be filled by the UHPC. Small amounts of air trapped in the UHPC and in the connection spaces during placement can result in the UHPC initially appearing to fill the void space, and then later subsiding slightly as the air escapes. The use of a form "chimney" combined with a top form can be used to sustain a slight pressure head on the unhardened UHPC and address any subsidence effects from the release of air.

3.2 Review Notes for Each Section

The following notes were gathered during the review of each section of the BCS. Included in the notes are ratings for the following:

1. Level of Detail

- Poor: Very little detail
- Fair: Somewhat detailed
- Good: Adequate amount of detail
- Excellent: Extremely detailed

2. Usefulness

- Poor: Lacking information and/or section not typically used in bridge projects
- Fair: Contains valuable information and/or section occasionally used in bridge projects
- Good: Useful when section is needed for bridge projects
- Excellent: Very useful when section is needed for bridge projects

3. Level of Importance (based on survey results)

- Low: Not used by many STAs
- Medium: Used occasionally by some STAs
- High: Used consistently by many DOTs

4. Level of Required Re-Work

- Low: Needs minor re-organization and re-write
- Medium: Needs more significant re-organization and re-write
- High: Needs major re-organization and re-write

It should be noted that these ratings are based on a cursory review of the overall document. Our team did not dig deep into the quality of the provisions and possible missing provisions.

Section 1: Structure Excavation and Backfill

Specifications for excavation, backfill, support of excavation, and water control within the BCS are beneficial as these items are common to bridge projects. There is currently a fair level of detail provided in the BCS, but additional guidance could be provided for the various topics included in this section. Lightweight backfill material could be added to this section. The only commentary are references to the AASHTO Guide Specifications for Highway Construction.

Level of Detail: Fair

Usefulness: Good

Level of Importance: Medium

Level of Required Re-Work: Medium

Section 2: Removal of Existing Structures

This section is well written and stays on topic. The guidance is focused on issues involving construction. Overall, it does not appear to need to be updated to reflect technical advancements since it was drafted. There are no notes in the commentary and no references are cited at the end of the section. Issues of professional responsibility are limited to how the Contractor is performing the work.

The section seems a bit light and could use some additional information. There is no mention about crane placement, working over traffic, or removal over railroads and track protection except the requirement that working drawings be submitted. Review and comments by a subject matter expert might provide some additional information or commentary.

Level of Detail: Poor

Usefulness: Fair

Level of Importance: Medium

Level of Required Re-Work: High

Section 3: Temporary Works

This section needs a re-write from an editorial standpoint. The writing does not flow and jumps back and forth between topics of consideration within each section, which makes it difficult to follow. The tone of some sections seems adversarial and requirements for submittals are overly vague with undefined requirements that are biased toward the Owner. Some sections, particularly steel and timber construction, drift off topic and inappropriately cite design guidelines while inadequately addressing construction or inspection issues.

Sections 3.3 to 3.8 generally stay on topic focusing on construction, not design. Some of the recommendations read like requirements and can be too specific for a general document such as this. References are typically 10 to 20 years old. Newer accelerated bridge construction methods should be included, as applicable. The section is valuable but short and needs a lot of re-work.

Level of Detail: Poor

Usefulness: Fair

Level of Importance: High

Level of Required Re-Work: High

Section 4: Driven Foundation Piles

This section has thorough descriptions for furnishing and driving piles. It provides limits and equations for testing, allowable stresses, and tolerances. Commentary columns are utilized and there are references to other manuals or specifications for guidance. Section appears to be well-organized and complete making it very useful for bridge projects with pile foundations with minimal revisions required.

Level of Detail: Excellent

Usefulness: Excellent

Level of Importance: High

Level of Required Re-Work: Low

Section 5: Drilled Shafts

Section is well organized and well written. Topics are broken down into multiple subsections and guidance stays on topic. There is a focus on construction issues without drifting into design suggestions or recommendations. Delineations of responsibility were appropriate, fair, and balanced.

The section is informative and open to multiple options with an appropriate level of flexibility. The entire chapter reads well and identified important concepts, processes, materials, equipment, etc. The longer subsections tended to be broken up into short paragraphs that maintained focus that did not bleed over into the other areas.

In general, this section does a good job of defining the desired outcomes, important issues to address during construction, and defined processes used to achieve a proper drilled shaft foundation. There is also guidance on how to present bid quantities and administer payment. These kind of guidelines should be expected in construction specifications.

Main recommendation would be to have the section reviewed and commented on by subject matter expert. Also, commentary was overall very good but somewhat inconsistent from section to section.

Level of Detail: Excellent

Usefulness: Excellent

Level of Importance: High

Level of Required Re-Work: Low

Section 6: Ground Anchors

In general, the section is fairly detailed, however, there appears to be a need to update the specification to current standards. For example, tendon grouting and tendon corrosion protection have changed significantly over the last 10 to 15 years. Items such as stainless steel strands or fiber reinforced polymer (FRP) strands in high performance grouts could be added. The references in this section are quite old as the newest reference dates to the year 2000. There is limited commentary.

Level of Detail: Good

Usefulness: Fair

Level of Importance: Medium

Level of Required Re-Work: Medium

Section 7: Earth-Retaining Systems

This section focuses on prefabricated proprietary walls. There is very little on walls designed by the engineer of record (EOR). The way to specify proprietary walls can be quite different than unit price walls. The wall is designed by the supplier. The EOR needs to define the pay limits for the wall in 3D as the wall thickness quantities are not defined until after the bid. This should be covered in the specification.

There is significant reference to the *AASHTO Guide Specifications for Highway Construction*. Our team believes most designers are not even aware of this document. It is published by the AASHTO Committee on Construction. Relevant information should be brought into this document or the reference should be removed. Also, the use of lightweight backfill materials should be covered.

Level of Detail: Good

Usefulness: Fair

Level of Importance: Medium

Level of Required Re-Work: Medium

Section 8: Concrete Structures

The organization of this chapter is fair and requires re-working to better align with traditional construction specifications. Similar to other sections, the headings jump around, are inconsistent, and seem to be out of place. Outside referenced material needs to be updated to site current documents. UHPC specifications should be included in this section. A subject matter expert to assist with providing additional information and guidance for improvements would be beneficial for revisions.

Level of Detail: Fair

Usefulness: Fair

Level of Importance: High

Level of Required Re-Work: Medium

Section 9: Reinforcing Steel

This chapter is decently organized and reads like a traditional construction specification. Several subsections appear to be out of place but could be resolved with some minor re-work. Outside referenced material appears to be out of date in several instances and should be updated. A full review by an industry expert is warranted to bring the material up to the latest standards.

Level of Detail: Good

Usefulness: Good

Level of Importance: Medium

Level of Required Re-Work: Medium

Section 10: Prestressing

The writing of this section is inconsistent and should be reviewed from an editorial standpoint. The initial subsections try to address the confusing topic of how different STAs treat the level of detailing in the contract plans and what necessary supplementary working drawings are necessary. This is an important topic that seems more appropriately addressed in the general notes or design guidelines for each particular project and STA. A

general statement to the effect that this type of information can vary widely and must be addressed in the contract documents should suffice. Subsections go off topic concerning construction and drift into design guidance, which seems inappropriate.

Subsections can become open narratives that cover multiple topics and scenarios, which is confusing, so further division to make points clear is recommended. The difference between the guidelines and commentary is inconsistent. Sometimes both seem to be saying the same things rather than one clarifying the other.

Prestressing is a very important topic and this section needs significant attention. A full review by subject matter experts for conformance with current practice is essential. Many items covered by this section are dynamic and subject to frequent changes in construction practices and materials. References to guide documents organizations, such as PTI, who are up to date and represent current industry practices should be included. Literature references are out of date as well.

Level of Detail: Poor

Usefulness: Poor

Level of Importance: Medium

Level of Required Re-Work: High

Section 11: Steel Structures

This is one of the more valuable sections. It has a lot of good information and specification language. In particular, the bolting requirements are thorough and well written. Improvements to be considered are to bring all the topics covered to a similar level of quality, as it is currently a bit uneven in the depth of treatment of various topics. More detail could be provided in the steel fabrication and erection provisions to meet the level of detail that exists in state specifications that have been updated to accommodate modern fabrication and erection practices.

Level of Detail: Fair

Usefulness: Fair

Level of Importance: High

Level of Required Re-Work: Medium

Section 12: Steel Grid Flooring

This section is well written and can be used effectively for steel grid flooring. Comparison with updated industry standards is needed to bring into alignment with best practices.

Level of Detail: Fair

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 13: Painting

The organization of this section is fair to poor and does not read like a traditional construction specification. The information in this section appears to be out of date and the details could be better handled by other industry organizations, such as the Steel Structures Painting Council (SSPC). SSPC specifications are widely used throughout the industry. A rework of this section is necessary to refresh the material and point the reader to relevant and up to date references.

Level of Detail: Fair

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 14: Stone Masonry

Work related to rubble and ashlar masonry is presented within this section. Material and dimensional requirements for both types of masonry are provided in detail without commentary. While specifications would be helpful for the construction of masonry structures, stone masonry is not commonly used for bridge projects. Masonry design involves ASD, so the *17th Edition of AASHTO Standard Specifications for Highway Bridges* is referenced instead of *AASHTO LRFD BDS*.

Level of Detail: Excellent

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Low

Section 15: Concrete Block and Brick Masonry

Work related to concrete block and brick masonry is presented within this section. Material and dimensional requirements for both types of masonry are provided in detail without commentary. While specifications would be helpful for the construction of masonry structures, concrete block and brick masonry are not commonly used for bridge projects. Masonry design involves ASD, so the *17th Edition of AASHTO Standard Specifications for Highway Bridges* is referenced instead of *AASHTO LRFD BDS*.

Level of Detail: Good

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 16: Timber Structures

This entire section could use a re-write for conformity to other specs. For example:

1. Article 16.1 states "reasonably close conformity with the details specified in the contract". This needs to be changed.

2. Article 16.3.1 states: "Quality of work shall be first class throughout, and all framing shall be true and exact". First-class is not defined and this statement is in conflict with article 16.1. Is it reasonably close, or exact?

References are very old and there is virtually no commentary. There is a lot of information on split ring connectors, yet they are rarely used. More information could be included on bolted connections. There is nothing regarding lag bolts, which are common. The American Institute of Timber Construction (AITC) has specifications that could be added.

Level of Detail: Fair

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 17: Preservative Treatment of Wood

This section should probably be included in Section 16 – Timber Structures, not as a separate section. This is because virtually all wood used in bridges is treated in some fashion. There should be text regarding field touch up of cut and drilled sections. Larger timbers, which are commonly used in bridges, do not have full thickness preservative treatment so cuts and holes expose untreated timber at the core. There are specialized ways of treating N cuts and holes that should be added.

There is only one reference. There are most likely industry specifications from the American Wood Preservers Association (AWPA).

Level of Detail: Fair

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 18: Bearing Devices

There are very few references but the AASHTO/NSBA Steel Bridge Bearing Task Group may be a good source for input. In general, this section is fairly detailed, however there is room for improvements and updates.

Several examples include:

1. Article 18.1.5.2.7: The long-term testing is a very expensive test. Industry indicates that this test should be a prequalification test only.

2. Article 18.9: The term "Anchor bolts" is no longer used. It should be "Anchor rods".

3. Article 18.8.1: A307 is not recommended for anchor rods. There is a specific ASTM that has been developed for anchor rods.

Level of Detail: Excellent

Usefulness: Good

Level of Importance: Medium

Level of Required Re-Work: Low

Section 19: Bridge Deck Joint Seals

There are a whole variety of proprietary bridge joint systems that are not covered. There is significant detail on modular joints but limited information on other joint systems. Consideration should be given to incorporating the modular joint testing protocol into the main specification.

This section has significant commentary, which is good. There are limited technical references. Our team is familiar with a significant amount of research on fatigue of modular joint systems that led to the testing requirements included in the specification. That research should be cited.

Level of Detail: Good

Usefulness: Fair

Level of Importance: Medium

Level of Required Re-Work: Medium

Section 20: Railings

This very brief section offers a general overview of railings with a low level of detail. Material requirements typically include references to other sections or documents. Little guidance is given for the actual construction or installation of railings. Overall, this section provides little information and would need a complete re-write to be considered a useful specification.

Level of Detail: Poor

Usefulness: Poor

Level of Importance: Low

Level of Required Re-Work: High

Section 21: Waterproofing

Waterproofing and damp proofing of concrete or masonry surfaces is common practice in bridge construction, especially for bridge decks. The level of detail for materials and installation in this section is good, which makes it useful. One particular item that would be helpful to include is a specification for spray applied membranes. Adding commentary or references could also be beneficial.

Level of Detail: Good

Usefulness: Good

Level of Importance: Low

Level of Required Re-Work: Medium

Section 22: Slope Protection

This section is decently organized and reads like a traditional construction specification. Outside referenced material appears to be out of date in several instances and should be updated. A full review by an industry expert is warranted to bring the material up to date to the latest standards.

