MEETING SUMMARY

SHRP2 SERVICE LIFE DESIGN FOR BRIDGES (R19A) NORTHEAST REGION PEER EXCHANGE

TO	Raj Ailaney, Patricia Bush, Pam Hutton
COPY	Sam Rosenblum
PREPARED BY	Mike Bartholomew
MEETING DATE	December 13, 2018
LOCATION	Double Tree by Hilton – Philadelphia, Pennsylvania

Background

The Federal Highway Administration (FHWA) in conjunction with the American Association of State Highway Transportation Officials (AASHTO) and the Transportation Research Board (TRB) have established the 2nd Strategic Highway Research Program (SHRP2) to address four focus areas – Safety, Renewal, Capacity, and Reliability. Project R19A – Service Life Design of Bridges, one of the Renewal projects, is an innovative technology approach being promoted to ensure that new more durable bridges are designed to remain operational for 100 years or more.

To assist agencies with advancing the implementation of Service Life Design, FHWA sponsored—and the Maine Department of Transportation (Maine DOT) hosted—a peer exchange with the Connecticut Department of Transportation, Delaware Department of Transportation, Maryland Department of Transportation, New Jersey Department of Transportation, Pennsylvania Department of Transportation, and the R19A Subject Matter Expert (SME) team in Philadelphia, Pennsylvania, on December 13, 2018. The peer exchange provided a forum for participants to discuss and exchange ideas on Service Life Design.

Twenty-one attendees participated in the peer exchange, including representatives from AASHTO, FHWA Headquarters, State representatives, and representatives from a private engineering consulting firm and academia. The peer exchange was formatted to provide a mix of presentations and facilitated roundtable discussions, as shown on the agenda in Appendix A. This structure provided attendees with several opportunities to collect information from their peers and examine different ways to implement Service Life Design. Representatives from Maine and Pennsylvania shared their noteworthy practices and strategies as wells as the challenges and barriers they experienced in applying Service Life Design. The event began with opening remarks from AASHTO, FHWA, and Maine DOT, and was followed with the technical sessions and group discussions.

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Service Life Design - Key Peer Exchange Findings

Maine, as the host state and an IAP Lead Adopter agency has indicated a desire to implement Service Life Design concepts, particularly for their coastal bridges. Pennsylvania, through their concrete durability testing program, found large differences in the chloride migration test results from their concrete suppliers. Based on this discovery, they are investigating changes to their standard concrete specifications to attempt to achieve better standardization.

For this Peer Exchange the participating states, Connecticut, Delaware, Maine, Maryland, New Jersey, and Pennsylvania were asked to respond to a survey questionnaire. Three responses were received, all from Pennsylvania, indicating that they had moderate knowledge of Service Life Design. Based on the group discussion topics, it was apparent that the other states attending had less understanding of Service Life Design.

Most of the states indicated that the philosophy of Service Life coordination between Design, Construction, and In-Service Operations would be a major challenge in their organizational structure. There is a lack of communication between the groups and implementing new concepts such as concrete material durability tests and hardened concrete cover measurements during construction will be a challenge. In-Service Monitoring of performance is also expected to be a challenge unless policies and organizational structure changes.

Peer Exchange Discussion Notes

Introduction

Patricia Bush (AASHTO) – Gave overview of the SHRP2 Program as documented in handout documents provided to participants. From publication *2017 Implementation Highlights - Advancing the State of the Practice*, identified $155 million in funding assistance, 340+ projects implemented, 300,000+ participants engaged, 12,300+ outreach activities, and 16,600+ hours of technical assistance rendered. Also discussed publication on *FHWA/AASHTO Implementation Assistance Program State Participation in Rounds 1-7*, which identified the 430 projects by product name and participating agency.

Raj Ailaney (FHWA) – Gave an overview of the SHRP2 Solutions for Bridges, which included the participating agencies for project R19A – Service Life Design of Bridges. Also discussed the deliverables being produced for R19A.

Wayne Frankhauser (Maine DOT) – Gave an overview of Maine DOT's participation as a Lead Adopter Agency in R19A, and the development of the concept of their "Forever Bridges."

