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Summary Report

Context Sensitive Solutions Technical Assistance: Minnesota Department of Transportation

November 29 – December 1, 2016

FHWA Task Order 6501-15053

Expanding the CSS/Livability Message
and Targeted Technical Assistance

June 2017

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16. Abstract <p>The Federal Highway Administration (FHWA) is sponsoring a Technical Assistance (TA) program to support states in applying Context Sensitive Solutions (CSS) to challenges they face in the transportation sector. FHWA is also inviting states that have completed a CSS process to join a virtual peer exchange where they can share information and lessons learned. Each state and state agency faces unique issues, but the results and key findings of these CSS efforts can offer valuable insight to other states.</p> <p>The Minnesota Department of Transportation (MnDOT) was an original adopter of CSS and participated in the initial pilot conducted by FHWA. Since the early 2000s, MnDOT has championed the integration of CSS into all of its business practices and phases of decision-making. To this end, MnDOT has developed policies, guidance, process improvement approaches, and training, all in support of CSS integration efforts. In 2009, MnDOT considered CSS one of its flagship initiatives. Most recently, MnDOT has focused on applying performance-based, data-driven practical design process that maximizes performance outcomes in a cost-effective manner.</p> <p>MnDOT and FHWA focused the TA on refining MnDOT's 2.5-day "Advanced Flexibility in Design" workshop. The intention was for contractor team subject matter experts (SMEs) to attend, review, and by provide feedback to the instructors.</p> <p>This report documents the TA provided by the SMEs, including the background and purpose of the TA; key takeaways from the workshop; list of attendees; a summary of all presentations and discussions during the workshop; and course improvement recommendations. The web link to the workshop information is provided as an appendix to the report.</p>					
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Background

The Federal Highway Administration (FHWA) is sponsoring a Technical Assistance (TA) program to support states in applying Context Sensitive Solutions (CSS) to challenges they face in the transportation sector. FHWA is also inviting states that have completed a CSS process to join a virtual peer exchange where they can share information and lessons learned. Each state and state agency faces unique issues, but the results and key findings of these CSS efforts can offer valuable insight to other states.

The Minnesota Department of Transportation (MnDOT) was an original adopter of CSS and participated in the initial pilot conducted by FHWA. Since the early 2000s, MnDOT has championed the integration of CSS into all of its business practices and phases of decision-making. To this end, MnDOT has developed policies, guidance, process improvement approaches, and training, all in support of CSS integration efforts. In 2009, MnDOT considered CSS one of its flagship initiatives. Most recently, MnDOT has focused on applying performance-based, data-driven practical design process that maximizes performance outcomes in a cost-effective manner.

MnDOT and FHWA division representatives proposed focusing the TA on refining MnDOT's 2.5-day "Advanced Flexibility in Design" workshop. The intention was for two subject matter experts (SMEs) to attend, review, and then provide general feedback on the workshop and recommendations to the instructors.

Purpose of the Meeting

The "Advanced Flexibility in Design" workshop is hosted biannually by MnDOT, in partnership with the University of Minnesota's Center for Transportation Studies. The workshop covers multiple topics related to the concept of introducing flexibility in highway design, with CSS concepts integrated throughout. While attendees report feeling engaged during the workshop, once they return to their regular routine and work, they report feeling ill-equipped to actually apply the concepts they have just learned into project development. The purpose of this TA effort is to identify ways to enhance the workshop so that participants are more prepared and inclined to integrate CSS into their everyday project work.

Key Takeaways

Upon their observations of the "Advanced Flexibility in Design" workshop, the SMEs provided a set of recommendations to the workshop organizers and instructors for improving the workshop. Overall, the course was very well constructed, with an appropriate duration and quantity of content. Structural modifications are not necessary or recommended. The recommendations relate mainly to the content of the sessions. Those recommendations are listed below, with greater detail provided in the following pages.

1. Place a greater emphasis on context and how it impacts design choices.
2. Place a greater emphasis on how flexibility improves responsiveness to context.
3. Place greater emphasis on how to find alternatives.
4. Place greater emphasis on the importance of the purpose and need statement for achieving right-size solutions.
5. Highlight the importance of outcomes and broader performance metrics.

Meeting Agenda

The TA was provided during the workshop held from November 29 to December 1, 2016. A web link to information on the Advanced Flexibility in Design workshop is provided in the Appendix.

Meeting Attendees

As noted below, the meeting attendees consisted primarily of MnDOT personnel as well as some local agency participants and consultants. It was taught by lead instructors Jack Broz, Jim Rosenow, and Charleen Zimmer.