Level of Detail: Good

Usefulness: Good

Level of Importance: Low

Level of Required Re-Work: Medium

Section 23: Miscellaneous Metal

This section is not well written and does not contain much useful information. Suggest it be removed or rewritten using example specifications from other states.

Level of Detail: Poor

Usefulness: Poor

Level of Importance: Low

Level of Required Re-Work: High

Section 24: Pneumatically Applied Mortar

The section reads well, stays on topic, maintains a focus on construction (means and methods, materials and testing, etc.), and is well organized. The guidance and recommendations presented in the section are well presented, appropriate, and tend to stay on topic. The section refers to other useful sections or publications that treat certain material in more depth.

A review and comment by a subject matter expert would be appropriate. There are few references and those included are general rather than specific to the topic described.

Level of Detail: Good

Usefulness: Good

Level of Importance: Low

Level of Required Re-Work: Medium

Section 25: Steel and Concrete Tunnel Liners

There is no specification for corrosion protection of steel plates. The grouting section is very brief considering it can be a significant portion of the work. There is very little commentary, and there are no significant references.

Level of Detail: Poor

Usefulness: Poor

Level of Importance: Low

Level of Required Re-Work: High

Section 26: Metal Culverts

There does not appear to be any notes on galvanizing. Our team believes it is part of AASHTO M36. This should be stated in the commentary. The commentary has a decent level of detail. There is good detail and installation procedures, which is critical for long-span steel arches. There are very few references.

Level of Detail: Excellent

Usefulness: Good

Level of Importance: Medium

Level of Required Re-Work: Low

Section 27: Concrete Culverts

This section is very useful for installing concrete culverts or pipes and relates to Section 12 of the *AASHTO LRFD BDS*. Multiple figures and tables provide valuable information and clarify requirements. Field inspection specifications have been added recently with a format that closely resembles *AASHTO LRFD BDS*, as there is a greater emphasis on the use of commentary than the rest of this section. Updating this entire section with additional commentary would be beneficial.

Level of Detail: Good

Usefulness: Excellent

Level of Importance: Medium

Level of Required Re-Work: Medium

Section 28: Wearing Surfaces

This specification only covers one material, latex modified concrete. There are other materials in use, such as polymers, UHPC, and methacrylate. There is no commentary and no significant references.

Level of Detail: Fair

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 29: Embedment Anchors

This section is only two pages on the installation and field testing of various anchors. Testing requirements are provided but manufacturer recommendations are usually referenced. There is a lack of definitive requirements or recommendations, but there is some guidance that could be valuable to a contractor. Post-installed anchors should be included in this section.

Level of Detail: Fair

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 30: Thermoplastic Culverts

While the use of thermoplastic and fiberglass culverts may not be common in bridge construction, there is a good level of detail provided in this section. As these are buried structures, the majority of section covers excavation and fill. This section appears to have been developed or updated recently as there are figures, tables, and commentary that present clear requirements better than most of the other sections in the *AASHTO LRFD BCS*.

Level of Detail: Good

Usefulness: Good

Level of Importance: Low

Level of Required Re-Work: Medium

Section 31: Aluminum Structures

Aluminum is not as commonly used in bridge construction as steel or concrete but Section 7 of the *AASHTO LRFD BDS* does cover aluminum structures as well. Both documents are noted to supersede the *AASHTO Guide Specifications for Aluminum Highway Bridges*. This section has a good level of detail and would be useful for construction involving aluminum.

Level of Detail: Good

Usefulness: Fair

Level of Importance: Low

Level of Required Re-Work: Medium

Section 32: Shock Transmission Units

While this section has a fair level of detail, shock transmission units (STU) are not typical in bridge construction. This section is very specific and is not relevant to the majority of bridge structures. Many different tests are listed, but it appears the manufacturer of an STU is responsible for providing a significant amount of information.

Level of Detail: Fair

Usefulness: Poor

Level of Importance: Low

Level of Required Re-Work: Medium

Section 33: Micropiles

Micropiles are increasing in popularity in bridge construction, which makes this a very useful section. There is a good level of detail provided, including material requirements and tolerances. Test pile and load test criteria are also included. Overall, this section appears to adequately cover micropiles, but updates based on recent testing or findings may be necessary as this is a newer method for foundations than traditional piles.

Level of Detail: Good

Usefulness: Excellent

Level of Importance: Low

Level of Required Re-Work: Medium

Section 34: Soil Nails

This section was added with the Fourth Edition of the *AASHTO LRFD BCS* so significant updates are not anticipated. The level of detail for installing and testing soil nails is good, but it is another specific topic that is not common in bridge projects.

Level of Detail: Good

Usefulness: Good

Level of Importance: Low

Level of Required Re-Work: Medium

Section 4: Develop Prioritized Approach for Reorganization and Maintenance of the BCS

The scope of this task was revised during a meeting with the T-4 Committee on March 9, 2021. The original scope was written based on certain assumptions regarding the response to the questionnaire. At the March 9th meeting the following revised scope was agreed upon:

1. Present options for reorganization including pluses and minuses.
2. Include recommendations for future maintenance of the document.

The results of the questionnaire clearly identified that there is still a need for a national specification for bridge construction. The goal of this task is not to re-write the document but to investigate ways to reorganize and possibly re-write the document to make it a more useful tool for the practicing bridge community and the AASHTO Committee on Bridges and Structures.

There are two main things to consider when investigating a re-organization of the BCS. The first is the impact to users of the document. The document should be organized in such a manner that users can quickly find the information that they need. This includes an organized division between major construction tasks. The second consideration involves the management of the specification by the AASHTO Committee on Bridges and Structures. At this time, there is not a clear definition of which technical committee is responsible for which section in the specification. Some sections are obvious, while others are not. It is recommended that both of these factors be included in any decision to reorganize the BCS.

Our team reviewed the current BCS structure and brainstormed on several potential reorganization approaches. It should be noted that the recommendations below are just a starting point for discussions with the T-4 Construction Committee. The prioritized list of tasks described later in this section will outline the recommended approach to decide on which option to pursue and how to decide on the final reorganization of the BCS.

4.1 Reorganization Options

Option 1: Reorganize to be More Consistent with Typical STA Standard Specifications

Most STAs have published standard construction specifications that typically follow the sequence of construction for a typical roadway or bridge project. There are variations from state to state, but there is a general approach for each state. It appears that the original *AASHTO Standard Specifications (SS) Division II* was based on this approach. Sections 1-30 of the current AASHTO LRFD BCS matches the original *AASHTO SS Division II*. Over the years, four new sections have been added:

- Aluminum Structures
- Shock Transmission Units
- Micropiles
- Soil Nails

These sections were simply tagged on the end of the specification so as to not disrupt the order of the original document. These sections are not in ideal locations within the specification.

Our team took an initial look at a potential reorganization using this approach. Table 4.1-1 depicts the recommended reorganization of the sections. Some of the sections were obvious. For example, current Section 33 for micropiles belongs near the existing sections on Driven Foundation Piles and Drilled Shafts. We have made a few suggested reorganizations such as moving culverts further up in the document as they may be considered preliminary earthwork types of construction.

Table 4.1-1: Reorganization Consistent with Typical STA Standard Specifications

AASHTO LRFD BCS		
New #	Current #	Section Title
1	1	Structure Excavation and Backfill
2	2	Removal of Existing Structures
3	3	Temporary Works
4	4	Driven Foundation Piles
5	5	Drilled Shafts
6	33	Micropiles
7	6	Ground Anchors
8	34	Soil Nails
9	24	Pneumatically Applied Mortar
10	7	Earth-Retaining Systems
11	22	Slope Protection
12	25	Steel and Concrete Tunnel Liners
13	26	Metal Culverts
14	27	Concrete Culverts
15	30	Thermoplastic Culverts
16	8	Concrete Structures
17	9	Reinforcing Steel
18	10	Prestressing
19	11	Steel Structures
20	12	Steel Grid Flooring
21	23	Miscellaneous Metal
22	31	Aluminum Structures
23	14	Stone Masonry
24	15	Concrete Block and Brick Masonry
25	16	Timber Structures
26	17	Preservative Treatment of Wood
27	18	Bearing Devices
28	32	Shock Transmission Units
29	29	Embedment Anchors
30	19	Bridge Deck Joint Seals
31	13	Painting
32	21	Waterproofing
33	20	Railings
34	28	Wearing Surfaces

Option 2: Reorganize to be Consistent with AASHTO LRFD Bridge Design Specifications

The approach for this option is to match up the construction specifications with the applicable design specifications. At first this might seem like a simple and logical approach. However, upon review, problems develop since certain *AASHTO LRFD BDS* sections do not apply to construction practices. Table 4.1-2 depicts the recommended reorganization of the sections to be consistent with the *AASHTO LRFD BDS*.

Table 4.1-2: Reorganization Consistent with AASHTO LRFD BDS

AASHTO LRFD BDS		AASHTO LRFD BCS	
#	Section Title	#	Section Title
1	Introduction		
2	General Design and Location Features		
3	Loads and Load Factors		
4	Structural Analysis and Evaluation	32	Shock Transmission Units
5	Concrete Structures	8	Concrete Structures
		9	Reinforcing Steel
		10	Prestressing
		24	Pneumatically Applied Mortar
		29	Embedment Anchors
6	Steel Structures	11	Steel Structures
		23	Miscellaneous Metal
7	Aluminum Structures	31	Aluminum Structures
8	Wood Structures	16	Timber Structures
		17	Preservative Treatment of Wood
9	Decks and Deck Systems	12	Steel Grid Flooring
		21	Waterproofing
		28	Wearing Surfaces
10	Foundations	1	Structure Excavation and Backfill
		4	Driven Foundation Piles
		5	Drilled Shafts
		6	Ground Anchors
		33	Micropiles
		34	Soil Nails
11	Abutments, Piers, and Walls	7	Earth-Retaining Systems
		14	Stone Masonry
		15	Concrete Block and Brick Masonry
12	Buried Structures and Tunnel Liners	25	Steel and Concrete Tunnel Liners
		26	Metal Culverts
		27	Concrete Culverts
		30	Thermoplastic Culverts
13	Railings	20	Railings
14	Joints and Bearings	18	Bearing Devices
		19	Bridge Deck Joint Seals
15	Design of Sound Barriers		
N/A	Sections Without Equivalent BDS Section	2	Removal of Existing Structures
		3	Temporary Works
		13	Painting
		22	Slope Protection

Option 3: Reorganize to be Consistent with AASHTO COBS Committee Structure

The basis of this option focuses on the future maintenance of the document by the AASHTO Committee on Bridges and Structures (COBS). There is a logical division of bridge engineering functions in the current AASHTO COBS. When certain construction specification changes/additions are warranted, it is not always clear which technical committee should be responsible for the changes. One could conclude that all changes to construction specifications should be managed by Technical Committee T-4. One could also conclude that changes should be managed by an appropriate technical committee and reviewed by the T-4 committee. Both of these approaches have been used in the past, but there has been some confusion on certain agenda items.

This approach could alleviate some of the previous confusion. The approach would be to assign management and upkeep of most of the construction specifications to specific technical committees. Provisions developed by these committees could still be run through the T-4 committee as the designated editor of the BCS. The T-4 committee could also be assigned sections that are not necessarily applicable to the other technical committees. Table 4.1-3 depicts the recommended reorganization of the sections to be consistent with the AASHTO COBS Technical Committee Structure.

There is no technical committee that is responsible for foundations, such as piles and drilled shafts. It seems logical to include these sections with Technical Committee T-15 as the closest match.

Table 4.1-3: Reorganization Consistent with AASHTO COBS Committee Structure

AASHTO Technical Committees	AASHTO LRFD BCS	
	#	Section Title
T-1 Security		
T-2 Bearings and Expansion Devices	18 19	Bearing Devices Bridge Deck Joint Seals
T-3 Seismic Design	32	Shock Transmission Units
T-4 Construction	1 2 3 14 15 24	Structure Excavation and Backfill Removal of Existing Structures Temporary Works Stone Masonry Concrete Block and Brick Masonry Pneumatically Applied Mortar
T-5 Loads and Load Distribution		
T-6 Fiber Reinforced Polymer Composites		
T-7 Guardrail and Bridge Rail	20	Railings
T-8 Moveable Bridges		
T-9 Bridge Preservation	21 28	Waterproofing Wearing Surfaces
T-10 Concrete Design	8 9 10 29	Concrete Structures Reinforcing Steel Prestressing Embedment Anchors
T-11 Research		
T-12 Structural Supports for Signs		
T-13 Culverts	26 27 30	Metal Culverts Concrete Culverts Thermoplastic Culverts
T-14 Structural Steel Design	11 12 13 23 31	Steel Structures Steel Grid Flooring Painting Miscellaneous Metal Aluminum Structures
T-15 Substructures and Retaining Walls	4 5 6 7 22 33 34	Driven Foundation Piles Drilled Shafts Ground Anchors Earth-Retaining Systems Slope Protection Micropiles Soil Nails
T-16 Timber Structures	16 17	Timber Structures Preservative Treatment of Wood
T-17 Metals Fabrication		
T-18 Bridge Management, Evaluation, and Rehabilitation		
T-19 Software and Technology		
T-20 Tunnels	25	Steel and Concrete Tunnel Liners

Recommended Option

Table 4.1-4 outlines the advantages and disadvantages of each option presented above based on the advantages and disadvantages. Our team recommends using the first option to keep the format consistent with typical STA standard construction specifications as it is a traditional specification outline familiar to users.