Service Life Design Concepts

- **Introduction to Service Life Design (SLD) –** presentation by Mike Bartholomew/Jacobs
  - Is that 700-page report on the website too? My recollection was that when the report was first published, it was not complete.
    - Yes
  - Where is the report on the AASHTO site?
    - It is the first link on the SHRP2 web page: http://shrp2.transportation.org/Pages/ServiceLifeDesignforBridges.aspx
  - Things like eliminating joints prior to initial design, sealing the deck right after it is built in areas where trucks are coming down the road spraying salt. In terms of coating system, is there anything in the report that addresses this?
    - There's a National Association of Corrosion Engineers (NACE) document on coating systems.

- How about timely maintenance?
    - Yes, you can't just build a bridge and leave it alone. You have to have a maintenance and replacement plan.
- Now we are using concrete strengths closer to 10000 psi which is close to w/c ratio 0.3. Has anything been developed or looked at with w/c ratios that low? Rapid chloride penetration test?
    - We are collecting all the test data that the IAP states have performed. We are recommending that the NTBuild 492 test to be done in replacement of the ASTM C1202 coulomb test.

- **Implementing SLD for Concrete Structures –** presentation by Neil Cumming/COWI
    - Slide 29 you go through ageing coefficients. Where did you get those values from?
        - Ageing coefficients are from fib Bulletin 34, which gives references to where the data is from.
    - Most of the data for ageing coefficient are from work done in Europe. Is any research done in US?
        - Let us know if you are researching it. We are looking for people who have done this research.
    - You mentioned chloride levels to initiate corrosion. Majority of those numbers are from black steel not epoxy reinforcing. What should we do in Pennsylvania?
        - There is an emerging body of research that will tell you what to use. People are working on this. Our research is primarily in galvanized steel.
        - I did not know epoxy was still being used.
        - The R19A SME team is putting together a table of different reinforcing steel. There will be threshold levels from about 50 papers we are extracting information from.
        - The protection for epoxy is only as good as the epoxy
    - In PA we use a lot of salt on our bridge decks. It does not seem to affect the compressive strength of our bridge decks. Have you seen data at all on the chloride effect on compressive strength of concrete?
        - No, I don't think there is one.

- **Group Discussion – What does 100-year SLD mean?**
    - It is a function of where the bridge is on a network. How the bridge is posted in each network.
    - There are disconnects when talking about the 100-year SLD.
    - You can't mix design and service. In order to get 100 years out of bridge you have to do certain things at the right times.
    - You cannot talk about service life without considering maintenance.
    - What about steel coatings? Are we working in the same direction as concrete?
        - NACE is working on this. They are talking to painters, contractors and put together an extensive table on what to expect. It is deemed to satisfy approach. We do have a worked example that we produced that will be on the SHRP2 R19A website.
        - Does it cover metalizing?
            - Yes
    - Is there any general thought into how traffic is changing in 100 years? Looking at bridge being there for projected future use?

    - How do you define end of service life? When does the cost of keeping it in use become unattainable? Economically?
    - Precast design has started to look at designing parking structures to be buildings in the future because parking structures might not be needed.
        - AASHTO LRFD takes into account what the traffic loading will be 75 years from now.
- Curve of initiation, deterioration, then failure… The work that Dr. fisher did for fatigue is very useful for bridge engineers. It would be nice to have something like that model that shows the numbers on the curve of initiation, deterioration, then failure to quantify the process.
    - That is being researched. The *fib* Commission 8 on Durability is developing a document for a mathematical model to estimate the corrosion propagation rate.

R19A Implementation Updates

- **Goals of Maine's R19A Participation –** presentation by Wayne Frankhauser/Maine DOT
  –
- **Goals of Pennsylvania's R19A Participation –** presentation by Tom Macioce/PennDOT
  - PennDOT's budget is $600 million for bridges for a year. Is that for preservation, rehabilitation, or replacement?
    - The funding is split between the three.
    - Breakdown?
        - In Pittsburgh Region we split it a 1/3 each.
  - Do you have a performance-based recommendation for concrete in your specifications?
    - No.
  - You reduced the cracking by tweaking the parameter in your specification?
    - Correct.
  - What was the issue with the adjacent box beam bridge that failed in Pennsylvania? Was there leaking between the adjacent section?
    - It was a strength failure. The bridge was hit multiple times. The bottom row strands were deteriorated and the row above was deteriorated but we could not see that.
  - How often do you have High Performance Concrete (HPC) cracks? How do you deal with them?
    - We have not done anything with the cracks so far. We are using Polyester Polymer Concrete (PPC) more now instead of HPC.
  - A recommendation to have less cracking in decks was to have no more silica fumes in decks. That has resulted in less cracking and cracks are much narrower.

