

From: noreply@wsu.edu
To: [curriculum.submit](#)
Subject: 722999 New or Restore Course: CE 520
Date: Monday, October 3, 2022 11:53:48 AM
Attachments: [2022.10.03.11.50.49.67.FormData.html](#)
[2022.10.03.11.50.46.41.currentFileUpload_CertificateCE520ResilientInfraEngRationale.pdf](#)

Xianming Shi has submitted a request for a major curricular change. His/her email address is: xianming.shi@wsu.edu.

Course Subject: CE

Course Number: 520

Title: Climate-Resilient Infrastructure Engineering
99

Total Credits:

Prerequisite: CE 317 or equivalent

Note proposed description:

Climate-Resilient Infrastructure Engineering 3 Techniques and current engineering practices related to climate change; engineering through life cycle of planning, designing, construction, maintenance, and operation activities. Recommended preparation: CE 317 or equivalent. Typically offered Fall. Cooperative: Open to UI degree-seeking students.

Catalog Description: 520 Climate-Resilient Infrastructure Engineering I 3 Overview of infrastructure systems & resilient infrastructure; Resilience definitions; Climate-resilient infrastructure; Risk assessment methods; Common hazards; Resilience quantification and evaluation system & frameworks; Planning for infrastructure resilience; Design, maintenance & operation for infrastructure resilience; Case studies. Part of the Pavement Durability & Sustainability Online Graduate Certificate Program. Cooperative: Open to UI degree-seeking students.

Grading Type: Letter graded A-F

Cooperative with UI: Yes

Requested Effective Date: Fall 2023

Dean: Krishnamoorthy, Siva - Assoc Dean - VCEA - UG

Chair: Xianming, Shi – Interim Chair – Civil and Environmental Engineering

UCORE Committee
Approval Date

All-University Writing
Com / Date

Catalog Subcommittee

AAC, PHSC, or GSC

Faculty Senate

From: [Shi, Xianming](#)
To: [curriculum.submit](#)
Cc: [Sivakumar, K.](#); [Bevenal, Haluk](#)
Subject: Re: 722999 New or Restore Course: CE 520
Date: Monday, October 3, 2022 11:59:34 AM
Attachments: [Outlook-Washington.png](#)

1. I approve this proposal in its current form.
As department chair.

Thank you,
Xianming



Xianming Shi, Ph.D., P.E., Professor, F. ASCE
Chair, Dept. Civil & Environmental Engineering
Editor-in-Chief, *Journal of Infrastructure Preservation & Resilience*
Director, Washington State Transportation Center (TRAC)
Washington State University
Sloan Hall 137, Pullman WA 99164-2910

Director, National Center for Transportation Infrastructure Durability and Life-Extension (TriDurLE)
Office: 509-335-7088; Xianming.Shi@wsu.edu
<https://TriDurLE.wsu.edu/>
<https://ce.wsu.edu/>
Go Cougs!

From: curriculum.submit@wsu.edu <curriculum.submit@wsu.edu>
Sent: Monday, October 3, 2022 11:50 AM
To: Shi, Xianming <xianming.shi@wsu.edu>
Cc: Sivakumar, K. <siva@wsu.edu>
Subject: 722999 New or Restore Course: CE 520

Xianming, Shi – Interim Chair – Civil and Environmental Engineering,
Krishnamoorthy, Siva - Assoc Dean - VCEA - UG,
Xianming Shi has submitted a request for a major curricular change.

Course Subject: CE

Course Number: 520

Title: Climate-Resilient Infrastructure Engineering
99

Total Credits:

Prerequisite: CE 317 or equivalent

Catalog Description: 520 Climate-Resilient Infrastructure Engineering I 3 Overview of infrastructure systems & resilient infrastructure; Resilience definitions; Climate-resilient infrastructure; Risk assessment methods; Common hazards; Resilience quantification and evaluation system & frameworks; Planning for infrastructure resilience; Design, maintenance & operation for infrastructure resilience; Case studies. Part of the Pavement Durability & Sustainability Online Graduate Certificate Program. Cooperative: Open to UI degree-seeking students.