Table 4.1-4: Comparison of Three Options

Option	Advantages	Disadvantages
Format consistent with typical STA Standard Construction Specifications	<ul style="list-style-type: none">Provides a document that is familiar to most owners and bridge designersRequires minimal change to the current format of the specification	<ul style="list-style-type: none">Will require a minor reshuffling of the current section layout
Format consistent with the AASHTO LRFD Bridge Design Specifications	<ul style="list-style-type: none">May be easier for users to find information that is applicable to the type of design they are executing	<ul style="list-style-type: none">The organization is not consistent with typical state standard specificationsThere are a number of BDS sections that do not have an obvious construction specification section
Format consistent with the structure of the AASHTO COBS Technical Committees	<ul style="list-style-type: none">Provides a better avenue for maintenance of the sections by the technical committees	<ul style="list-style-type: none">The structure of the AASHTO COBS Technical Committees has changed from time to timeA reorganization of committees would require a reorganization of the document

4.2 Prioritization of Work to Re-write AASHTO LRFD Bridge Construction Specifications

A complete re-write of the *AASHTO LRFD Bridge Construction Specifications* might seem like a potential approach to addressing the issues discovered during this project. While this can be done (similar to the development of the *AASHTO LRFD Bridge Design Specifications*), our team does not recommend this approach for the following reasons:

- Unlike the *AASHTO LRFD Bridge Design Specifications* that needed to be instituted as a whole, the construction specifications can be done in separate phases.
- The cost for the re-write of the entire document in one project would be significant, making it difficult to budget.
- A complete re-write would take years to accomplish. Re-writing of high priority sections could be done more quickly.

Based on this, a prioritized approach to a re-write may be the best approach. The best way to prioritize re-writing of sections is to base it on the usage of each section. This allows the AASHTO COBS to get the most benefit quickly and at a less cost.

One of the questions posed to the 50 STAs was:

What sections of the AASHTO LRFD BCS are the most useful?

The results of this question are shown in Table 4.2-1. The prioritized sections have been color coded with one potential approach where the highest priority sections could be rewritten at one time, followed by the medium priority sections, and then the low priority sections. The demarcation between priorities could be adjusted based on the available funding for potential projects.

Table 4.2-1: Potential Prioritization of Section Re-writing

AASHTO LRFD BCS		Number of STAs using the Sections Regularly	Priority Key
#	Section Title		
11	Steel Structures	13	High
3	Temporary Works	11	
4	Driven Foundation Piles	10	
5	Drilled Shafts	9	
8	Concrete Structures	9	
18	Bearing Devices	6	Medium
2	Removal of Existing Structures	5	
7	Earth-Retaining Systems	5	
10	Prestressing	5	
6	Ground Anchors	4	
19	Bridge Deck Joint Seals	4	
27	Concrete Culverts	4	
1	Structure Excavation and Backfill	3	
9	Reinforcing Steel	3	
26	Metal Culverts	3	
13	Painting	2	Low
23	Miscellaneous Metal	2	
24	Pneumatically Applied Mortar	2	
29	Embedment Anchors	2	
30	Thermoplastic Culverts	2	
33	Micropiles	2	
12	Steel Grid Flooring	1	
14	Stone Masonry	1	
15	Concrete Block and Brick Masonry	1	
16	Timber Structures	1	
17	Preservative Treatment of Wood	1	
20	Railings	1	
21	Waterproofing	1	
22	Slope Protection	1	
25	Steel and Concrete Tunnel Liners	1	
28	Wearing Surfaces	1	
31	Aluminum Structures	1	
32	Shock Transmission Units	1	
34	Soil Nails	1	

4.3 Future Maintenance of the Document

The *AASHTO LRFD Bridge Construction Specifications* have historically not had the same level of maintenance as the *AASHTO LRFD Bridge Design Specifications*. Certain sections have had significant re-work, but others appear to have been left unchanged for many years. One reason for the lack of consistent maintenance may be that responsibility for maintenance of the bridge construction specifications is not clearly defined. The other reason for a lack of consistent maintenance may be that most changes to the *AASHTO LRFD Bridge Design Specifications* do not result in a need to change the construction specifications. The actual reason is not important. The goal of this task is to identify a process to keep the document current. The following sections contain recommendations for future maintenance of the document.

Assigning Ownership of Maintenance Responsibilities

There are several potential approaches to provide long-term maintenance of the document. The key is to assign ownership to the experts who can best provide the technical expertise for each section. The following sections contain several recommended approaches for assigning maintenance responsibilities for the construction specifications.

1. *AASHTO Technical Committee T-4 Construction Committee*

This option is to assign ownership and maintenance of the document to the AASHTO COBS Technical Committee T-4. While this may seem like a logical connection, having one technical committee manage an entire specification would be overwhelming. For this reason, this option is not recommended.

2. *Industry Partners*

It may be possible to engage industry partners and committee for future maintenance of the document. These outside experts can be counted on to provide continuity of knowledge and state-of-practice knowledge to keep the specifications relevant and up to date.

3. *AASHTO Committee on Bridges and Structures Technical Committees*

This option is based on assigning ownership and maintenance of each section of the document to the appropriate AASHTO COBS Technical Committees. In a previous section of this report, a recommendation tree for reorganization of the document based on the AASHTO technical committee structure was presented (Option 3). Table 4.1-3 for Option 3 above could be used as a basis to assign ownership and maintenance for sections in the specifications. Many of the sections within the construction specifications have a logical fit with certain technical committees. Specification sections that do not have a specific fit, could be aligned with Technical Committee T-4.

Section 5: Prioritized Recommendations for Re-writing of Specifications

Any potential re-write of the BCS need not be a complete cover-to-cover project. The development of the *AASHTO LRFD Bridge Design Specifications* was a monumental project because it had to be done as a whole. Construction specifications are different since individual specifications generally do not rely or depend on other specifications or provisions for completeness. This fact allows for a multiple phase approach to a re-write.

5.1 Recommended New Sections or Additions to Existing Sections

One of the questions posed to the 50 STAs was:

Are there areas that the AASHTO LRFD BCS doesn't currently cover that you recommend adding?

There were a number of responses. Some suggestions were made by multiple states. The following table includes responses and a recommended approach to addressing these requests:

Table 5.1-1: Suggested Changes and Additions to the BCS

Suggested Addition	Recommended Approach	Comments
Ultra-High Performance Concrete (UHPC)	Add to existing section: <ul style="list-style-type: none">Concrete Structures	The <i>AASHTO LRFD Guide Specifications for ABC</i> includes construction specifications in AASHTO format
Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS)	Create new section entitled: <ul style="list-style-type: none">GRS-IBS	The <i>AASHTO LRFD Guide Specifications for ABC</i> includes construction specifications in AASHTO format
Non-Metallic Concrete Reinforcing and Fiber Reinforced Polymers	Convert "Reinforcing Steel" section to "Concrete Reinforcing" and add non-metallic reinforcing	Option: Create new section
Geofoam and Other Lightweight Fill Materials	Add to existing section: <ul style="list-style-type: none">Structure Excavation and Backfill	The <i>AASHTO LRFD Guide Specifications for ABC</i> includes construction specifications for Geofoam in AASHTO format
Overhead Sign Structures	Create new section entitled: <ul style="list-style-type: none">Traffic and Sign Structures	Option: Add provisions to existing sections: <ul style="list-style-type: none">Steel StructuresConcrete StructuresAluminum StructuresTimber Structures
Clamshell Box Culverts	We are not sure what this is referring to. Provisions could be added to the following sections: <ul style="list-style-type: none">Concrete CulvertsMetal Culverts	
Additional Wearing Surfaces	Add to existing section: <ul style="list-style-type: none">Wearing Surfaces	
Post-Installed Concrete Anchors	Add to existing section: <ul style="list-style-type: none">Embedded Anchors	

Suggested Addition	Recommended Approach	Comments
Preservation	Create new section entitled: <ul style="list-style-type: none"> • Preservation/Rehabilitation 	This section could cover patching specifications, re-painting, strengthening, seismic retrofitting, etc.
Design Build and Public / Private Partnerships	Provide text within an introduction for the specifications that will address: <ul style="list-style-type: none"> • Alternative Contracting Provisions (Structures) 	This would primarily cover the impact of alternative contracting mechanisms on typical construction specification. Item might include: <ul style="list-style-type: none"> • Define responsibilities for the owner's engineer and the builder's engineer • Cover incentives and disincentives • A+B bidding
Non-Painting Coatings	Convert "Painting" section to "Coatings" and add other types of coatings	
Mass Concrete and Self-Consolidating Concrete	Add to existing section: <ul style="list-style-type: none"> • Concrete Structures 	

The results of the survey indicate the most commonly used sections. This can serve as a basis for a prioritized or phased re-write. The following are the recommended tasks to accomplish a complete re-write of the *AASHTO LRFD Bridge Construction Specifications*:

Table 5.1-2: Recommended Phases for Re-writing of the BCS

Phase	Task	Recommended party to assign the work
1	Decide on Reorganization Option	AASHTO COBS Executive Committee with consultation with Technical Committee T-4
	Finalize Priority of Sections (High, Medium, Low)	AASHTO COBS Executive Committee with consultation with Technical Committee T-4
	Re-write of high priority sections. Suggested sections at this time include: <ul style="list-style-type: none"> • Steel Structures ¹ • Temporary Works • Driven Foundation Piles • Drilled Shafts • Concrete Structures ^{1,2} Add new provisions as noted in Table 5.1-1	Consultant
	Option: Re-format remaining sections. This involves sorting the existing text into a consistent format: <ol style="list-style-type: none"> 1. Description 2. References 3. Materials 4. Construction Methods 5. Measurement and Payment (No substantive change to the text is proposed for this task.)	Consultant

2	<p>Re-write of medium priority sections. Suggested sections at this time include:</p> <ul style="list-style-type: none"> • Bearing Devices • Removal of Existing Structures • Earth-Retaining Systems • Prestressing ² • Ground Anchors • Bridge Deck Joint Seals • Concrete Culverts • Structure Excavation and Backfill • Reinforcing Steel • Metal Culverts <p>Add new provisions as noted in Table 5.1-1</p>	Consultant
3	<p>Write new Sections as noted in Table 5.1-1. Suggested sections include:</p> <ul style="list-style-type: none"> • GRS-IBS • Signs, Luminaires, and Traffic Signals • Alternative Contracting Provisions (Structures) • Preservation/Rehabilitation 	Consultant
4	<p>Re-write of low priority sections. Suggested sections at this time include</p> <ul style="list-style-type: none"> • Painting • Miscellaneous Metal • Pneumatically Applied Mortar • Embedment Anchors • Thermoplastic Culverts • Micropiles • Steel Grid Flooring • Stone Masonry • Concrete Block and Brick Masonry • Timber Structures • Preservative Treatment of Wood • Railings • Waterproofing • Slope Protection • Steel and Concrete Tunnel Liners • Wearing Surfaces • Aluminum Structures • Shock Transmission Units • Soil Nails <p>Add new provisions as noted in Table 5.1-1</p>	Consultant

Table 5.1-2 Footnotes:

1. Steel Structures and Concrete Structures are high priority sections, however, both sections will require significant effort and moving one of these sections to Phase 2 should be considered.
2. Including Concrete Structures and Prestressing sections in the same phase should be considered.

A consultant was noted for most of this work. This is based on the general understanding that AASHTO COBS members do not have sufficient time for such a significant project. Any or all of the sections can be re-written by AASHTO committee members or volunteer states.

All re-writing should be done in collaboration with industry organizations. This could include the engagement of industry partners to offer insight into certain sections that are pertinent to their areas of expertise. To some extent this is already underway with the establishment of the National Steel Bridge Alliance (NSBA). The NSBA has written a number of guidelines, guide specifications, and specifications that have been reviewed and endorsed by AASHTO COBS. Other organizations, such as PCI, PTI, ASBI, CRSI, etc., are potentially available and could be engaged for specification collaboration. These organizations have not established a formal collaborative process with AASHTO COBS. Therefore, their role maybe more of a consultancy at this time.

The use of this model brings national experts into the process of developing specifications, thereby providing exceptional expertise. This approach might not work for all sections within the BCS; however, it could be used to address the most commonly used sections in the specifications.