- **Overview of Material Testing for Service Life Design –** presentation by Neil Cumming/COWI
  - Who provided the data for MMFX reinforcing steel?
    - Paul Tourney

- We had two projects at PennDOT. One used epoxy and the other used MMFX. No one bid on the project with MMFX because of the cost in comparison to epoxy.
- Also, the availability of MMFX can scare bidders off.

- **Pennsylvania's Concrete Durability Testing Program –** presentation by Clay Naito/Lehigh University
  - Did you include light weight concrete in your testing?
    - No.
  - Did you perform tests at 56 days at well as 28 days? Any correlation?
    - Migrations started to go up, but we did not get a lot of concrete for that test.
      - Wondered if there was any difference in migrations between 28-day and 56-days.
  - We do have numbers for rapid chloride with non-steady state migration.
  - How many years did this testing take?
    - There were two phases. Phase 1 was one construction season where we struggled to get concrete mix designs. Phase 2 was a second construction season, where we received concrete mix proportions from PennDOT projects.
  - What about the ageing coefficient in the analyses?
    - We followed what was done in SHRP2 and fib bulletin. A lot of the mixes had higher slag and were outside the range that was in fib 34. We don't have the data. Someone needs to provide us with testing data.

- **Group Discussion – Challenges of Durability Testing**
  - Lessons learned in Maine. When using corrosion inhibitors (DCI®) in Maine we've realized that it conflicts with the NT Build 492 test method, so we also performed the test for chloride diffusion (Salt Ponding). DCI® is in Maine's standard spec for all concrete. They double the dosage in salt water areas.
    - How does DCI® compare to corrosion inhibitors from Master Builders? Have you looked into that?
      - No.
  - One DOT did a study on five corrosion inhibitors. Have you looked into this?
    - Have not seen that study. Clay said he will try to find it to provide.
  - Neil proposed to the DOT's to really think about requiring measurement of concrete cover after the fact. We do not have any recognized standards on how to measure or what do with the results. Bulletin 34 gives you a standard deviation from concrete cover. As an example, a pier is constructed that show areas of low cover. In terms of analyzing that in respect to average and standard deviation in the model how do you analyze the pier. Things to think about when you're specifying measuring concrete cover.
    - When it came to the Tappan Zee Bridge if there was deficient cover (most frequently pier cap) we would look at area that showed most deficient. For example, top to bottom of the end of the pier cap.
  - Something to keep in mind is that if you implement this testing not everyone is going to know how to do it.
  - Any concerns on doing tests like this?
    - Tom said that the cost does not seem out of the ordinary.

    - You do not need to have your own lab. More and more commercial labs are available for testing. CTL, Siva, Vector Corrosion and WSP's lab in Vancouver are examples of these labs.

- **Maine's Forever Bridge – Beal's Island –** presentation by Wayne Frankhauser/Maine DOT & Bob Blunt/VHB
  - You used #18 stainless bars in the caissons. What size was the caisson?
    - 7'-6" diameter. Area of steel of about 1.2%.
    - There was no composite action research of the steel casing at the time, so we neglected the steel casing.
    - Single layer or double layer?
      - Single layer.
  - One issue when you get the data is what you do with it. When you get the chloride profile results are you going to adjust any of the plans?
    - If there is something favorably wrong, yes. It is already in construction. The data will be primarily used for future projects.
    - The idea is to get the surface chloride out of the data?
      - Yes
  - Do you set the performance requirement first and then do the test? What are the performance criteria based on?
    - No, we did not have enough data and did not have a basis to create a standard, so we held the contractor to our current standard.
  - At this time, is this kind of service life design a project specific approach?
    - Yes
    - What about the future?
      - You'll have to continue doing this analysis on a project specific basis.
- **R19A Participation from Other Agencies –** presentation by Mike Bartholomew/Jacobs
  - You mentioned that you are trying to come up with a recommended material spec that DOT's could use. Many producers really have to adjust the mix to get the chloride requirements to work in certain regions. Clay has found that many producers do very odd mixes to meet these requirements. If you come up with specific requirements some of the producers may stop providing because they can't meet the requirements.
    - We are trying to tighten up the requirements and the producers are going to have work with us.
  - It is going to be very difficult to achieve a specific performance specification because things and factors are consistently changing.
    - Pennsylvania seems to be variable, but all of the other states seem to be more consistent.
    - Timing is everything. Fly ash may be approved for use on a project, but six months later that source may run out of product.
    - Our goal is to recommend spec requirements to achieve more uniformity in the concrete to meet required durability parameters.
- **Group Discussion – Avoidance of Deterioration vs. Design Based on the Environment**
  - In all the superstructures it depends on what we are looking for and what factors we are faced with.