Grading Type: Letter graded A-F

Cooperative with UI: Yes

Requested Effective Date: Fall 2023

From: [Beyenal, Haluk](#)
To: [Sivakumar, K.](#); [curriculum.submit](#)
Cc: [Shi, Xianming](#)
Subject: RE: 722999 New or Restore Course: CE 520
Date: Monday, October 3, 2022 2:01:24 PM
Attachments: [image001.png](#)
[image004.png](#)

I approve the course. However, the syllabus should be revised to reflect WSU requirements.
<https://syllabus.wsu.edu/required-syllabus-elements/>



HALUK BEYENAL

Professor
Associate Dean for Research and Graduate Studies
Associate editor: Frontiers – Microbiotechnology, Ecotoxicology and
Bioremediation. Editorial board: Scientific Reports, Biofouling
School of Chemical Engineering and Bioengineering
Voiland College of Engineering and Architecture
Washington State University
Office: 509-335-6607
Mobile: 509-592-7892
Email: beyenal@wsu.edu
<http://www.biofilms.wsu.edu/>

From: Sivakumar, K. <siva@wsu.edu>
Sent: Monday, October 3, 2022 1:59 PM
To: Beyenal, Haluk <beyenal@wsu.edu>
Cc: Shi, Xianming <xianming.shi@wsu.edu>
Subject: RE: 722999 New or Restore Course: CE 520

Haluk:

Could you please reply directly to curriculum.submit@wsu.edu with your approval (and copy Xianming).
Same for the other proposal.

Siva

From: Beyenal, Haluk <beyenal@wsu.edu>
Sent: Monday, October 3, 2022 1:41 PM
To: Sivakumar, K. <siva@wsu.edu>
Subject: RE: 722999 New or Restore Course: CE 520



Rationale for the Requested CE 520 New Course

This course titled “*Climate-Resilient Infrastructure Engineering*” was identified as a key course to be incorporated in the graduate certificate program of *Pavement Durability & Sustainability*. The certificate program will provide education and workforce development (E&WD) opportunities for practicing engineers and some on-campus graduate students, by specifically addressing a prioritized need identified by the Advisory Board members of the Department of Civil and Environmental Engineering (CEE) in a CY2021 survey. This program is designed to contribute to a skilled, diverse, informed and practice-ready transportation workforce, by offering mandatory and optional courses customized to bridge the gap between conventional CEE curriculum and emerging industry needs.

The objective of this course is to introduce to the practitioners the concept, techniques, and current engineering practices on infrastructure resilience related with climate change. Attendees will learn and understand the skills and techniques to manage the infrastructure resilience for the whole life cycle through planning, designing, construction, maintenance, and operation activities. Currently there is no such course addressing the emerging need identified by industry stakeholders. CE 520 will be a Global Campus course and the mode of delivery will be asynchronous, online instruction.

How this impacts other units in Pullman and other branches

This new course has been designed to supplement existing graduate courses in CEE department and should positively impact other units in Pullman and other branches. Specifically, practicing engineers and graduate students with their concentration area in transportation engineering and structural engineering may be the main audience. This course will be offered remotely for online access; as such it would benefit other WSU branches as well.

Department of Civil and Environmental Engineering



Course Logistics	
Semester, Year	Summer, 2023
Class Number:	CE 520
Course Title	Climate-resilient Infrastructure Engineering
Catalog Description	The objective of this course is to introduce to the practitioners the concept, techniques, and current engineering practices on infrastructure resilience related with climate changes. Attendees will learn and understand the skills and techniques to manage the infrastructure resilience for the whole life cycle through planning, designing, construction, maintenance, and operation activities.
Credits	3
Prerequisites	None
Meeting Location	Zoom meeting
Meeting Days and Times	To be determined (TBD)
Class Time	Two 75-minute lectures per week, WSU Canvas
Development:	Dr. Haifeng Wang, 716-507-7157, haifeng.wang@wsu.edu Dr. Jiguang Zhao, 971-382-6905, jiguang.zhao@wsu.edu
Instructor Information	
Name	Jiguang Zhao
Office Location	N/A
Contact Info	Jiguang Zhao, Jiguang.zhao@wsu.edu , 971-382-6905
Office hours	TBD
Instructor Information	
Name	Haifeng Wang
Office Location	PACCAR 154
Contact Info	haifeng.wang@wsu.edu , 509-335-2829
Office hours	TBD