5.2 Budget Level Estimate for Recommended Prioritized Re-write

The team has developed a budget level cost estimate for the re-write and supplements to the *AASHTO LRFD BCS*. The estimate is based on several previous AASHTO Specifications our team has written and information gathered during this project. In general, the cost per page for a well-written specification is \$1500. For each section, we applied the following cost factors based on the level of detail noted:

1. Changes to Excellent Sections: \$375 per Page
2. Changes to Good Sections: \$750 per Page
3. Changes to Fair Sections: \$1,125 per Page
4. Changes to Poor Sections: \$1,500 per Page
5. New or Supplemental Sections: \$1500 per Page

The team developed rough estimates for supplemental pages for each section based on the level of detail found in this study and estimated the page count for new sections noted in this report. Finally, costs were grouped based on the prioritized approach noted in the report. Table 5.2-1 shows the results of the budget estimate process broken out by prioritized phases.

Table 5.2-1: Estimated Cost to Re-write Sections and Recommended Phases

Phase	AASHTO LRFD BCS		Section Cost	Phase Cost
	#	Section Title		
1	11	Steel Structures	\$63,750	\$176,625
	3	Temporary Works	\$30,000	
	4	Driven Foundation Piles	\$10,875	
	5	Drilled Shafts	\$9,750	
	8	Concrete Structures	\$62,250	
2	18	Bearing Devices	\$13,500	\$203,250
	2	Removal of Existing Structures	\$12,000	
	7	Earth-Retaining Systems	\$15,000	
	10	Prestressing	\$60,000	
	6	Ground Anchors	\$13,500	
	19	Bridge Deck Joint Seals	\$31,500	
	27	Concrete Culverts	\$15,000	
	1	Structure Excavation and Backfill	\$18,750	
	9	Reinforcing Steel	\$13,500	
	26	Metal Culverts	\$10,500	
3	New	GRS-IBS	\$12,000	\$76,500
	New	Signs, Luminaires, and Traffic Signals	\$7,500	
	New	Alternative Contracting Provisions (Structures)	\$12,000	
	New	Preservation/Rehabilitation	\$45,000	
4	13	Painting	\$17,250	\$210,000
	23	Miscellaneous Metal	\$4,500	
	24	Pneumatically Applied Mortar	\$6,000	
	29	Embedment Anchors	\$9,750	
	30	Thermoplastic Culverts	\$15,750	
	33	Micropiles	\$16,500	
	12	Steel Grid Flooring	\$7,125	
	14	Stone Masonry	\$5,625	
	15	Concrete Block and Brick Masonry	\$6,000	
	16	Timber Structures	\$19,125	
	17	Preservative Treatment of Wood	\$6,375	
	20	Railings	\$9,000	
	21	Waterproofing	\$13,500	
	22	Slope Protection	\$12,000	
	25	Steel and Concrete Tunnel Liners	\$9,000	
	28	Wearing Surfaces	\$15,000	
	31	Aluminum Structures	\$16,500	
	32	Shock Transmission Units	\$10,500	
	34	Soil Nails	\$10,500	

Estimated Cost for All Four Phases = \$666,375

15% Contingency = \$99,956

Total Estimated Cost = \$766,331

Section 6: Conclusions

This project has identified a number of issues with the current *AASHTO LRFD Bridge Construction Specifications*. This should not be a surprise, as it is the general opinion within the AASHTO Community that this document needs significant updating. The following general conclusions can be drawn from this project:

1. The questionnaire provided very good feedback. The number one takeaway is that the BCS is being used by many STAs on a regular basis. This justifies maintaining the *AASHTO LRFD Bridge Construction Specifications*.
2. The COBS may want to consider converting the document to a guide specification. There has been anecdotal evidence that contractors are using the BCS as a basis for claims against STAs, since it is considered the “National Standard Specification”.
3. Some reorganization of the sections is in order. Newer sections seem to have been simply tacked on to the end of the document. We have offered up several reorganization options, each with its advantages and disadvantages.
4. Most sections in the document have very little commentary. The addition of commentary to the *AASHTO LRFD Bridge Design Specifications* had been a significant improvement over the original *Standard Specifications*. The BCS could benefit from a similar effort.
5. Many of the sections need updating to current standards and practices and reformatting to be consistent with industry and STA specifications.
6. The questionnaire identified several potential new provisions that should be added to the specifications.
7. Our team has made recommendations for:
 - a. Potential reorganization of the specifications
 - b. Prioritized re-writing of the specifications
 - c. Additions to the specifications
 - d. Future management and upkeep of the specifications

The next page contains Table 6.1-1, which is a synopsis of our recommends and observations. The following notes apply to this table:

- The order of sections is based on the recommended re-organization.
- The Potential Industry Partners is preliminary at this time. More research into these organization should be done to confirm these potential partnerships.
- The Potential TRB Committee Partners are also preliminary at this time. TRB has many committees, including materials committees. The materials committees are not listed in the table.
- AASHTO COBS may also want to consider collaborating with other AASHTO Committees, such as the Committee on Construction, Committee on Maintenance, Committee on Design, Committee on Traffic Engineering, and the Committee on Environment and Sustainability. These committees may have relevant input into a future re-write.

Table 6.1-1: Summary of Findings and Recommendations

Synopsis of a Potential Reorganization with Information Noted in the Report and other Requested Information								
Current #	Section Title	Potential COBS Tech Committee Home	Potential Industry Partners	Potential TRB Committee Partners	Level of Detail	Usefulness	Level of Importance	Required Level of Re-work
1	Structure Excavation and Backfill	T-4 Construction		AKG50 - Transportation Earthworks	Fair	Good	Medium	Medium
2	Removal of Existing Structures	T-4 Construction		AKC40 - Construction of Bridges & Structures	Poor	Fair	Medium	High
3	Temporary Works	T-4 Construction		AKC40 - Construction of Bridges & Structures	Poor	Fair	High	High
4	Driven Foundation Piles	T-15 Substr. & Ret. Walls	• Deep Foundations Institute	AKG70 - Foundations of Bridges and Other Structures	Excellent	Excellent	High	Low
5	Drilled Shafts	T-15 Substr. & Ret. Walls	• Deep Foundations Institute	AKG70 - Foundations of Bridges and Other Structures	Excellent	Excellent	High	Low
33	Micropiles	T-15 Substr. & Ret. Walls	• Deep Foundations Institute	AKG70 - Foundations of Bridges and Other Structures	Good	Excellent	Low	Medium
6	Ground Anchors	T-15 Substr. & Ret. Walls	• Deep Foundations Institute	AKG70 - Foundations of Bridges and Other Structures	Good	Fair	Medium	Medium
34	Soil Nails	T-15 Substr. & Ret. Walls	• Deep Foundations Institute	AKG70 - Foundations of Bridges and Other Structures	Good	Good	Low	Medium
24	Pneumatically Applied Mortar	T-4 Construction		AKC40 - Construction of Bridges & Structures	Good	Good	Low	Medium
7	Earth-Retaining Systems	T-15 Substr. & Ret. Walls		AKC40 - Construction of Bridges & Structures	Good	Fair	Medium	Medium
22	Slope Protection	T-15 Substr. & Ret. Walls		AKC40 - Construction of Bridges & Structures	Good	Good	Low	Medium
25	Steel and Concrete Tunnel Liners	T-20 Tunnels		AKB60 - Tunnels and Underground Structures	Poor	Poor	Low	High
26	Metal Culverts	T-13 Culverts	• National Corrugated Steel Pipe Association	AKB70 - Culverts, Buried Bridges and Soil Structure Interaction	Excellent	Good	Medium	Low
27	Concrete Culverts	T-13 Culverts	• American Concrete Pipe Association	AKB70 - Culverts, Buried Bridges and Soil Structure Interaction	Good	Excellent	Medium	Medium
30	Thermoplastic Culverts	T-13 Culverts	• Plastic Pipe Institute	AKB70 - Culverts, Buried Bridges and Soil Structure Interaction	Good	Good	Low	Medium
8	Concrete Structures	T-10 Concrete Design	• Portland Cement Association • Precast Prestressed	AKB30 - Concrete Bridges	Fair	Fair	High	Medium
9	Reinforcing Steel	T-10 Concrete Design	• Concrete Reinforcing	AKB30 - Concrete Bridges	Good	Good	Medium	Medium
10	Prestressing	T-10 Concrete Design	• Portland Cement Association • Precast Prestressed Concrete Institute	AKB30 - Concrete Bridges	Poor	Poor	Medium	High
11	Steel Structures	T-14 Structural Steel Design	• National Steel Bridge Alliance (AISC) • American Iron and Steel Institute	AKB20 - Steel Bridges	Fair	Fair	High	Medium
12	Steel Grid Flooring	T-14 Structural Steel Design	• Bridge Grid Flooring Manufacturers	AKB20 - Steel Bridges	Fair	Fair	Low	Medium
23	Miscellaneous Metal	T-14 Structural Steel Design		AKC40 - Construction of Bridges & Structures	Poor	Poor	Low	High
31	Aluminum Structures	T-14 Structural Steel Design	• The Aluminum Association	AKC40 - Construction of Bridges & Structures	Good	Fair	Low	Medium
14	Stone Masonry	T-4 Construction		AKC40 - Construction of Bridges & Structures	Excellent	Fair	Low	Low
15	Concrete Block and Brick Masonry	T-4 Construction	• American Concrete Institute	AKC40 - Construction of Bridges & Structures	Good	Fair	Low	Medium
16	Timber Structures	T-16 Timber Structures	• American Institute of Timber Construction	AKC40 - Construction of Bridges & Structures	Fair	Fair	Low	Medium
17	Preservative Treatment of Wood	T-16 Timber Structures	• American Wood Protection Association	AKC40 - Construction of Bridges & Structures	Fair	Fair	Low	Medium
18	Bearing Devices	T-2 Bearings & Exp. Devices	• National Steel bridge Alliance Steel Bridge	AKC40 - Construction of Bridges & Structures	Excellent	Good	Medium	Low
32	Shock Transmission Units	T-3 Seismic Design		AKB50 - Seismic Design and Performance of Bridges	Fair	Poor	Low	Medium
29	Embedment Anchors	T-10 Concrete Design		AKB30 - Concrete Bridges	Fair	Fair	Low	Medium
19	Bridge Deck Joint Seals	T-2 Bearings & Exp. Devices		AKC40 - Construction of Bridges & Structures	Good	Fair	Medium	Medium
13	Painting	T-14 Structural Steel Design	• Structural Steel Painting Council	AKB20 - Steel Bridges	Fair	Fair	Low	Medium
21	Waterproofing	T-9 Bridge Preservation		AKC40 - Construction of Bridges & Structures	Good	Good	Low	Medium
20	Railings	T-7 Guardrail and Bridge Rail		AKC40 - Construction of Bridges & Structures	Poor	Poor	Low	High
28	Wearing Surfaces	T-9 Bridge Preservation		AKC40 - Construction of Bridges & Structures	Fair	Fair	Low	Medium

The contents of this report contain recommendations and suggestions that are the opinions of CHA Consulting, Inc. and Modjeski & Masters, Inc. based on the work specified for this project. The contents of this report are intended as guidance for the AASHTO Committee on Bridges and Structures, and may not represent the opinions of the committee or its individual members.

Report Submitted by:



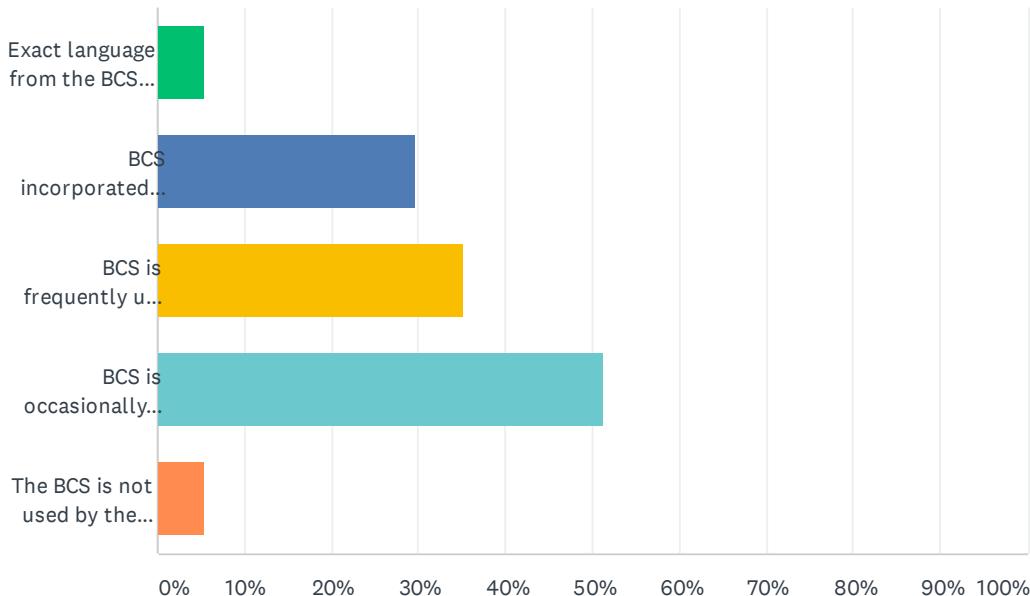
Michael P. Culmo, P.E.
Chief Bridge Engineer
CHA Consulting, Inc.