- Do you see any use with designing for the environment?
    - Maine is working on getting comfortable with the approach now. If they can use stainless-steel they will.
- If we are using stainless steel in the bridge deck, do we still need to use HPC? What should we specify in our performance spec?
    - HPC is mainly used to get the bridge constructed and in service quicker. It does not have much to do with the strength it creates with stainless steel.
- Has anybody heard anything about an upcoming AASHTO report regarding the use of less cover with stainless steel reinforcing?
    - Most participants were unsure about seeing that report from AASHTO but several thought that you do not need as much cover for stainless steel bars.
- We use lightweight concrete more and more because the bridge weight has become more of a restriction. Any data on lightweight concrete?
    - No, we have not seen any data on lightweight concrete's resistance to chlorides.
- It comes down to cost when applying SHRP2. Are there any recommendations coming out of this report on what we should do?
    - Oregon has the best recommendations on what to do on service life design in the future. The report is on our website.
    - Do Oregon recommendations include steel bridges?
        - No, it is primarily for concrete bridges.
- It is not just a cost analysis because the repair and rehab intervals that you face in the future are crucial. Taking a lane out of service on an interstate highway less often for repairs will save you money and that is something you need to take into consideration.
- A Life Cycle Cost Analysis report has been developed for the R19A project. It incorporates user costs and the compares different alternative design scenarios.
- It was additional $47,000 to treat one bridge with epoxy coating protection. (Louis from Pittsburgh).
- In Maine it was $6/square yard for abutments, piers, fascia's, and concrete wearing surfaces but used Silane.

Group Discussion Topics

- **Design Issues – How is concrete cracking taken into account?**
    - People say the *fib* Bulletin 34 methodology falls apart when you have cracking. You need to consider service life in conjunction with maintenance. Cracked density is important. The occurrence of cracking will not reduce the service life of bridge, but it will increase the amount of maintenance you have to perform on the bridge.
    - Cracking in concrete happens. We design for crack control and specify certain things to mitigate cracking in design phase. Then we build for crack control. Then we maintain for crack control.
    - Don't think you can numerically calculate the cracks.
    - Location and size of the crack determines how the crack will be handled. There's not a black and white way to handle cracks.
    - Dangerous territory in specifying a certain size of cracks that are allowable because factors vary.

- You have a normally cracked deck with epoxy coated bars. Is there a higher probability of failure at the crack or at the bars?
    - As long as the coating is still intact then there is no exposure to chloride.
- What is your opinion for galvanizing rebar?
    - The jury is still out on how effective it is. The preference varies. If the zinc coating is not there anymore then you have a dangerous situation because the corrosion cell will then burn through the zinc and bar.
- We have a steel girder bridge with a concrete deck that was constructed with 1/8" cracks. We eliminated joints and reviewed our design but were unable to determine what went wrong. Is there an opportunity to come look at our steel design and determine what was wrong?
    - There was probably a combination of multiple things to cause this to happen. Flexibility, thermal, curing…
- Maintaining a constant temperature for first 36 hours to 78 hours is extremely critical. Thermal protection is a critical factor.
    - How do you do that?
    - Blanket with heaters at the ends. Hang a tarp at bottom of girders and blow hot air.
    - There was good research done by Montana and Kansas DOT on deck cracking and how to prevent it.

- **Construction – How can we verify the durability properties specified in design are achieved during construction?**
    - Warranties…
    - Trial batches, pre-screening
    - QAQC plans, PCI manual has requirements.
        - I don't think they have anything about durability qualities.
    - Having to wait 28 days for NT build results is a concern. Sometimes by the time you get the testing results back, it is too late.
        - Quantify the loss and get some money back. But you may have to do something if it is way off.
    - There's not as much experience in the field anymore. Sometimes have to write things step by step for contractor with inspector being out there constantly.
        - Specify higher penalties.
        - Penalty plus mitigation.
    - Are you guys communication with ACI 211 on concrete mix designs?
        - Not that I am aware of.
            - We are using ACI 211 so any changes being made to concrete mix design need to be communicated with ACI 211.
                - Everything that we are doing is within the parameters of ACI 211.
    - Be aware that if you are operating in design build a lot of the verification that is in the design specs are being removed by the contractor in the design phase, so as owners you need to make sure that does not happen.
        - Make sure you write it into the RFP.

