Idaho State University

Disaster Response Complex

College of Science and Engineering

Department of Civil and Environmental Engineering

IGEM20-001

A Disaster Response Complex for Emergency Responders in Idaho

1st Year Annual Report

July 1, 2019 – August 31, 2020

August 31, 2020

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1.0 Basic Project Information

Funding Agency

Higher Education Research Council - Idaho Global Entrepreneurial Mission Program

Awarded Institution

Idaho State University, College of Science and Engineering, Department of Civil and Environmental Engineering

Grant Number

IGEM20-001

Project Title

A Disaster Response Complex for Emergency Responders in Idaho

Principal Investigator

Mustafa Mashal, Ph.D., P.E., Associate Professor

Co-Principal Investigator

Bruce Savage, Ph.D., P.E., Professor and Department Chair

Report Type

1st Year Annual Report: July 1, 2019 – August 31, 2020

2.0 Executive Summary

In the post 9/11 years, the national demand for training of emergency responders from the military and law enforcement branches has grown rapidly. There is a higher demand for emergency training of emergency responders than the current facilities can support. Recently, researchers at Idaho State University were awarded funding from the State of Idaho under HERC-IGEM grant. The focus of the project is the development of a Disaster Response Complex (DRC) for research, certification, and training of emergency responders in collaboration with the Directorate of National & Homeland Security at the Idaho National Laboratory (INL), and the Center for Advanced Energy Studies (CAES). The DRC has three pillars: 1) research, 2) curriculum and certification, and 3) training. All three pillars include the development of new indoor and outdoor complexes with training lanes/simulations to be used in both research, teaching, and training of emergency responders and the instrumentation of a collapsed structure. The training lanes will be used in combination with Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) surrogates/markers, the use of robots/small Unmanned Aerial Vehicle (sUAV), Virtual Reality (VR), Augmented Reality (AR), Geographic Information System (ArcGIS), Light Detection and Ranging (LiDAR), and Radio-Frequency Identification (RFID). The curriculum pillar includes offering courses in topics such as emergency response, gamma/chem spectroscopy, and safety culture. For the training pillar, the facility can be used to host events for clients such as the Department of Defense (DoD) CBRNE Response Enterprise (CRE) customers, military personnel, Idaho National Guard, and law enforcement agencies/fire departments from Idaho and the region. It is expected that the DRC will be a comprehensive facility that will incorporate natural (earthquakes, hurricanes, flooding) and man-made hazards in the training of emergency responders.

3.0 Summary of Project Accomplishments

This is the first annual report for the project. The first-year budget for the project was $525,100, which has been expended to the full amount. The formal project award letter from the Idaho State Board of Education (SBOE) was received on August 7, 2019. Given the COVID-19 situation and the lockdown, there were delays in the project. The project personnel would like to thank the Idaho State Board of Education for offering a no-cost two months extension for the first year of the project. This helped the personnel to accomplish more tasks for the project and use the first-year funding to the full benefit. Despite the pandemic and the lockdown in Idaho, the project personnel made substantial progress in the first year toward all three pillars of the DRC as described below. In addition, in line with ISU's branding, logos for the DRC were created. A website is also almost ready to be launched.

A. Research Pillar

Efforts in the research pillar were primarily focused on the use of robotics, AR, VR, Arc GIS, LiDAR, and RFID. Other research areas such as markers/surrogates for CBRNE training were also discussed with researchers from INL and ISU. Updates in each area of the research pillar are outlined as follows.

- Robotics: ISU researchers have discussed ideas with collaborators from Idaho National Laboratory (INL). INL has good capabilities, facilities and experts in robotics. Through the discussions, an ISU graduate student was identified and assigned to work with the INL group. The student has been focusing on the research aspect of the DRC and will be jointly supervised by senior researchers from ISU and INL. The graduate student (PhD level), collaborators from INL, academic advisor and supervisor from ISU have been identified. The student's paperwork was processed for access to labs and facilities at INL. The student will be working on adding capabilities to an existing INL's robot (e.g. enhancement for end of arm tooling and attachment of sensors/camera) to enhance its performance for disaster response. The student has also made the use of robotics in disaster response as the topic of his PhD dissertation at Idaho State University.
- AR/VR: ISU has partnered with INL researchers to develop a concept paper for the use of new technologies in disaster response and training. CAES provided $24,700 in funding for INL

researchers to develop the concept paper in collaboration with ISU researchers. Two ISU students have been working under the supervision of the INL researchers on this aspect of the project. The researchers from ISU and INL have been holding regular weekly meetings to discuss the elements and progress of the concept paper. The AR/VR is an emerging area of research interest to many public and private institutions, especially during a pandemic when travel is limited. The project personnel discussed the use of AR/VR for the training of emergency responders with the United States Northern Command, Defense Nuclear Weapons School, and other partners. There is a growing interest in this area and ISU/INL are actively looking for research and funding opportunities.