Appendix: Questionnaire Results

The questionnaire was distributed to all 50 STAs. Results included in this Appendix are for the 37 anonymous responses. Since the questionnaire did not ask responders what state they represented, it is unknown whether or not the responses represent 37 different states. However, some states are known and the various answers to certain questions has led to the assumption that individuals who completed the survey are from different states.

Q1 How is the AASHTO LRFD BCS used in your construction contract administration? Select all that apply.

Answered: 37 Skipped: 0



ANSWER CHOICES		RESPONSES	
Exact language from the BCS is used as contract requirements.		5.41%	2
BCS incorporated via reference in contract requirements.		29.73%	11
BCS is frequently used to develop STA contract language.		35.14%	13
BCS is occasionally used to develop STA contract language.		51.35%	19
The BCS is not used by the STA.		5.41%	2
Total Respondents: 37			

#	PLEASE PROVIDE MORE DETAILS ABOUT HOW YOU USE THE BCS, ESPECIALLY IF YOU SELECTED MORE THAN ONE RESPONSE. IF YOUR STATE DOES NOT OR RARELY USE THE BCS, PLEASE INDICATE THE REASONS.	DATE
1	BCS language is sometimes modified and used as STA contract language in lieu of always stating to follow BCS except as follows. I believe more BCS and AWS language should be used to reduce the size of our spec book, but our contractors apparently aren't required to have a copy of the BCS and AWS.	2/20/2021 9:48 AM
2	We have written and continue to update our construction specifications based on successful construction practice to date. Occasionally, we used the language in BCS, when we have limited knowledge in certain subjects. Most of the times, we modified the language to comply with our specification writing style requirements and to fit with the situations.	2/19/2021 2:01 PM
3	NHDOT staff specifically mentioned they use for the steel erection provisions, high-load multi-rotation bearing provisions, and steel fabrication requirements. It is also occasionally used as guidance for new Special Provisions or as a check for our rarely used Special Provisions.	2/19/2021 8:34 AM
4	The BCS is often used in the development of unique special provisions.	2/18/2021 4:29 PM
5	We have used the BCM in developing some of our guidance as it relates to retaining walls	2/16/2021 3:45 PM

Evaluation and Updating of the AASHTO LRFD Bridge Construction Specifications

6	Direct reference to AASHTO LRFD BCS from STA specifications for the following: 1. Steel girder fabrication and HS fastener installation 2. Elastomeric bearing pads and PTFE 3. Design of temporary works, falsework, and formwork 4. Post-tensioning anchorages, ducts, grouting equipment, etc. 5. Structural plate pipe fabrication and installation 6. Modular expansion joints Use BCS as resource in developing new and updating existing STA specifications: Recent Examples: Driven piles, soil nail retaining walls, concrete curing, precast fabrication, prestressing,	2/16/2021 11:36 AM
7	The BCS is used more as a source of information to help prepare the actual state bridge construction specifications and special provisions.	2/11/2021 9:19 PM
8	The AASHTO Bridge Constr Specs are occasionally used as a guide for the development or comparison of our state standard specifications for bridge construction. The BCS provides a "national" or "AASHTO"-level guideline or baseline that is consistent with the AASHTO Design Specs. The BCS is not directly referenced as "included" in the AASHTO Design Specs and the BCS is not directly referenced in IDOT contract plans or our Standard Specifications for Road & Bridge Construction (SSRBC), and so it is not a "contract" document per se.	2/10/2021 3:27 PM
9	PennDOT construction specifications related to bridge construction - as we update our specifications we review and incorporate the LRFD Bridge Construction Specifications. We modify the language slightly to comply with our state's specification language style of imperative mode.	2/9/2021 6:13 PM
10	NYSDOT uses the language from the BCS in our Standard Specifications.	2/5/2021 8:17 AM
11	Specs are referred to when information is needed to amend or improve current standard specs.	2/3/2021 9:16 AM
12	We have used BCS as a resource when developing new specifications and updating older specs.	2/3/2021 8:51 AM
13	My impression is that our contract language is very similar to language that exists in the BCS but I don't have a sense for how frequently the BCS was consulted to develop that language. For the past 20 years our contract language evolutions have mainly been the result of project experiences or changes led by industry and trade associations.	1/29/2021 4:49 PM
14	The BCS is rarely used by our STA. We have a complete set of construction specifications that cover everything in the BCS. We occasionally use it as a reference when updating our in-house specifications.	1/29/2021 4:13 PM
15	Probably used as a reference more than anything. Our field engineers rely on plans and state construction specifications. We do have a couple of plan notes that reference the BCS.	1/29/2021 2:23 PM
16	The State's construction standard specifications, and project special provisions are always developed, and studied to conform with the BCS, and concurrent with the local Construction Associations.	1/29/2021 12:51 PM
17	State has its own construction specifications	1/29/2021 11:51 AM
18	MDOT Administration does not allow the direct use of the construction spec by the contractor in order to reduce the amount of standardized specs he is required to purchase.	1/29/2021 10:12 AM
19	Our agency references the BCS for material, testing and sampling requirements in our construction specifications. We also use the BCS as a source of information when developing new construction specifications.	1/29/2021 7:59 AM
20	usually satisfied with the language we develop	1/28/2021 7:28 PM
21	We do not use the BCS. We have a State Standard Specification that serves the same purpose. We would not use the BCS in its current format as it trends toward Prescriptive Specifications. Our State prefers Performance Specifications (although our spec is far from perfect in that aspect). Our State recognizes that means and methods are the risk of the Contractor and trend towards performance specifications so the State does not take on that risk.	1/28/2021 5:45 PM
22	It is referenced when state standard specifications are being reviewed for periodical updates or when new special provisions are needed. Technically, this is also a required document by FHWA for all federal aid projects per 23 CFR § 625.4(d)(2) and we were required to add it as a minimum standard in our state Bridges and Structures Manual.	1/28/2021 3:57 PM

Evaluation and Updating of the AASHTO LRFD Bridge Construction Specifications

23	We have at least one Section in our Standard Specifications (Temporary Works) that requires conforming to the AASHTO LRFD BCS. I'm not aware of any other references.	1/28/2021 3:18 PM
24	Some people in the organization do not believe it is accurate.	1/28/2021 2:44 PM
25	When preparing our state's Standard Specifications for Highway Construction, the BCS is used for the development of bridge related construction requirements.	1/28/2021 2:38 PM

Q2 What sections of the AASHTO LRFD BCS are the most useful?

Answered: 37 Skipped: 0

#	RESPONSES	DATE
1	Section 5: Drilled Shaft Section 8: Concrete Structures Section 10: Prestressing	2/26/2021 2:19 PM
2	8-13, 18-19, 31, 26-31, but almost all of the sections should be used by MDOT SMEs to some extent	2/20/2021 9:48 AM
3	No comments	2/19/2021 2:01 PM
4	In order of usefulness - 1. Steel (Chapter 11) 2. Bearings (Chapter 18) 3. Chapters 2 & 3 4. Chapters 4-6 and 33	2/19/2021 8:34 AM
5	The materials requirements are probably used the most frequently.	2/18/2021 4:29 PM
6	Bridge bearing material and fabrication testing requirements. Drilled shaft construction. Structural Steel testing and fabrication.	2/18/2021 2:40 PM
7	Those with information related to retaining walls.	2/16/2021 3:45 PM
8	All are used to some degree.	2/16/2021 1:52 PM
9	Sections 1 thru 11, 13, 18, 19, 23, 24, 26, 27, and 29. These correspond to bridge elements used.	2/16/2021 11:36 AM
10	All sections are reasonably useful. There are certain sections that end up being referenced more often by our state than others, but they are all useful when needed.	2/16/2021 11:00 AM
11	Section 11 (for Steel structures) and Section 19 (for Modular Joint systems)	2/16/2021 10:38 AM
12	Section 11 Steel Structures is very useful. Almost all of the other sections provide a valuable reference when questions or situations come up that are not covered in our specifications.	2/12/2021 2:00 PM
13	Concrete and prestressed concrete.	2/11/2021 9:19 PM
14	Sections on Temp works, Drilled shafts, Conc Structures, Reinf., and Steel Structures are probably most often looked at.	2/10/2021 3:27 PM
15	8, 10, 11, 4	2/9/2021 6:13 PM
16	The language from most sections of the BCS are used in the NYSDOT Standard Specifications.	2/5/2021 8:17 AM
17	Temporary works,	2/4/2021 5:27 PM
18	Used as a reference when needed. None specific.	2/3/2021 9:16 AM
19	temporary works, earth-retaining systems have been used	2/3/2021 8:51 AM
20	With limited usage of the BCS this is difficult to answer.	1/29/2021 4:49 PM
21	Are use is so limited that there are no particular sections we find most useful.	1/29/2021 4:13 PM
22	5, 11, and 27	1/29/2021 2:23 PM
23	Steel & concrete structures, prestressing, bearing devices, and foundations (i.g driven piles, drilled shafts).	1/29/2021 12:51 PM
24	Steel	1/29/2021 11:51 AM
25	Temporary Works	1/29/2021 10:12 AM
26	All of it. Needs to be updated however	1/29/2021 9:28 AM
27	Sections 1, 2, 3, 4, 6, 18, 19, 26, 27 & 30	1/29/2021 7:59 AM

Evaluation and Updating of the AASHTO LRFD Bridge Construction Specifications

28	8 in 2010s	1/28/2021 7:28 PM
29	We do not use BCS	1/28/2021 5:45 PM
30	New, unusual, and complex items are the most helpful to look up in the BCS.	1/28/2021 3:57 PM
31	I reference many BCS sections when developing specifications. I believe certain sections need updating, such as Concrete Finishing.	1/28/2021 3:18 PM
32	Walls and foundations	1/28/2021 3:18 PM
33	NA	1/28/2021 2:44 PM
34	Concrete Structures (8), Steel Structures (10), Drilled Shafts (5) and Temporary Works (3).	1/28/2021 2:38 PM
35	—	1/28/2021 2:30 PM
36	Steel and concrete. We also directly reference the Bearings Section.	1/28/2021 2:21 PM
37	Not noted	1/28/2021 2:09 PM

Q3 What sections of the AASHTO LRFD BCS are the least useful or are not used?

Answered: 37 Skipped: 0

#	RESPONSES	DATE
1	Timber Structures Aluminum Structures Thermoplastic Pipe	2/26/2021 2:19 PM
2	have none to offer.	2/20/2021 9:48 AM
3	Based on discussions with a few technical resources at ODOT, Section 21 - Waterproofing Section 31 - Aluminum Structures There could be more.	2/19/2021 2:01 PM
4	I doubt we have ever used Chapters 15 (Concrete Block and Brick Masonry), 21 (Waterproofing), nor 24 (Pneumatically Applied Mortar).	2/19/2021 8:34 AM
5	I don't think sections on less-commonly used materials are often referenced, such as stone masonry, timber, shock transmission units.	2/18/2021 4:29 PM
6	Wearing surfaces. Masonry. Thermal plastic culverts. Basis of payment.	2/18/2021 2:40 PM
7	Our State Specifications and Contract Plans generally cover other areas in the BCM	2/16/2021 3:45 PM
8	NA	2/16/2021 1:52 PM
9	Not useful at present because STA doesn't use these elements, but may become useful in the future: Sections 12, 14, 15, 31, 32.	2/16/2021 11:36 AM
10	Most sections are utilized by our state. There are a few that really don't apply to our state (Section 30/32).	2/16/2021 11:00 AM
11	N/A	2/16/2021 10:38 AM
12	Sections that do not apply to typical work in our state are Sections 30-32.	2/12/2021 2:00 PM
13	N/A	2/11/2021 9:19 PM
14	It is hard to say which sections are least useful, but some sections are maybe looked at less often than other. Sections on stone or brick masonry are not used.	2/10/2021 3:27 PM
15	16, 17,32	2/9/2021 6:13 PM
16	The language from most sections of the BCS are used in the NYSDOT Standard Specifications.	2/5/2021 8:17 AM
17	Topics that are state specific contract items	2/4/2021 5:27 PM
18	Used as reference when needed. None specific.	2/3/2021 9:16 AM
19	we do not use concrete block and brick masonry much in our work. we do not use SI units in our work.	2/3/2021 8:51 AM
20	With limited usage of the BCS this is difficult to answer.	1/29/2021 4:49 PM
21	Nothing specific comes to mind. As noted earlier, our use of the BCS is limited.	1/29/2021 4:13 PM
22	12, 15, 25 and 32	1/29/2021 2:23 PM
23	Steel grid flooring, and preservative treatment of wood.	1/29/2021 12:51 PM
24	Almost all sections are rarely used	1/29/2021 11:51 AM
25	Stone masonry	1/29/2021 10:12 AM
26	can't answer. We use it all as situation arise.	1/29/2021 9:28 AM
27	All provide a potential source of useful information. Especially for items that may be	1/29/2021 7:59 AM

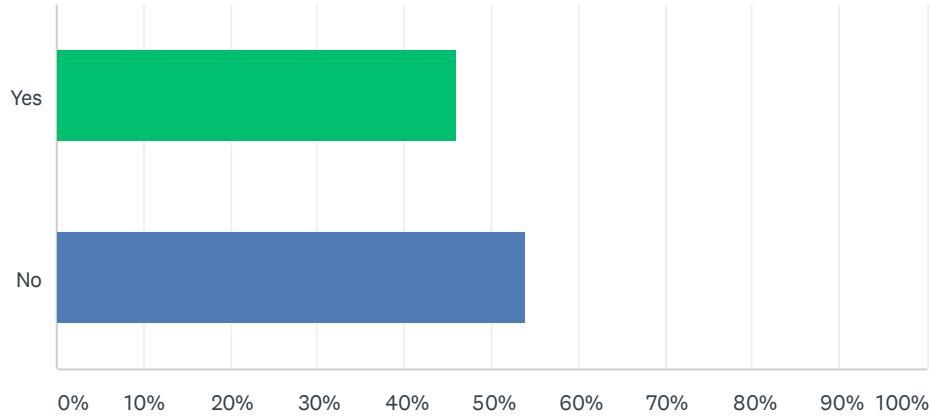
Evaluation and Updating of the AASHTO LRFD Bridge Construction Specifications

infrequently used by our agency.