First Name	Last Name	Affiliation
Justin	Attipou	MnDOT
Jorge	Bernal	Anoka County Highway Department
Rachel	Broughton	MnDOT
David	Carlson	Parsons (CSS SME)
John	Chock	MnDOT
Robert	Ellis	City of Eden Prairie
Daniel	Erickson	MnDOT
Brittany	Fossell	MnDOT
Derek	Fredrickson	MnDOT
Dale	Gade	MnDOT
Marta	Grieman	MnDOT
Yuzhe Rachel	Guan	MnDOT
Neil	Heinonen	Hennepin County Public Works
Anton	Jerve	City of Saint Paul Department of Planning and Economic Development
Robert	Jones	MnDOT
Adam	Josephson	MnDOT
Jeffrey	Kapoun	Ramsey County Public Works
Bobby	Kuennen	Dakota County Transportation
Andrew	Lawver	MnDOT
Becky	McCarty	Steele County
Andrew	McGovern	Hennepin County Public Works
Christopher	Morris	MnDOT
Michelle	Moser	MnDOT
Paul	Moser	Ramsey County Public Works
Kevin	Nelson	KLJ
Tyler	Newhall	Stonebrooke Engineering
Randy	Newton	City of Eden Prairie - Engineering Division
Kevin	Peterson	Washington County Public Works
Norm	Plasch	MnDOT
Matthew	Pooler	MnDOT
Daniel	Prather	MnDOT
Almin	Ramic	MnDOT
Aislyn	Ryan	MnDOT

Benjamin	Sandoz	MnDOT
Nikiforos	Stamatiadis	University of Kentucky (CSS SME)
Jamie	Strandemo	MnDOT
Dan	Sullivan	MnDOT
Dan	Swanson	MnDOT
James	Sweeney	MnDOT
Dustin	Thomas	MnDOT
Mackenzie	Turner Barga	MnDOT
Michael	Veaderko	MnDOT
Carlos	Zhingre	MnDOT

Meeting Summary

The goal of the workshop was to educate attendees on how to apply risk assessment and design flexibility to improve MnDOT’s return on investment while improving the compatibility of transportation projects with their settings, and the capacity of those projects to accommodate multiple modes.

The primary learning objective is the use of design flexibility to achieve solutions that are more context sensitive, with the intended benefits of higher rates of return on investments, better service to multiple modes, and higher effectiveness among practitioners in the application of flexibility in design. The workshop provides attendees with an overview of recent developments in current design issues, and basic knowledge of how to use flexibility to develop contextual designs.

Structurally, the workshop includes a total of 13 sessions over the course of 2.5 days, covering topics including safety (which is the main focus of day one), data, speed considerations, and geometrics. Each session entails a short presentation followed by a group exercise.

A summary of the content of each day is presented below, with specific feedback from the reviewers integrated throughout.

Day 1

Session 1: Introductions and Welcome

Jim Rosenow and Scott Bradley of MnDOT opened the workshop with an overview of MnDOT’s activities in the areas of CSS and Performance Based Practical Design (PBPD). They discussed the fact that Missouri DOT (MoDOT) was the first state to use the term practical design and the reasons why MoDOT attempted to change the way that projects are delivered. Mr. Bradley highlighted the several MnDOT case studies that have appeared in publications demonstrating successful application of CSS and PBPD.

Mr. Rosenow and Mr. Bradley then explained the need and power of flexibility in design. PBPD is a goal-oriented method of project delivery that is focused on using a broad set of criteria to solve a need, rather than jumping to a solution based on a single problem. However, PBPD does not mean that design standards are going away, rather designers need to work within them to make sure they are tuned correctly to make sense of the system and the need. The PBPD process is data-driven, as opposed to data-determined. In other words, data does not solely determine the decision—rather, practitioners of PBPD draw insights from the data in order to make informed decisions that also take into account the wider context of local conditions and economic realities.

MnDOT is increasingly understanding safety performance as a function of design, and recognizing the possibility for predicting crash rates based on geometric decisions in the design process. Until recently,

the identification system provided in NCHRP 15-47: Developing an Improved Highway Geometric Design Process was used as a basis for design decisions, but opportunities now exist to refine that system based on better data. Improving system performance can greatly benefit the public. At this point, the presenters introduced the first exercise, which focused on building an understanding of return on investment (ROI).

Chris Roy, Deputy Director of Engineering Services at MnDOT, introduced the four elements of delivering projects successfully: safety, cost, meeting public expectations, and doing more projects, meaning that when projects are managed well and have met the other three elements, the department has the capacity to deliver more projects. He proposed that design exceptions present an opportunity to use good engineering judgement. Making good exceptions in the design process relies on data, experience, and diligent documentation.