Teaching Assistant(s) Information	
Name	TBD
Office Location	TBD
Contact Info	TBD (Phone and email)
Office hours	TBD
Required Materials and Course Fees	
Textbooks	N/A
Other Materials	Reading materials will be provided before the start of each new topic/module and posted on the WSU online teaching platform.
Fees	None
Student Learning Outcomes and Assessment	
Learning outcomes	<ul style="list-style-type: none"> • Understand concepts of climate change, natural hazard modeling and their interactions with critical infrastructure; • Familiar with infrastructure resilience assessment with qualitative and quantitative method; • Be familiar with the basic procedures for infrastructure resilience planning; • Understand the major steps for transportation infrastructure resilience assessment; • Know how to select appropriate design strategies for improving infrastructure resilience; • Learn the economics and policy related with infrastructure resilience engineering; • Understand how to incorporate infrastructure resilience engineering principles into project management.
Assessment	Student learning outcomes will be assessed through homework, exams, and final report.
Expectations for Student Effort	
	Students should expect to spend a minimum of 9 hours per week for each online 3-credit course, be engaged in the following types of activities: reading, listening to/viewing media, discussion, or conversation in the Learning Management Systems (LMS) or other academic technology, conducting research, completing assignments and reviewing instructor feedback, studying for and completing assessments.
Course Timeline	
	See the class schedule file.
Assignments, Assessments, and Grading Policy	
Homework	One homework will be assigned weekly to reinforce students' understanding of the ideas and concepts being learned. The homework will be in the form of quizzes or reading reports for given reading material.

	<ol style="list-style-type: none"> 1. Late homework (up to 24 hours) will receive a 20% late penalty and must be submitted directly to the instructor. 2. Assignments must be submitted in PDF format. A cover page must accompany each assignment. Figures must be drawn clearly. 3. Each homework assignment should be treated as a professional document. Be proud of the way it looks while knowing that the calculations are as accurate as possible. Remember that engineers must maintain very high standards in the quality of their work. 4. Students are expected to do all homework individually although general discussion of concepts amongst peers is encouraged. At the end of each homework assignment please write "I certify that the work submitted is my own" then sign. Students who are caught copying from others or the internet will receive 0 for the entire homework component of the grade. 5. Graded homework will be returned during the lecture period. All homework assignments will be used in calculating the final grade. Individual arrangements will be made with students who have documented, legitimate absences which prevent them from submitting their homework on time such as an illness requiring a doctor's visit, an automobile accident, a family emergency, jury duty, participation in a sanctioned university activity, etc.
<p>Midterm and Final Exam</p>	<p>Midterm and Final Exam: All exams must be taken at the announced time. In case of an emergency (such as being hospitalized), the instructor should be notified as soon as possible. A student who misses an exam without a legitimate excuse and/or prior approval of the instructor will receive zero for that exam. Students with a legitimate excuse provided in writing and/or prior approval of the instructor will be given a make-up exam.</p> <p>Midterm:</p> <p>There will be an in-class midterm exam.</p> <p>Final:</p> <p>There will be a 3-hour final exam.</p> <p>Both midterm and final exams will be composed of: single/multiple choice questions and short answer questions. The exam questions are related to the learning objectives. Specifically, questions related to natural hazard, infrastructure resilience planning, assessment, and design strategy will be included in the exam questions. The exams will be graded based on the students' performance.</p>

Grading Policy	Students are responsible for checking the accuracy of their grades. If a grade is missing or incorrect, notify the instructor at your first convenience (note that the graded assignment must be provided to prove a grading error). Final course grade shall be determined as follows:		
	Homework	45%	
	Midterm Exam	15%	
	Final Exam	30%	
	Final Report	10%	
	Students' grades will be determined as follows:		
		A: > 91	A-: 87 to 90.9
	B+: 83 to 86.9	B: 79 to 82.9	B-: 75 to 78.9
	C+: 71 to 74.9	C: 67 to 70.9	C-: 63 to 66.9
	D+: 59 to 62.9 D+	D: 55 to 58.9	F: < 55
Attendance and Make-up Policy			
Attendance Policy	Students should make all reasonable efforts to attend all class meetings. However, in the event a student is unable to attend a class, it is the responsibility of the student to inform the instructor as soon as possible, explain the reason for the absence (and provide documentation, if appropriate), and make up class work missed within a reasonable amount of time, if allowed. Missing class meetings may result in reducing the overall grade in the class		
Make-up Exams Policy	A student who misses an exam without a legitimate excuse and/or prior approval of the instructor will receive zero for that exam. Students with a legitimate excuse provided in writing and/or prior approval of the instructor will be given a make-up exam.		
Academic Integrity Statement			
	<p>All members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Students are responsible for understanding the full <u>Academic Integrity Statement</u>. Students who violate WSU's Academic Integrity Policy (identified in WAC 504-26-010(3) and -404) will:</p> <ul style="list-style-type: none"> • Fail the course. • Be reported to the Center for Community Standards. • Have the right to appeal my decision. • Not be able to drop the course or withdraw from the course until the appeals process is finished. <p>If you have any questions about what is and is not allowed in this course, ask your course instructor.</p>		
WSU Reasonable Accommodation Statement			
	Reasonable accommodations are available for students with documented disabilities or chronic medical or psychological conditions. If you have such a condition and need accommodations to fully participate in this		