28	31 in 2010s	1/28/2021 7:28 PM
29	Temporary works has been superceded by the recently issued guide. Consider advancing NCHRP Synthesis 536 to an AASHTO guide document.	1/28/2021 5:45 PM
30	1. Specifications for common items like concrete that states have already developed over the years. 2. Measurement/payment. Technically, the BCS mandates certain units which could conflict with what states use. This muddies the issue since it is a required FHWA document.	1/28/2021 3:57 PM
31	Since I am a designer, I don't often use Section 24 - Pneumatically Applied Mortar.	1/28/2021 3:18 PM
32	NA	1/28/2021 3:18 PM
33	NA	1/28/2021 2:44 PM
34	Everything after Slope Protection (22)	1/28/2021 2:38 PM
35	-	1/28/2021 2:30 PM
36	Ground anchors, grid floorings, timber and preservatives, brick and stone masonry, pneumatically applied mortar, aluminum, slope protection, shock transmission units	1/28/2021 2:21 PM
37	Not noted	1/28/2021 2:09 PM

Q4 Do you find the measurement and payment section useful?

Answered: 37 Skipped: 0



ANSWER CHOICES		RESPONSES	
Yes		45.95%	17
No		54.05%	20
TOTAL			37

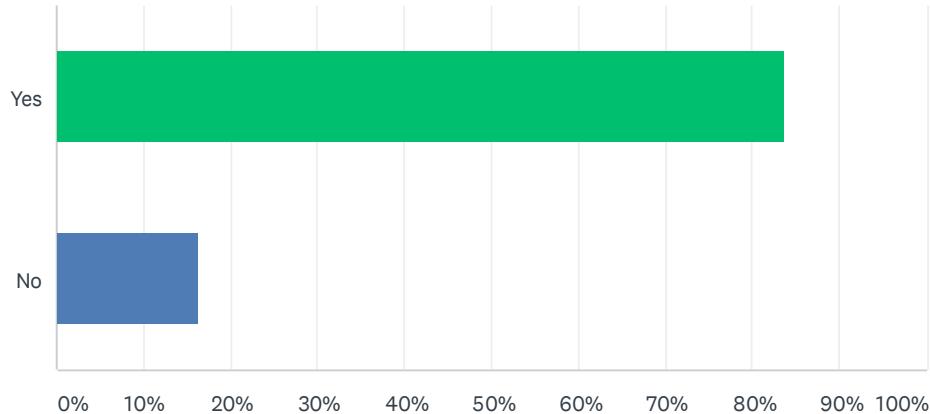
#	WHY?	DATE
1	I don't use it a reference. Maybe C&S has based their measurements and payments on BCS before, but now I only refer to C&S pay items and specs.	2/26/2021 2:19 PM
2	great reference point for industry practice	2/20/2021 9:48 AM
3	We have written our own language and continue to update the language in the measurement and payment section based on experience from past construction projects.	2/19/2021 2:01 PM
4	NHDOT believes we have a good handle on how to measure and pay. That said, I think I recall heading to the BCS to see how AASHTO recommends paying for drilled shaft obstruction removal.	2/19/2021 8:34 AM
5	I'm answering "no" because I don't think we often use these sections. Whenever possible we try to measure and pay for items in a similar manner as items already covered by our standard specifications.	2/18/2021 4:29 PM
6	Is redundant with agency standards	2/18/2021 2:40 PM
7	Our established specifications work well for us.	2/16/2021 3:45 PM
8	We use our own agency defined measurement and payment.	2/16/2021 1:52 PM
9	It is informational to see how items are paid for in the BCS, but it doesn't relate very well to how STA subdivides the work into pay items.	2/16/2021 11:36 AM
10	It provides a good basis for state-specific spec development and sets a baseline consistency from DOT to DOT which benefits all stakeholders involved in projects.	2/16/2021 11:00 AM
11	Our DOT uses agency-specific measurement and payment which is updated from time to time.	2/16/2021 10:38 AM
12	It provides a reference that can be useful when developing new specs or modifying existing specs but it's not critical.	2/12/2021 2:00 PM
13	We develop our own methods of measurement and payment.	2/11/2021 9:19 PM

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14	They do provide a guide for at least a recommended basis for some items of work that are not common or not already covered in state specifications.	2/10/2021 3:27 PM
15	The measurement and payment provides guidance regarding a national perspective. This national perspective assists DOT's with developing measurement and payment for state use.	2/9/2021 6:13 PM
16	The language from most sections of the BCS are used in the NYSDOT Standard Specifications.	2/5/2021 8:17 AM
17	state specific contract language and not useful for reference.	2/4/2021 5:27 PM
18	At times when referred to. d To determine common methods of measurement.	2/3/2021 9:16 AM
19	they can provide a good starting point in the development of our own measurement and payment sections. they provide a good example for the appropriate wording for these sections. they bring up points that may have otherwise been missed.	2/3/2021 8:51 AM
20	Measurement and payment language is really important in contract administration. We have our own language we use. We would take on contractual risk if we attempted to adopt the BCS language. Also, the BCS measurement and payment language is not consistent with the other civil elements of our projects.	1/29/2021 4:13 PM
21	Covered in state specifications	1/29/2021 2:23 PM
22	It is consistent with our construction specs. STA and Contractors are happy to use both.	1/29/2021 12:51 PM
23	Somehow useful but does not apply to state practice	1/29/2021 11:51 AM
24	These are provided by MDOT Construction Division per MDOT standards.	1/29/2021 10:12 AM
25	It has good suggestions and sometimes would modified according to our AGC and state practice	1/29/2021 9:28 AM
26	These help to establish consistency between the many differing contracting agencies.	1/29/2021 7:59 AM
27	satisfied with our current sections	1/28/2021 7:28 PM
28	Our specification covers this. We would want to keep it that way so that we are in control of our historical unit prices.	1/28/2021 5:45 PM
29	It is mandated, i.e. "shall" on the code (left) side, but should be suggested on the commentary (right) side.	1/28/2021 3:57 PM
30	It serves as a reference to see how AASHTO recommends measuring and paying. If possible, we prefer to be consistent with AASHTO, in order to enhance the likelihood of bidders and contractors seeing uniformity. We also look at other states to make sure we are consistent with at least states near Louisiana.	1/28/2021 3:18 PM
31	NA	1/28/2021 2:44 PM
32	AASHTOWare standards and state construction staff preferences are generally the primary considerations when developing measurement and payment	1/28/2021 2:38 PM
33	Good suggestions on how to measure and pay for items. We do not necessarily copy the language, but it is helpful in giving a starting point	1/28/2021 2:21 PM
34	Not used	1/28/2021 2:09 PM

Q5 Do you find the material sampling, testing, and acceptance (ASTM, AWS, PTI, PCI, AISC, and other industry references) useful?

Answered: 37 Skipped: 0



ANSWER CHOICES		RESPONSES	
Yes		83.78%	31
No		16.22%	6
TOTAL			37

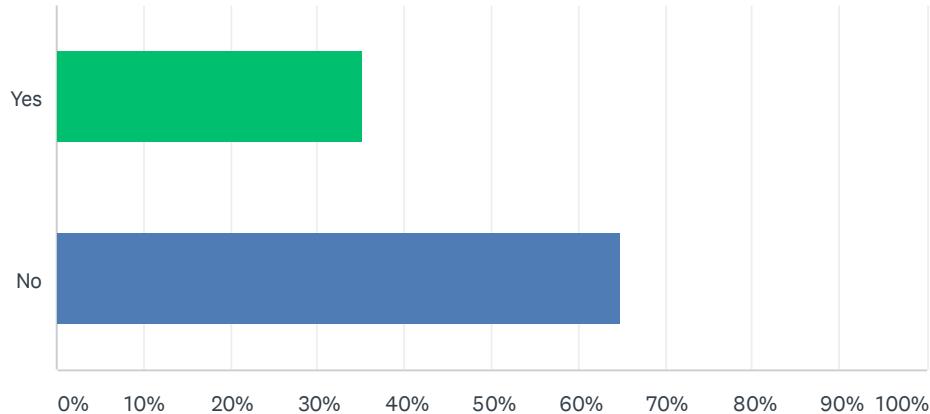
#	IF YES, WHAT AREAS?	DATE
1	ASTM testing, AWS welding requirements, and AASHTO test methods.	2/26/2021 2:19 PM
2	concrete, steel, bearings, and joints	2/20/2021 9:48 AM
3	All mentioned references.	2/19/2021 2:01 PM
4	I can't give a specific, but specs should point to the materials specs.	2/19/2021 8:34 AM
5	All of these sections are useful for materials not covered by our standard specifications.	2/18/2021 4:29 PM
6	Bearing materials, finishes and testing.	2/18/2021 2:40 PM
7	The BCM is a source to make sure our specifications meet current industry references.	2/16/2021 3:45 PM
8	Used as a basis for some of our specifications	2/16/2021 1:52 PM
9	All of the areas (sampling, testing, acceptance, industry references). It is beneficial to see how products and elements are specified in an industry / national specification like BCS. Having a national standard helps the STA know whether their specs are in line with the industry or if some revisions are warranted.	2/16/2021 11:36 AM
10	All	2/16/2021 11:00 AM
11	ASTM for materials	2/16/2021 10:38 AM
12	All areas. It provides a reference that can be useful when developing new specs or modifying existing specs but it's not critical.	2/12/2021 2:00 PM
13	As a guide that points to what other specifications need to be looked at.	2/11/2021 9:19 PM
14	They do provide a guide for at least some recommended materials requirements.	2/10/2021 3:27 PM
15	ASTM, AWS, PTI, PCI	2/9/2021 6:13 PM

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16	The language for material sampling, testing and acceptance is used in the NYSDOT Standard Specifications.	2/5/2021 8:17 AM
17	Only as reference as developing contract language but not used in actual project.	2/4/2021 5:27 PM
18	When referenced to specific tests when needed. Also refer to ASTM, AWS, AISC. None specific.	2/3/2021 9:16 AM
19	Yes. Our specifications frequently reference ASTM, AWS, PCI and AISC standards. We are also looking at incorporating PTI specifications into our standards for post-tensioning anchorages, grouting procedures, etc.	1/29/2021 4:13 PM
20	ASTM, AWS, PCI and AISC	1/29/2021 2:23 PM
21	Steel structures, earth retaining walls, prestressing, bridge deck joints, waterproofing, and wearing surfaces.	1/29/2021 12:51 PM
22	Use MDOT standards	1/29/2021 10:12 AM
23	it helps conducting our business according to the latest tests	1/29/2021 9:28 AM
24	These are useful for illustrating what industry standard material, sampling, testing and acceptance are available.	1/29/2021 7:59 AM
25	Although, it is very difficult to keep these documents up to date. And it is tough to check things like ASTM references as there are significant costs associated with that access.	1/28/2021 5:45 PM
26	Sometimes, though it's nice to limit the amount of external test methods and references needed to design and oversee construction.	1/28/2021 3:57 PM
27	I am a designer, so I am not involved very much with materials testing and acceptance. Our Construction Section and Materials Lab may use those areas.	1/28/2021 3:18 PM
28	NA	1/28/2021 2:44 PM
29	The Department's Material Section typically address these issues for construction testing and acceptance but the Bridge Section may use for identifying materials for design considerations	1/28/2021 2:38 PM
30	across the board	1/28/2021 2:21 PM

Q6 Are there areas that the AASHTO LRFD BCS doesn't currently cover that you recommend adding?