Initial Feedback: None

Sessions 2, 3, and 4: Controlling Criteria, Risk, and Safety

The rest of the first day focused heavily on the issues of safety and the use of the traditional tools to address safety in design such as the HSM. Session 2 covered the changes in controlling criteria and sessions 3 and 4 covered risk reduction, safety improvement, and the use of the predictive model in the HSM.

Initial Feedback: PBPD could be better integrated into these sessions and likewise subsequent sessions. The principles and practices of defining context were not effectively applied to safety, and there was no discussion on the underlying causes of safety concerns or explanation of how context can impact safety.

Recommendations:

- Explain in greater detail the importance of clarity around the project's purpose and need for the success of the entire development process. Identifying purpose and need is critical to avoiding generalities and establishing specific project goals and targets.
- Expand the discussion about risk characterization beyond simply operational or geometric conditions. Include an explanation of how to diagnose causation, and why doing so is important for understanding safety risk. Explain how understanding context can assist in developing possible alternatives to address that risk.
- Redesign some of the activities to encourage greater participation. For example, the presenters showed a photo of a high school intersection that presented a good opportunity for interaction. Participants could have been invited to identify context considerations for designers to consider, and propose other solutions to address the problem.
- In the HSM session, increase the complexity and give participants more of a challenge. Improve the relevance to flexible design by explaining how context be both a cause of concern regarding safety, and a source of valuable guidance for a safety remedy.
- Integrate the concepts of flexibility and contextual design into the discussion about minimizing impacts.
- Highlight the relationship between context and risk minimization (Slide 28).
- When participants offer examples of safety challenges they have encountered instructors should explain the relevance to flexibility and how the HSM could help inform a context sensitive design that addresses the safety challenge.

Session 5: Universal Design

The final session of the day covered the importance of universal design, which is required under the Americans with Disabilities Act (ADA), and how to serve all transportation users. This session featured storytelling by Todd Grugel, MnDOT's ADA representative, and Jaime Taylor of the Commission on the Deaf, Deafblind, and Hard of Hearing Minnesotans (MNCDHH). One statement from the presenters that appeared to resonate with the class was, "If it looks stupid, it probably is stupid"—meaning that if the design appears to be forced or wrong in relation to other elements around it, it likely will be unsuccessful. The instructors gave examples of a utility box directly in the path of a wheelchair ramp, and the bad placement of a crosswalk button with an audible signal. Compliance with ADA is the minimum—stopping at mere compliance is not always sensible. Flexibility and context are important for understanding real user needs and which measures will meet them effectively. This session effectively integrated the concept of maintaining flexibility while adhering to standards.

The day ended with two effective exercises. The first exercise involved walking outside and down the street with the presenters. Participants gained an understanding of the challenges faced by people with disabilities, and how standard street and sidewalk design can dampen effective ADA delivery. This exercise had a deep impact on the group and vividly demonstrated the importance of understanding the broader context of a transportation facility and its relationship to land use and users of varying ability.

The second exercise invited participants to try using a wheel chair to go up standard ramps, and to navigate a room with vision-impairing goggles. The exercise illustrated that merely complying with ADA requirements does not always translate into a pleasant experience for users with disabilities.

Initial Feedback: None

Day 2

Sessions 6 and 7: Traffic Data and Design Speeds

These sessions covered the use of traffic data, but emphasized that designers should not focus solely on traffic. Focusing solely on peak period design may create problems during periods of non-peak traffic.

Initial Feedback: The content of these sessions was too basic for an advanced class. The presenter did not sufficiently explain how context impacts decisions or how flexibility should be applied when considering traffic, speed, and lane configurations. Traffic issues were explored reasonably well, but Level-of-Service (LOS) was the only metric explained.

The exercise on understanding multimodal level of service (MMLOS) did not cover the fundamentals of MMLOS and did not offer a thorough explanation of the issues it presents as a metric. The exercise was somewhat confusing and may have given the wrong impression regarding how MMLOS is calculated. The exercise also did not include setting targets for improvement, or looking beyond the existing constructed roadway to explore alternative solutions. MnDOT may wish to consider not starting with a premise in the exercise that a better MMLOS results in a degradation of single occupancy vehicle level of service— but rather consider the possibility that the facility may be over-built. (e.g. Road Diet considerations).

The design speed discussion was lively and acknowledged that context and function should inform the selection of design speed. However, during the exercise—when participants were asked to select a design speed for a corridor and explain their decisions—there was no discussion of the need to define the context or identify changes in land use. The absence of these elements begged the question—why modify any corridor elements and possibly lower the speed without understanding these factors?