- **In-Service – How can a regular monitoring plan be implemented to verify that performance matches design intent?**
  - You're handing this over to the bridge inspector that has known nothing about what you have done in the past on the job.
  - It is easier to implement now that everything is electronic.
  - A lot of the old bridges we only have old plans or inspection reports. The bridge birth certificate needs to stay with the plans.
  - What is in the bridge birth certificate?
    - Documentation of what was designed, what was built, inspection monitoring reports
    - This is different than inspection though. You need to come up with a monitoring process.
  - Develop a plan for monitoring similar bridges. Only monitor 2 out of 20 of similar bridges…
  - How you capture it and how you store it. There isn't a national database. Tell us what you want captured and how often you want it captured and we will do it.
  - Isn't the Long-Term Bridge Performance (LTBP) program collecting this information?
    - Tom does not know what has happened to the information that they have provided them?
  - Wayne from Maine thinks that it would be easy to implement monitoring for the Beal's Island bridge.
  - What is the solution? If you determine that you are going to initiate corrosion in 5 years?
    - Chloride extraction. 5 years to get funding together. Sealers to deck, crack repair, joint repair, replacing the overlay.
  - Design builds have different criteria when it comes to monitoring. Most contractors will not do the required testing unless they are absolutely forced to do it.
  - What other states have implemented structural monitoring?
    - Pennsylvania does some tests every 6 weeks, others are 3 years.
    - They have a lot of data and aren't able to relate it to the capacity of the bridge.
    - Does the firm that is doing the work have a plan on what the data actually means?
      - The RFP asks for a monthly assessment, but they have not received what they wanted yet.
      - We want a comparison.
      - Part of the issue is that the engineering firm and the sub are not working well together. The data guy is not a bridge engineer and cannot organize the data the way they want.
      - Definitely have some challenges.
- **What organizational structures are required to successfully achieve longer lasting bridges?**
  - (Maine) It would be fairly easy for us to implement something like this because we are active in trying to work on this.
  - Some of the other states in other peer exchanges did not think that they would be able to implement things like this.
    - Probably due to upfront cost.

    - Some states can take funding they already have and allocate it to this. Other states would have to take it up with the state engineer to get funding.
- Do you see problems with finding someone with interest in doing this?
    - Finding someone that is interested in this is tough because it is foreign for most bridge engineers. Most people did not learn this in school. A lot of changes would need to be made and this is new to most people.
- Are we looking into life cycle analysis? Bridge preservation program? As opposed to service life design.
    - The people who lead this in New Jersey are technicians and engineers.
- What is the cost of doing the engineering work during design to do this activity? And also, during construction?
    - It would be good to have an idea of this.
    - Along with preservation, you have to monitor and do all the other things that you usually would need to do.
- Avoidance strategy does not work for everything on the bridge.
- Report needs to be put together by designer to specify mitigation.
- You need information in quantifiable terms.

Wrap Up and Adjourn

- **Additional Topics to Consider for Future Peer Exchanges**
    - Painting
    - Can you provide the agenda to give people an idea of what they are to expect?
        - It would be helpful to have the topics on the agenda ahead of time.
    - Conversation about existing non-destructive testing methods that are available. New technologies related to non-destructive methods.
    - Would like to see more about how to implement this into design and construction. There is a disconnect between design and construction. Come up with a method to combine the two.

Appendix A – Agenda

SHRP2 R19A Service Life Design for Bridges
Northeast Region Peer Exchange, December 13, 2018