Answered: 37 Skipped: 0



ANSWER CHOICES		RESPONSES	
Yes		35.14%	13
No		64.86%	24
TOTAL			37

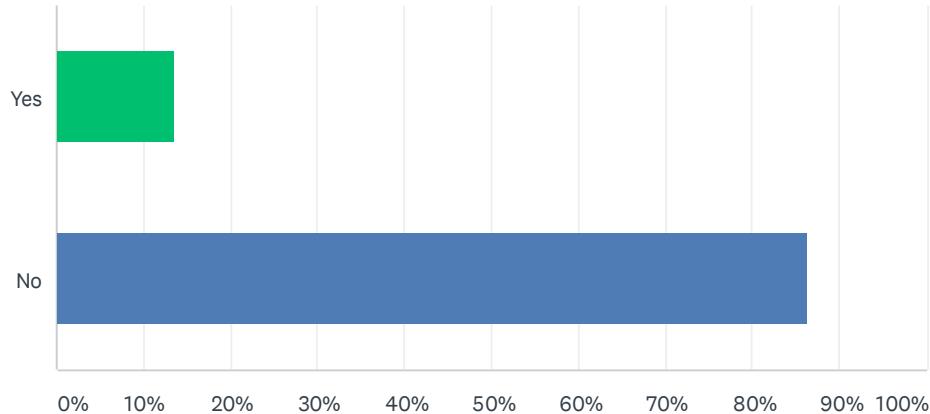
#	IF YES, WHAT AREAS WOULD YOU RECOMMEND ADDING?	DATE
1	GRS-IBS abutments and ABC using precast elements.	2/26/2021 2:19 PM
2	I serve on T-15, so I know there are a couple that we hope to get added. From the NHDOT perspective, no one is clamoring for additional topics.	2/19/2021 8:34 AM
3	Ultra high performance concrete. GRS-IBS bridge abutments. Non-metallic rebar.	2/18/2021 2:40 PM
4	1. Geofoam fills (currently no industry standard specifications exist) 2. Clamshell box culverts 3. Overhead Sign Structures 4. GRS-IBS 5. Lightweight fill materials such as lightweight cellular fill 6. UHPC 7. Wearing Surfaces (Section 28) only covers Laytex modified concrete overlays. Could add additional types of wearing surfaces such as polyester concrete, thin-bonded polymer, etc. 8. It would be beneficial to update some outdated BCS sections to be more current and consistent with BDS. For example, BDS recently made significant revisions to requirements for post-installed anchors, but BCS is not yet updated to match. BDS and BCS should be updated concurrently, if BCS revisions are necessary.	2/16/2021 11:36 AM
5	Updates in FRP, UHPC, PPP, Design Build etc.	2/16/2021 10:38 AM
6	There are probably some areas that could be expanded or added, but I would hesitate to try to cover everything that could be included. The BCS would become too large and too close to an actual "specification".	2/10/2021 3:27 PM
7	Yes, fabrication and weld inspection requirements for temporary structural components. More specifically, if these temporary structural components are part of a primary load path for a non-redundant structure. T-14 is working on developing an addition to LRFD BCS.	2/9/2021 6:13 PM
8	metalizing and micropiles	2/3/2021 8:51 AM
9	We use the BCS on a very limited basis. Unless the BCS is completely restructured, I don't think we would use an added sections.	1/29/2021 4:13 PM
10	Polymer chip seals/bridge deck sealers	1/29/2021 2:23 PM

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11	Steel fabrication	1/29/2021 10:12 AM
12	preservation and construction quality . QA/QC using the latest technology	1/29/2021 9:28 AM
13	Post-installed concrete anchors	1/29/2021 7:59 AM
14	Polyester concrete, non-proprietary UHPC	1/28/2021 3:57 PM
15	NA	1/28/2021 2:44 PM
16	UHPC is probably advanced far enough along to be added. The Guide Specs for Highway Construction cover many of the other elements that may be associated with bridge projects.	1/28/2021 2:21 PM

Q7 Are there areas currently covered by the AASHTO LRFD BCS that you would recommend removing?

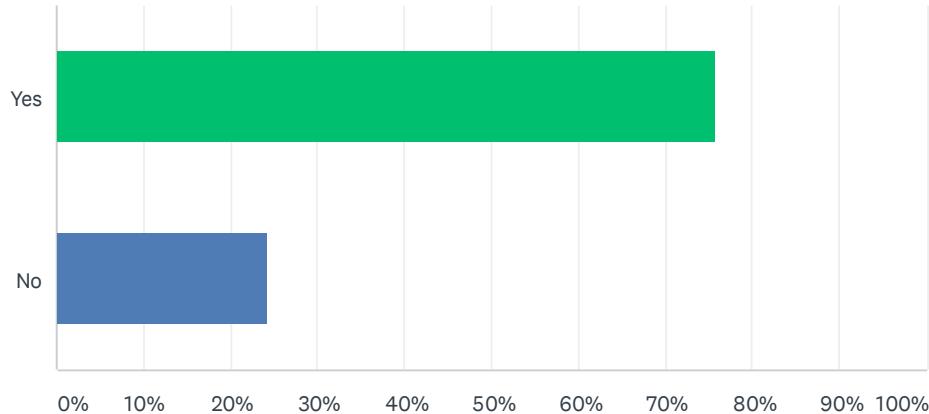
Answered: 37 Skipped: 0



#	IF YES, WHAT AREAS WOULD YOU RECOMMEND REMOVING?	DATE
1	I don't recommend removing any sections, as the USA is a large country, and not every state will use each and every section. Some sections might be useful in Vermont or Alaska, while not in Arizona or New Mexico.	2/26/2021 2:19 PM
2	The use of DTIs in Section 11	2/20/2021 9:48 AM
3	I mentioned chapters, above, that NHDOT doesn't use, but unless the other 49 States concur, we aren't recommending any removals.	2/19/2021 8:34 AM
4	Comment: Even though some sections are not currently used by our STA, they may be useful in the future.	2/16/2021 11:36 AM
5	Lots of long sections which are difficult to read and follow such as the modular joints	1/29/2021 9:28 AM
6	temporary works (superceded), demolition (NCHRP Synthesis 536)	1/28/2021 5:45 PM
7	It would be nice not having it mandated by FHWA. If it is turned into a guide spec, how would that change FHWA's requirements?	1/28/2021 3:57 PM
8	NA	1/28/2021 2:44 PM
9	Our state does not use sections 14, 15, 23, 24, 31 and 33.	1/28/2021 2:38 PM
10	I would only remove them if they became outdated and T-4 did not feel an update is warranted for the sections mentioned in response to question 3. They aren't hurting anything by leaving them in until they start to become outdated, if that happens.	1/28/2021 2:21 PM

Q8 The AASHTO LRFD BCS are currently written in a “contract language” format. Do you find this format helpful?

Answered: 37 Skipped: 0



ANSWER CHOICES		RESPONSES	
Yes		75.68%	28
No		24.32%	9
TOTAL			37

#	WHY?	DATE
1	This format is similar to our contract language, and we recommend it remains.	2/26/2021 2:19 PM
2	When we used the language from BCS, we modified the language to comply with our specification writing style requirements and to fit with the situations.	2/19/2021 2:01 PM
3	I view the BCS as a template for our State specifications.	2/19/2021 8:34 AM
4	As stated previously, we often use the BCS in developing unique special provisions.	2/18/2021 4:29 PM
5	Is helpful even though we still need to tailor language to comply with agency standards.	2/18/2021 2:40 PM
6	It would be consistent with our contract documentation.	2/16/2021 3:45 PM
7	Contract language is required for the direct referencing of BCS. Contract language makes it easier to come to agreement on what the requirements should be, and to know what requirements are essential when using the BCS to develop specifications.	2/16/2021 11:36 AM
8	Because it then is consistent with how our state's specifications are written.	2/16/2021 11:00 AM
9	It matches the format of our specifications. The commentary provides background/supporting information which is helpful.	2/12/2021 2:00 PM
10	Again, as a guide for perhaps articulating a specification, however we typically prepare our own contract language.	2/11/2021 9:19 PM
11	The BCS is not clear in its intent and purpose to provide guidance and recommendations for specifications, and the specification format gives the appearance of a complete specification. I think at the very least, there should be some clarification of intent, purpose, and applicability of the BCS.	2/10/2021 3:27 PM
12	The language is written in a format that the states can modify. As written is acceptable.	2/9/2021 6:13 PM
13	The language from most sections of the BCS are used in the NYSDOT Standard	2/5/2021 8:17 AM

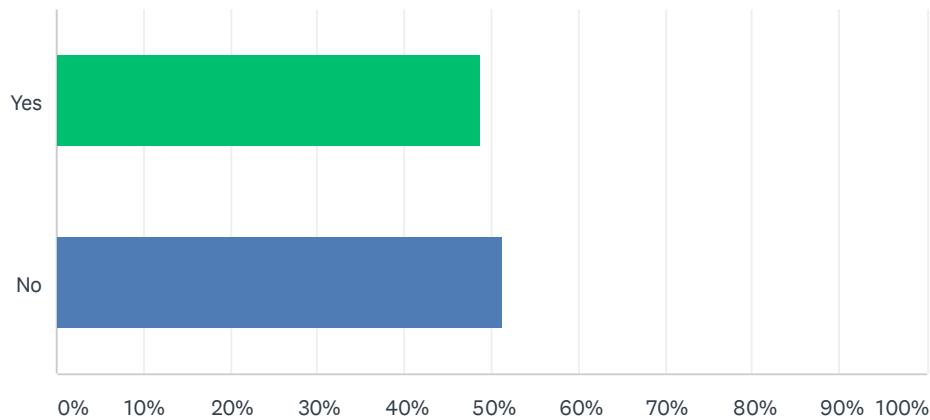
Evaluation and Updating of the AASHTO LRFD Bridge Construction Specifications

Specifications.

14	helps when writing specific contract language as example.	2/4/2021 5:27 PM
15	Helps when specifications are developed.	2/3/2021 9:16 AM
16	it is easily incorporated into our contract documents.	2/3/2021 8:51 AM
17	I would keep the BCS in contract language format so we could easily incorporate if desired.	1/29/2021 4:49 PM
18	We don't use this as contract language. From my perspective, it would be better to move away from the contract language format and make this more of an advisory or commentary type of manual.	1/29/2021 4:13 PM
19	The contract language does not apply to states contracting methods	1/29/2021 11:51 AM
20	It can be extracted easily	1/29/2021 9:28 AM
21	The language provides a good guide for writing our state specifications.	1/29/2021 7:59 AM
22	since will be used for contracts	1/28/2021 7:28 PM
23	we do not engage the BCS through our Contracts	1/28/2021 5:45 PM
24	While it's nice to have as a template, it still requires work to get in usable format for our state. Our state uses active imperative language in contract specifications, so we have to change all the "shall" and passive voice language. AASHTO documents also tend to have language like "when specified in the contract..." that can't be left because the language is being used as the contract.	1/28/2021 3:57 PM
25	We have converted our Standard Specifications to Active Voice/Imperative Mood, which is less wordy and more clear.	1/28/2021 3:18 PM
26	Provides good template for incorporating into our state specs. Also, helps distinguish between suggested and required verbiage	1/28/2021 2:21 PM

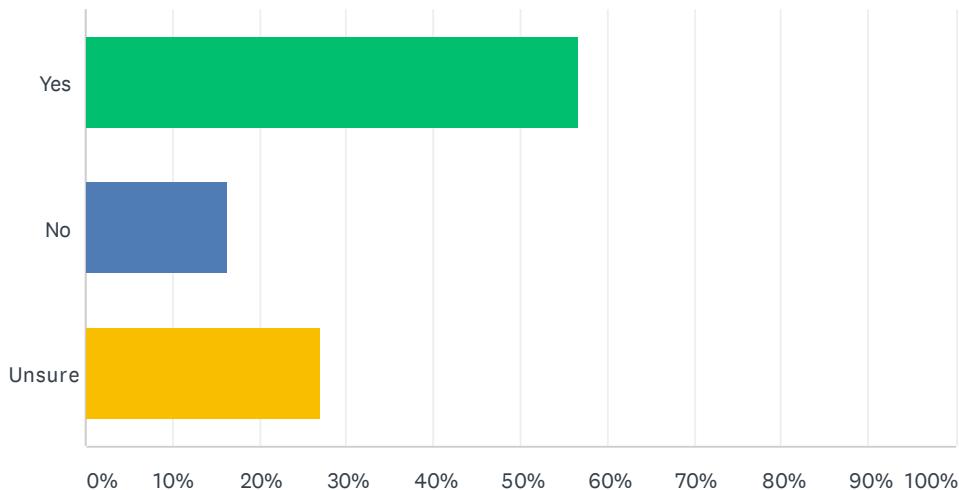
Q9 Would it be better to rewrite these as more of a guidance document that STA's and public owners can reference when developing their own specifications?