	<p>class, please visit your campus' Access Center/Services website to follow published procedures to request accommodations. Students may also contact their campus offices to schedule an appointment with an Access Advisor. All disability related accommodations are to be approved through the Access Center/Services on your campus. It is a university expectation that students connect with instructors (via email, Zoom, or in person) to discuss logistics within two weeks after they have officially requested their accommodations.</p> <p>For more information, contact an Access Advisor on your home campus:</p> <ul style="list-style-type: none"> • <u>Pullman, WSU Global Campus, Everett, Bremerton, and Puyallup Access Center: 509-335-3417 or email access.center@wsu.edu</u> • <u>Spokane Access Services: email spokane.access@wsu.edu</u> • <u>Tri-Cities Access Services: email tricities.AccessServices@wsu.edu</u> • <u>Vancouver Access Center: 360-546-9739 or email van.access.center@wsu.edu</u>
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Accommodation for Religious Observances or Activities

	<p>Washington State University reasonably accommodates absences allowing for students to take holidays for reasons of faith or conscience or organized activities conducted under the auspices of a religious denomination, church, or religious organization. Reasonable accommodation requires the student to coordinate with the instructor on scheduling examinations or other activities necessary for course completion. Students requesting accommodation must provide written notification within the first two weeks of the beginning of the course and include specific dates for absences. Approved accommodations for absences will not adversely impact student grades. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence. Students who feel they have been treated unfairly in terms of this accommodation may refer to Academic Regulation 104 – Academic Complaint Procedures. See also Rule 82, available at https://registrar.wsu.edu/academic-regulations.</p>
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Discrimination and Harassment Policy Statement