Recommendations:

- Introduce the concept of multimodal transportation and how to evaluate MMLOS. This topic would be appropriate for an advanced course and would fit well into the discussions in Sessions 8, 9, and 10.
- Modify the exercise to include an exploration of flexibility and a requirement to apply flexibility, identify changes in land use, and recognize context and function-modes.
- In the segment on speed design, include a discussion about design consistency and how it can impact the final design.
- Place greater emphasis on identifying the context first and then start thinking about the design speed and elements of the roadway.
- The discussion on cross section issues should more thoroughly address context and multimodal concepts – for example, consider the tradeoffs that a designer needs to make in order to address all users and how context (urban/suburban/rural) can influence these considerations.

Sessions 8, 9, and 10: Allocating Space and Horizontal/Vertical Alignments

These sessions covered the topics of allocating space in conditions of a constrained right-of-way (ROW), the factors involved in horizontal alignment and superelevation, and the factors involved in vertical alignment and sight distances. The presenters provided an overview of lane widths, and why and when they apply. The primary focus was evaluating 12-foot and 11-foot lane widths in both rural and urban contexts. The presenters introduced NCHRP Report 783: Controlling Criteria for Geometric Design, specifically the recommendation for designers to consider 10–12-foot lanes for urban and suburban arterials.

Initial Feedback: The session covered the available guidance for considering lane width and allocating space, but did not explain the application of these tools or how they can assist with ensuring design flexibility. The segment about visual cues with regard to land use/activity, and how they can influence design, was effective. This session also included an overview of the fundamentals of intersection design. However, presenters did not provide an opportunity for participants to discuss the importance of context or the fact that, in some cases, volumes and speed may dictate design features that conflict with other features of the context. This section did introduce the concept of designing “from the outside in”—that is, considering the full context and then designing a street or roadway that fits into its built environment and accommodates all the users—but did not elaborate on why that approach is important.

The session about horizontal alignment devoted too much time to the issues of superelevation and side friction, while overlooking how context can influence alignment and geometric concerns. The exercise could benefit from imposing greater constraints to make it more challenging for participants and require them to think through how to accommodate the alignment through design flexibility. The workshop encountered similar issues with the vertical alignment discussion; the discussion centered too much on background without actually addressing flexibility or context.

Recommendations:

- Expand the discussion of existing guidance on lane widths, to include how they can be used to ensure design flexibility.
- Provide an opportunity for participants to discuss the importance of context in intersection design, and the potential conflicts between volume, speed, and other elements of context.

- Elaborate more on the importance of designing “from the outside in.”
- Spend more time on how context can influence alignment and geometric concerns in allocated space.
- Revise the exercise to impose more design constraints, to make it more challenging for participants and force them to include flexibility in their designs.
- Spend less time on background during the discussion on vertical alignment, and spend more time on discussing the relevance of flexibility and context.

Day 3

Session 11: Freeway Interchanges

This session focused on freeway interchanges. The presenters provided an overview of various interchange designs, design components, and FHWA’s list of high-risk design elements. The presenters facilitated discussions regarding lane continuity, fork geometry, local connections, sight distance, geometric combinations, and vertical clearance.

The session ended with an exercise focused on interchange design. Participants were tasked with designing a freeway to support a hypothetical city land use plan, within a given context of community issues and land uses, and with preference given to developing a local road network connecting to the highway. Participants were instructed to design “from the outside in” but not given any information about what that means.

Initial Feedback: The discussions about lane continuity, fork geometry, and other key concepts were fairly basic and straightforward. They also did not sufficiently cover how flexibility can be achieved to fit context and performance. Additionally, the participants should have been given clearer instruction about what it means to design “from the outside in.”

Recommendations:

- Refine the discussions to include more complex concepts and incorporate flexibility and context.
- Refine the exercise instructions to include an explanation of what it means to design “from the outside in.”

Session 12: Roadside Design

This session covered roadside design. The presenters discussed clear roadside concepts, provided an overview of American Association of State Highway and Transportation Officials (AASHTO) guidance, and explained the criteria in MnDOT’s Road Design Manual. The discussion on clear zone emphasized the concept of flexible design and the fact that the widths noted are only guidelines and not standards. The concept of additional considerations when determining the clear zone width was also presented.

Initial Feedback: None

Session 13: Retrofit Designs

This session covered retrofit designs. Compared to the earlier sessions, the presenter of this session spent more time explaining CSS and particularly PBPD in greater detail, specifically in terms of interchange treatments, ramp designs, operational alternatives. Participants were asked to consider how modifications can be made using materials already available, without needing to fund expensive improvements.