Answered: 37 Skipped: 0



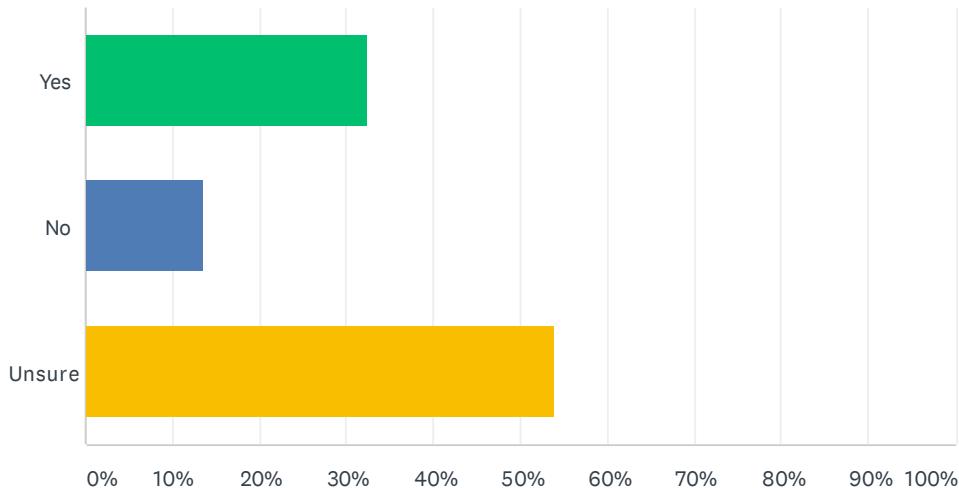
Q10 Currently, the organization of the AASHTO LRFD BCS does not necessarily align with the AASHTO LRFD Bridge Design Specifications (BDS) (chapters don't align, etc.) Would you find it helpful to reorganize the AASHTO LRFD BCS so that they match up with the AASHTO LRFD BDS? For example, the AASHTO LRFD BDS currently covers drilled shaft design in Chapter 10, Section 10.8. This realignment would move drilled shaft construction guidance to Chapter 10, Section 10.8 of the AASHTO LRFD BCS.

Answered: 37 Skipped: 0



Q11 Should the AASHTO LRFD BCS be modified to accommodate alternative contracting mechanisms such as Design-Build?

Answered: 37 Skipped: 0



ANSWER CHOICES		RESPONSES	
Yes		32.43%	12
No		13.51%	5
Unsure		54.05%	20
TOTAL			37

#	WHY?	DATE
1	A "Guide Construction Specification for Design-Build" would be more useful.	2/26/2021 2:19 PM
2	We have a set of bridge construction specifications for alternative contracting methods for use in our state. Generally, we think that construction standards and methods should be the same for both conventional and alternative contracting projects, but different processes. The processes are state-specific. We would not discourage AASHTO from this endeavor, but we are not sure that the end result of this alternative contracting addition to BCS would change anything for us.	2/19/2021 2:01 PM
3	That sounds like a tremendous undertaking, but I can definitely see this as expanding the usefulness of BCS. (Note that NHDOT doesn't do a lot of alternative contracting.)	2/19/2021 8:34 AM
4	Again, we tend to use the guidance in the BCS as a template for developing our own unique special provisions, which we keep consistent with our standard practices.	2/18/2021 4:29 PM
5	Don't use design build contracting enough to warrant a wholesale change in LRFD construction specification formatting.	2/18/2021 2:40 PM
6	These project delivery methods will be more prevalent in the future, but differences in State Laws might prove to be difficult to navigate in this type of document.	2/16/2021 3:45 PM
7	Unsure what this includes. In DB projects, UDOT includes the standard specifications (written for design-build), but in the DB RFP clarifies terminology usage, meaning of acceptance, etc. (For example, who is being referred to in a DB contract when specs say Engineer.) If this is the intent - to include a separate section that describes how the specifications are to be used in a DB project - it could be beneficial for those who have less experience with DB projects. It would be a significant effort to modify the entire specification book throughout to	2/16/2021 11:36 AM

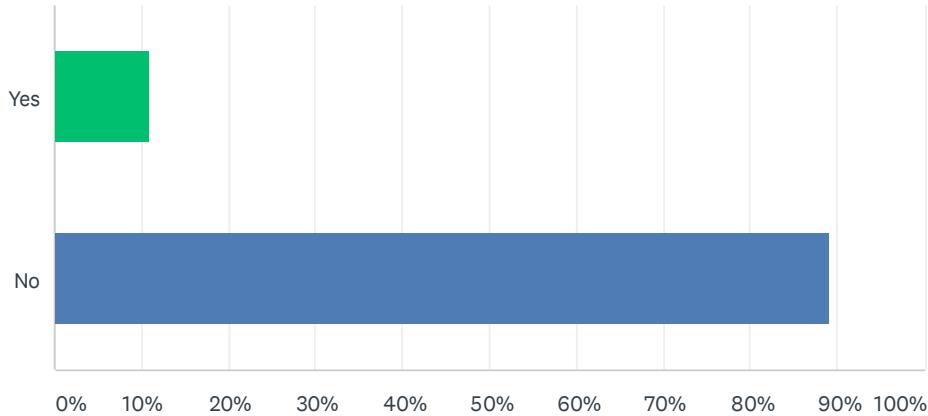
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incorporate the differences in the delivery method and may create issues for those who directly reference the BCS in the STA specifications. Also, various STAs may structure their DB contracts differently.

8	Because, inevitably, a large percentage of states either currently use ACM's or will moving forward.	2/16/2021 11:00 AM
9	It matches the format of our specifications. The commentary provides background/supporting information which is helpful.	2/12/2021 2:00 PM
10	Depends on how it is to be implemented. In or state, while we utilize DB, we are more concerned on the design and detailing side that the DB team uses details that have stood the test of time and have worked well. As for material and construction specifications, we require the use of our own standard specifications.	2/11/2021 9:19 PM
11	Contract administration and contracting methods should not be in the scope of the BDS or BCS	2/10/2021 3:27 PM
12	The BCS provides national guidance, thus the states can modify the BCS to accommodate design build and P3. A section on best practices for alternative contracting would be helpful.	2/9/2021 6:13 PM
13	NYSDOT has progressed many DB projects. We have already created guidelines specific to DB projects.	2/5/2021 8:17 AM
14	Several agencies use Design-Build Contracts. Will be a good reference.	2/3/2021 9:16 AM
15	not sure why it cannot be used in design-build contracts as it is currently written.	2/3/2021 8:51 AM
16	If it doesn't complicate things too much, I think this would be a good think. Our STA (and probably many other STA's) have made significant movements towards DB deliver over the past 20 years. Having construction guidance that covers DBB delivery but also addresses the unique DB aspects would be helpful.	1/29/2021 4:13 PM
17	SD currently only allows Design Bid Build. Other contracting methods are under consideration by our Legislature	1/29/2021 2:23 PM
18	Alternative contracting are commonly used and should be covered.	1/29/2021 11:51 AM
19	Design -build is the exception not the norm. It would help to have both	1/29/2021 9:28 AM
20	Performance Specs vs Prescriptive Specs is the key. The document is predominantly prescriptive and would need to be modified to performance.	1/28/2021 5:45 PM
21	This document should really pertain to the materials and end products. Alternative contract methods are more about how to pay for them or means/methods. For design-build, CMGC, etc. we don't need to change our standard specs. I also wouldn't want that kind of thing in a mandated FHWA document.	1/28/2021 3:57 PM
22	BCS could have each section address general construction requirements, then have specific following subsections that address any unique effects introduced by Design-Bid-Build, Design-Build, Construction Manager/General Contractor, etc.	1/28/2021 3:18 PM
23	Provided that DBB provisions remain then the addition of DB would be acceptable.	1/28/2021 2:38 PM
24	Not sure if there is a big enough difference in the language. If there is a big difference, a separate document may be better. I'm really not sure.	1/28/2021 2:21 PM

Q12 Does your state have any specifications you feel should be added to supplement, or replace an existing specification in the current AASHTO LRFD BCS?

Answered: 37 Skipped: 0

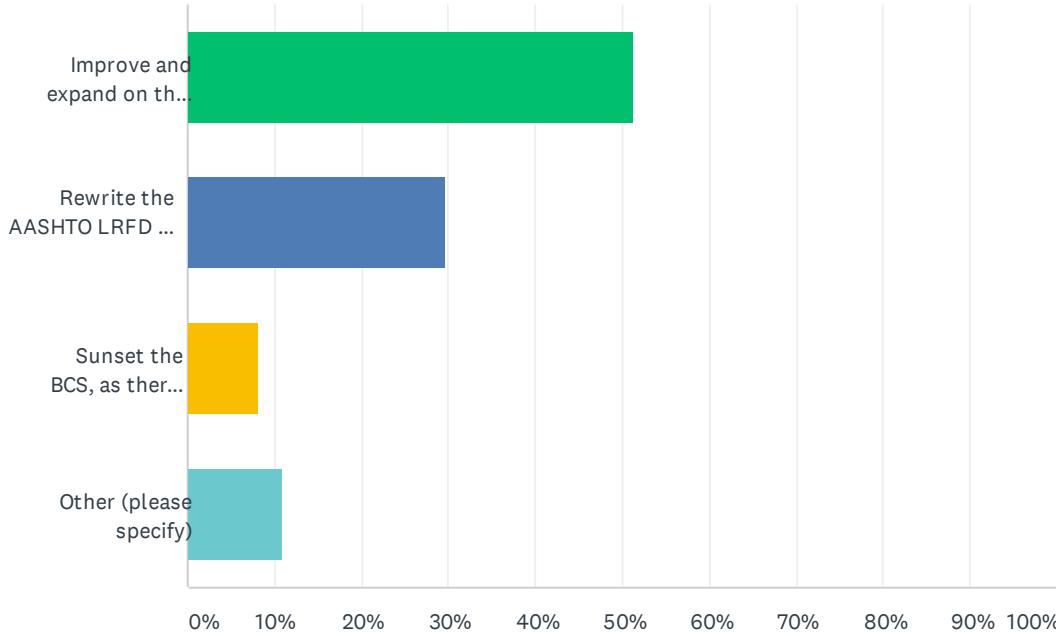


ANSWER CHOICES		RESPONSES	
Yes		10.81%	4
No		89.19%	33
TOTAL			37

#	IF YES, PLEASE SPECIFY.	DATE
1	We have developed a good GRS Abutment specification that would be useful in an update to the BCS, if a new section for GRS is created.	2/26/2021 2:19 PM
2	Comment: Not as a replacement. UDOT has some specifications that may be useful as a baseline or starting point to supplement, such as Geofoam Fill, GRS-IBS.	2/16/2021 11:36 AM
3	Construction Trucks passing on the bridge for pavement projects (MTV - Material Transfer Vehicle)	2/16/2021 10:38 AM
4	11.5.5.4.6b - Being a state that requires DTIs for almost all structural bolting, we have found that the "visible gap must remain" requirement is not a realistic expectation in the field since it is a subjective requirement based on visible interpretation of a gap that is less than 0.005". I understand the basis of this requirement as explained in the commentary, however it would be helpful to have guidance on what can be done to prevent contractors from applying unnecessary force when using DTIs that is not based on a subjective measurement/criteria, and if there are concerns that the contractor is unnecessarily over tightening bolts what can/should be done to investigate. One approach may be that if X% of bolts in a connection have refusals in all spaces, X number of bolts with refusals in all spaces shall be removed and checked to verify that the nut can be turned down by hand. 11.5.5.4.6a - Again, since we have had issues with the "visible gap" requirement, has AASHTO considered aligning with Section 7.2.4 of the 2020 RCSC for DTI Pre-Installation Verification testing?	2/12/2021 2:00 PM
5	preservation policy for overlay ,patching and waterproof membranes	1/29/2021 9:28 AM

Q13 What do you think should be done with the AASHTO LRFD BCS?

Answered: 37 Skipped: 0



ANSWER CHOICES		RESPONSES	
Improve and expand on the current content, keeping the current format and removing outdated material.		51.35%	19
Rewrite the AASHTO LRFD BCS into a guidance document to aid in the development of contract specifications, but not to be used directly as contract language.		29.73%	11
Sunset the BCS, as there is no longer a need for a national bridge construction specification.		8.11%	3
Other (please specify)		10.81%	4
TOTAL			37

#	OTHER (PLEASE SPECIFY)	DATE
1	I do not know of anywhere that MDOT directly points to BCS. MDOT basically just uses the BCS through other references.	2/20/2021 9:48 AM
2	We think that these two options are possible. Improve and expand on the current content, keeping the current format and removing outdated material. Rewrite the AASHTO LRFD BCS into a guidance document to aid in the development of contract specifications, but not to be used directly as contract language.	2/19/2021 2:01 PM
3	Unsure. I would like to hear other states' needs and views. In general though, the more we can "keep it simple", the better.	1/28/2021 3:57 PM
4	Keep it current but do not expand it.	1/28/2021 2:44 PM