- Arc GIS and LiDAR: the outdoor collapsed structure is planned to be surveyed and shot by LiDAR during different construction stages. Results will be used for the AR/VR aspect of the project.
- RFID: a faculty with expertise in Electrical Engineering at ISU has been collaborating with the project personnel on the use of RFID in civil engineering applications. The internal seed grant was provided by the College of Science and Engineering at ISU to obtain preliminary results for the use of RFID and its accuracy. Although the seed grant is geared toward the application of RFID in the handling of precast concrete components, the results from the research will provide valuable insight if RFID can be used in the instrumentation of a collapsed structure or rubble pile. Based on the preliminary results, the researchers at ISU are interested to explore the application of RFID technology in disaster response.
- CBRNE: several meetings were held at the CAES between ISU and INL researchers. The meetings were focused on the development of chemical and biological markers. Collaborators from INL are well-established in the radiological and nuclear detection areas. Available opportunities for research in the development of markers/surrogates from agencies such as the Defense Threat Reduction Agency (DTRA) were discussed. This effort is continuing.
- Other technologies such as the use of sUAV have also been considered for applications in disaster response. INL has good capabilities in sUAV. In addition, the project personnel have discussed collaborating with the College of Technology at ISU, which has several sUAVs; some equipped with LiDAR.
- A journal paper titled “A Disaster Response Complex for Training of First Responders in Idaho” was prepared for submission to “Countering WMD Journal” which is published by the United States Army Nuclear and Countering WMD Agency.
- A graduate student attended the 9th Annual Energy Policy Research Conference in Boise, Idaho in September 2019. The student participated in the discussions and presented a poster from the project.
    - D. Garz, J. Cantrell, K. Hogarth, M. Mashal, and B. Savage (2019). A Disaster Response Complex for Training of First Responders in Idaho, 9th Annual Energy Policy Research Conference, Boise, ID, United States.
- The project PI (Dr. Mashal) attended the Winter Collaboration Meeting at CAES, January 23-24, 2020. The meeting was attended by many researchers from the Idaho National Laboratory, MIT, North Carolina State, and other universities.
    - Dr. Mashal had a presentation on “A Disaster Response Complex (DRC) for Training of Emergency Responders in Idaho”.
    - Three students attended the meeting and presented a poster.
        - J. Cantrell, D. Garz, U.S. Medasetti. M. Mashal, and B. Savage (2020). “A Disaster Response Complex for Research, Curriculum, and Training of First Responders”, CAES Winter Collaboration Meeting, Idaho Falls, ID, United States.

- An abstract from the DRC project was submitted for oral presentation at the 2020 American Society of Civil Engineers Southern Idaho Section "Civil Engineering Conference". The abstract was accepted for presentation, unfortunately, the conference was canceled due to the pandemic.
- An abstract from the DRC project was submitted for poster presentation at the 62nd Annual Meeting and Symposium of the Idaho Academy of Science and Engineering, April 11, 2020, Coeur d'Alene, Idaho. The conference was canceled due to the pandemic.
- The project personnel explored several grants from the Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA), and the National Institute of Standards and Technology (NIST) for the DRC. A number of collaborators from ISU's Public Safety, Emergency Management, Emergency Services Department, and GIS Center were identified to pursue upcoming funding opportunity announcements in various topics under the DRC.
- CAES nominated the DRC as the CAES project for the Leadership in Nuclear energy Commission (LINE). The LINE Commission makes recommendations to the Governor on policies and actions of the State of Idaho to support and enhance the long-term viability and mission of the Idaho National Laboratory and other nuclear industries in Idaho. The Idaho LINE commission is looking to receive some recognition from the Governor for fostering research across the state.
- The project PI (Dr. Mashal) was nominated for the CAES Fellows Initiative, primarily for his work on the DRC project. The CAES Fellows initiative provides recognition and opportunities to university faculty, INL researchers, and staff who serve as leaders in the collaborative CAES community. The program incentivizes greater participation and collaboration by the community at large and serves as a vehicle to strengthen the CAES brand and identity. The CAES Fellows Initiative provides recognition, resources, and opportunities to a diverse cohort of academic faculty, INL researchers, and staff who are recognized and engaged leaders in the CAES community, active in a CAES focus area, and share the inter-institutional collaborative spirit that embodies CAES. In June 2020, CAES selected Dr. Mashal as one of six new CAES fellows. The six members of this diverse group — including a researcher with the U.S. Department of Energy's Idaho National Laboratory and faculty members from Boise State University, ISU and University of Wyoming — demonstrated extensive engagement in the CAES community, collaborating with partners at INL and the CAES universities in at least one of the focus areas outlined in the CAES strategy. Dr. Mashal was offered supplemental funding and opportunities by ISU toward the DRC project. These include:
    - ISU-CAES funds provided $16,000 to the project personnel toward setting up a small "Visualization Laboratory" in the Department of Civil and Environmental Engineering.
    - ISU-CAES funds provided Dr. Mashal with approximately $10,800 to engage ISU students in the DRC project and have them being co-supervised by the INL researchers.
    - ISU Research Office provided Dr. Mashal with $225,000 in funding toward materials and supplies, and building infrastructure. A part of this funding (approximately $30,000) was spent toward construction of the DRC outdoor training campus.
- Numerous meetings and tours of the DRC were held to discuss research collaboration with INL, CAES, ISU, law enforcement, office of emergency management, local fire departments, and private industry.