Initial Feedback: The discussion about completing modifications affordably would have benefited from greater attention to context and alternative measures that include greater design flexibility. Also, it was unclear why this discussion on modifications was included in the session about retrofits.

Conclusion

The workshop was concluded with a roundtable discussion of key takeaways: what participants had learned, what implementation challenges they anticipate, and what additional information and guidance they need. Noteworthy comments included:

- **Key lessons learned:** There is a surprising amount of room for flexibility within design standards. Participants found it helpful to understand the background of the design standards.
- **Implementation concerns:** Personnel at the management level must balance a myriad of project considerations. Management (specifically, project managers) should attend the course so they can understand the importance of considering design flexibility early in the design process and the resulting benefits. Additionally, traffic engineers and designers need to reach a shared understanding about the importance of design flexibility.
- **Remaining needs:** Participants need more direction on how to effectively document decision making. Questions that should be answered in documentation include: What is the issue? What did you look at and why? How did you arrive at the answer? How can decisions made in the scoping report be implemented? MnDOT offered to provide participants with the CSS and other supplemental course material.

Roadmap of Course Improvement Suggestions

After observing the workshop, the SMEs provided feedback on the content of the workshop and discussed recommendations for improving the workshop with the organizers and instructors (detailed above). Overall, the course was very well constructed, with an appropriate duration and quantity of content. Structural modifications are not necessary or recommended. The recommendations relate mainly to the content of the sessions.

The best practices related to standard design and geometric issues were appropriate for Minnesota. The case studies were all effective, vetted, and drawn from throughout Minnesota, which was appropriate for a room full of participants working in Minnesota. The presenters should consider ways to effectively incorporate the concepts of context and design flexibility into case studies discussed during the workshop, or sufficiently explain how to account for them. Participants may have benefited from examples illustrating how other design teams applied the standards, then considered the context, and subsequently revised their designs to ensure flexibility and solutions that saved money and reduced adverse effects. FHWA is working in partnership with the Institute of Transportation Engineers (ITE) to develop a Practitioner's Guide for Walkable Thoroughfare Design that will provide examples of context sensitive design solutions applicable to urban and suburban roads. The publication is expected to be released in the Fall. Participants may also have benefited from having stakeholders (for example, other agency representatives or outside advocates) in the room to discuss how they can help planners and designers with defining and understanding the context.

Additionally, even though the course was intended to cover flexibility in design, there could have been more substantive discussion around how and why to apply flexibility. The instructors indicated that previous iterations of the course that had more focus on CSS. Consequently, it may be helpful to update the current material with some of the CSS-focused content from prior years. In addition to covering how

to define context and how context can influence design, addressing how CSS can be a driver for flexibility throughout the course would be very effective.

The recommendations are as follows:

1. **Place a greater emphasis on context and how it impacts design choices.** Presenters should facilitate additional discussion around how context issues shaped the design decisions in all the examples described during the presentations. This approach was applied well on the third day during the session about interchanges. It simply needs to be applied to all the sessions throughout the course.
2. **Place a greater emphasis on how flexibility improves responsiveness to context.** Presenters should include examples that demonstrate how flexibility benefits the design process, and in the exercises participants should be prompted to discuss how they would integrate flexibility in order to suit the context.
3. **Place greater emphasis on how to find alternatives.** Presenters, when describing case studies, should explain how the design teams identified alternatives, and conduct a brief comparison between the original or standard solution, and the alternative solution. Doing so can help participants better understand how flexibility is applied in design.
4. **Place greater emphasis on the importance of the purpose and need statement for achieving right-size solutions.** Throughout the workshop, presenters should emphasize the importance of the purpose and need statement for both CSS and PBPD, especially when it comes to right-sizing projects. Presenters should also emphasize the importance of developing performance targets that reflect the purpose and need.
5. **Highlight the importance of outcomes and broader performance metrics.** In the case studies and examples presented, the presenters should elaborate more on the results of design decisions and discuss the potential outcomes and benefits to users and the system itself, in addition to traditional metrics. Multimodal performance metrics were mentioned early in the workshop, during Mr. Bradley's introduction, but they were not mentioned again throughout the rest of the workshop. Emphasizing the benefits of context-sensitive and flexible design will reinforce its value and importance in the minds of participants.

Appendix

- CSS Website – MnDOT/University of Minnesota Center for Transportation Studies
<http://www.contextsensitive.umn.edu/index.html>