	<p>Discrimination, including discriminatory harassment, sexual harassment, and sexual misconduct (including stalking, intimate partner violence, and sexual violence) is prohibited at WSU (See <u>WSU Policy Prohibiting Discrimination and Harassment</u> (Executive Policy 15) and <u>WSU Standards of Conduct for Students</u>). If you feel you have experienced or have witnessed discriminatory conduct, you can contact the WSU</p>
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	<p>Compliance & Civil Rights (CCR) and/or the <u>WSU Title IX Coordinator</u> at 509-335-8288 to discuss resources, including confidential resources, and reporting options. (Visit <u>ccr.wsu.edu</u> for more information). Most WSU employees, including faculty, who have information regarding sexual harassment or sexual misconduct are required to report the information to CCR or a designated Title IX Coordinator or Liaison. (Visit <u>ccr.wsu.edu/reporting-requirements</u> for more info).</p>
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<p>Lauren’s Promise</p>	
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	<p><i>Lauren’s Promise – I will listen and believe you if someone is threatening you.</i></p> <p>Lauren McCluskey, a 21-year-old honors student athlete, was murdered on Oct. 22, 2018, on the University of Utah campus by a man she briefly dated. <i>We must all take actions to ensure that this never happens again.</i></p> <p><u>University Support and Response for Discrimination and Harassment</u></p> <p>Discrimination, discriminatory harassment, sexual harassment, and sexual misconduct (including stalking, intimate partner violence, and sexual violence) are prohibited at WSU (see Executive Policy 15 – <u>WSU Policy Prohibiting Discrimination and Harassment</u>, the <u>WSU Standards of Conduct for Students</u>, and relevant employee manuals). WSU has instituted procedures to respond to violations of these laws and standards, programs aimed at the prevention of such conduct, and intervention on behalf of victims.</p> <p>If you are in immediate danger, call 911.</p> <p>If you are experiencing sexual assault, domestic violence, stalking, discrimination or harassment, you have support and options. If you share information with me, please know that I am required to reach out to the Title IX Coordinator in WSU Compliance and Civil Rights (CCR), and CCR will reach out to you with information about on and off campus reporting options and resources. CCR is a system-wide resource (all campuses) which is available for intake consultations for you to learn more about available support. You can reach them directly at 509-335-8288, <u>ccr@wsu.edu</u>, or <u>report online</u> (anonymous reports accepted).</p> <p>You can also speak to a victim advocate, a medical provider, or counselor <u>confidentially</u> about your concerns. Advocates help survivors of crime determine their own needs in regards to their physical and emotional health, reporting options, and academic concerns. At no cost, advocates connect survivors to campus and community services, and provide accompaniment to important appointments (court, hospital, and police) and support throughout the process. For a list of confidential victim advocates and medical providers, please visit <u>CCR Resources</u>.</p>
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	<p>WSU Police Department (WSU PD) officers and campus security will treat victims of sexual assault, domestic violence, stalking, hate crimes, and other crimes with respect and dignity. WSU PD, campus security departments, CCR, and victim advocates can also help you with safety planning.</p>
<p>Safety and Emergency Notification</p>	
	<p>Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the “Alert, Assess, Act,” protocol for all types of emergencies and the “<u>Run, Hide, Fight</u>” response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able).</p> <p>Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBI’s <u>Run, Hide, Fight video</u> and visit the <u>WSU safety portal</u>.</p> <p>Full details can be found at https://provost.wsu.edu/classroom-safety/</p>

Class Schedule

Lecture	Week	Topic
1	1	I.1 Overview of infrastructure systems and resilient infrastructure (Wang, working)
2	1	I.2 Resilience and recovery curve (Wang, done)
3	1	I.3 Climate change and climate-resilient infrastructure (Wang, done)
4	2	II.1 Risk assessment methods - (part 1, theoretical background) (Wang, done)
5	2	II.2 Risk assessment methods - (Part 2, practical tools) (Wang, done)
6	3	II.3 Wind hazard, flooding, and sea level rise (Wang, Done)
7	3	II.4 Fire, extreme heat, and other hazards (Wang, Done)
8	3	III.1 Resilience quantification and evaluation system/frameworks (part 1) (Wang,done)
9	4	III.2 Resilience quantification and evaluation system/frameworks (part 2) (Wang, working)
10	4	III.3 Single component/structure resilience assessment (Wang, working)
11	4	III.4 Network and regional resilience assessment (Wang, working)
12	5	III.5 Case study: Transportation infrastructure resilience evaluation (Wang, working)
13	5	III.6 Guest lecture 1: Resilience to wind for communication/transmission system (Liyang Ma, Scheduled)
14	5	Midterm exam
15	6	III.7 Guest lecture 2: Resilience to hurricane for transportation system (Shaopeng Li, Scheduled)
16	6	Planning for infrastructure resilience (Zhao, completed)
17	7	Building strategies for infrastructure resilience (Zhao, completed)
18	7	Transportation infrastructure vulnerability assessment (Zhao, completed)
19	7	Climate change and pavement flooding risk assessment (Zhao, completed)
20	8	Pavement design for climate change (Zhao, completed)
21	8	Hydrologic Design of Transportation Infrastructure for Climate Change (part 1) (Zhao, completed)
22	8	Hydrologic Design of Transportation Infrastructure for Climate Change (part 2) (Zhao, completed)
23	9	Transportation infrastructure operation and maintenance for resilience (Zhao, completed)
24	9	Tampa Transportation System Resilience Assessment (Zhao, completed)
25	9	San Francisco Transportation Vulnerability and Risk Assessment (Zhao, completed)
26	10	Resilient infrastructure investment and financing (Zhao, completed)
27	10	Guest Lecture 3 (Zhao, under development)
28	11	Policy on climate-resilient infrastructure (Zhao, completed)
29	11	Recent research on climate-resilient infrastructure (Zhao, completed)
30	11	Review for final exams (Zhao, under development)