Double Tree by Hilton Philadelphia Center City

Time	Topic	Speakers
8:30 – 8:50 am	**Welcome and SHRP2 Introduction** • AASHTO, FHWA & State Introduction (20 min)	Patricia Bush, AASHTO Raj Ailaney, FHWA Wayne Frankhauser, Maine DOT
8:50-10:15 am	**Service Life Design Concepts** • Introduction to Service Life Design (SLD) (30 min) • Implementing Service Life Design for Concrete Structures (30 min) • Group Discussion Topic – What does 100-yr SLD mean? (20 min)	Mike Bartholomew, Jacobs Neil Cumming, COWI All participants
10:15-10:30 am	**Break**	
10:30-12:00 am	**R19A Implementation Updates** • Goals of Maine's R19A Participation (10 min) • Goals of Pennsylvania's R19A Participation (10 min) • Overview of Material Testing for Service Life Design (25 min) • Pennsylvania's Concrete Durability Testing Program (25 min) • Group Discussion Topic – Challenges of Durability Testing (20 min)	Wayne Frankhauser, Maine DOT Tom Macioce, PennDOT Neil cumming, COWI Clay Naito, Lehigh University All participants
12:00-1:00 pm	**Lunch**	
1:00-2:30pm	**R19A Implementation Updates (continued)** • Maine's Forever Bridge – Beal's Island (45 min) • R19A Participation from Other Agencies (20 min) • Group Discussion Topic – Avoidance of Deterioration vs. Design Based on the Environment (25 min)	Bob Blunt, VHB Mike Bartholomew, Jacobs All participants
2:30-2:50 pm	**Break**	
2:50-4:30 pm	**Group Discussion Topics** • Design Issues – How is concrete cracking taken into account? • Construction – How can we verify the durability properties specified in design are achieved during construction? • In-Service – How can a regular monitoring plan be implemented to verify that performance matches design intent? • What Organizational Structures Are Required to Successfully Achieve Longer Lasting Bridges?	Mike Bartholomew, Jacobs - Facilitator All participants
4:30-5:00 pm	**Wrap Up & Adjourn** • Additional Topics to Consider for Future Peer Exchanges • Fill Out Evaluation Forms	Mike Bartholomew, Jacobs

Appendix B – List of Attendees

R19A North East Peer Exchange
Philadelphia, PA
December 13, 2019

	First	Last	Agency	Email
✓	Raj	Ailaney	FHWA	raj.ailaney@dot.gov
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Appendix C – Summary of Evaluations

What were the most important ideas you learned from the workshop?

Better understanding of chloride penetration models.
Concrete mix designs play a large role in life design.
Many ideas of how to improve concrete elements on a bridge.
Performance specifications/goals
Available tests to determine chloride concentration.
Durability properties and design versus construction
Good guidelines for quantifying service life
Model progress
Exposure to sources of information
Sharing of practices amongst states
Continue mitigation of all cracking

Are there questions or issues you wished the workshop had addressed that it didn't?

More about service life design for other bridge materials?
I would have liked to see more discussion on steel ideas (painting).
Lightweight concrete performance and testing?

Would you like to learn more about the SHRP2 *Service Life Design for Bridges* (R19A) product?

Yes
Keep the website up to date and current.
Hope the product will turn to AASHTO document for use (NCHRP – 108)

Please provide us with additional comments, feedback, or ideas related to this event or future SHRP2 events:

Rating	Subject knowledge level prior to workshop	Subject knowledge level after workshop	Knowledge of SHRP2 prior	Knowledge of SHRP2 after	Overal Content Effective	Presentation Effectiveness	Provided a better understanding of implementing	I understand how Service Life Design can benefit my agency	Encouraged Active Participation	Was worthwhile	Expectations Met	Presented clear information
1	1	0	3	0	0	0	0	0	0	0	0	0
2	0	0	1	0	0	0	0	0	0	0	0	0
3	3	0	2	0	0	0	0	0	0	0	0	0
4	2	0	1	0	0	0	0	0	0	0	0	0
5	1	2	1	2	0	0	1	1	1	1	0	0
6	4	1	2	2	1	1	0	1	0	1	2	2
7	1	4	3	2	3	3	3	2	3	3	3	3
8	2	3	1	4	5	5	6	5	5	3	4	4
9	0	4	0	4	4	3	2	4	3	4	5	3
10	0	0	0	0	1	2	2	1	2	2	0	2
strongly disagree (1-2)	1	0	4	0	0	0	0	0	0	0	0	0
moderately disagree (3-5)	6	2	4	2	0	0	1	1	1	1	0	0
moderately agree (6-8)	7	8	6	8	9	9	9	8	8	7	9	9
strongly agree (9-10)	0	4	0	4	5	5	4	5	5	6	5	5
sum	14	14	14	14	14	14	14	14	14	14	14	14
% strongly disagree	7%	0%	29%	0%	0%	0%	0%	0%	0%	0%	0%	0%
% moderately disagree	43%	14%	29%	14%	0%	0%	7%	7%	7%	7%	0%	0%
% moderately agree	50%	57%	43%	57%	64%	64%	64%	57%	57%	50%	64%	64%
% strongly agree	0%	29%	0%	29%	36%	36%	29%	36%	36%	43%	36%	36%