B. Curriculum and Certification Pillar

- On the curriculum side, the project personnel and INL researchers/instructors have been holding regular weekly meetings to develop a four-day long class in advanced gamma spectroscopy. A course description was prepared. The course content is geared toward the science officers from the

military. The content of the course has been discussed with military officers from the United States Northern Command and the Defense Nuclear Weapons School.

- In partnership with Battelle Energy Alliance (BEA) and CAES, Idaho State University hosted the Laboratory Operations Supervisor Academy (LOSA) at no cost to 30 participating faculty, staff and students. LOSA is a prestigious training program developed by BEA, the operating contractor for INL and several other national labs for the Department of Energy. This half-day training discussed principles for the Safe Conduct of Research (SCoR) and utilized simulations and scenarios to demonstrate and build a lab safety culture. The Project PI (Dr. Mashal) and Project Manager (Jared Cantrell) offered this training at ISU. The LOSA Pilot training was sponsored by BEA for nearly $14,000. The project personnel have plans to expand LOSA for other faculty, staff, and students at ISU and make it a class under the DRC for the upcoming semesters.

- The project personnel have had discussions and tours of the outdoor DRC with potential instructors/partners to develop curriculum for emergency responders in the military, law enforcement, emergency management, and local fire departments. This is an on-going activity and with the projected completion of the training lanes in the outdoor DRC later in 2020, it is forecasted to gain more momentum. Given the current pandemic situation and travel restrictions, the project personnel are targeting participants from the local and regional level at this point. The project personnel have invited a couple of private industries to actively participate in the curriculum development for the DRC. The response from the private industry has been very positive so far. The project personnel are planning to reach out to potential instructors and form an "Advisory Committee" for the curriculum pillar of the DRC. The Advisory Committee will include experts from local fire departments, public institutions, law enforcement, state employees, and INL.

C. Training and Exercise Pillar

- This pillar includes the design and construction of an outdoor collapsed structure. The original footprint of the collapsed structure was 200 ft x 200 ft, the total area of the outdoor training and exercise facility was about 1-acre. The collapsed structure would house several training lanes such as subterranean, car-rescue, and shoring with possibilities for future expansion. Before starting construction, ISU held several meetings with potential users from the Idaho National Guard, Idaho National Laboratory, Idaho Office of Emergency Response, and local fire departments to gather their input/feedback for the outdoor facility and the training lanes. Based on the feedback of the potential users, the Idaho National Guard suggested enlarging the size of the overall facility to about 3-acres to accommodate Homeland Response Force (HRF) training sessions which typically can have between 500-800 responders training at once. The Civil Support Teams (CST) units are smaller (e.g. 22 responders) compared to HRF, but they hold more frequent training sessions (e.g. 12 times per year). The Idaho National Guard also indicated a desire for adding another training lane for high-angle rope rescue. It should be noted that the outdoor facility is planned to be utilized toward all three pillars of the DRC. The aforementioned stakeholders shared their needs for a training complex such as the DRC. They also provided ISU with information on the upcoming major training and exercise such as the Cascadia Rising 2022 in Idaho and the Wasatch Quake 2021 exercise in Utah. The contact at the Idaho National Guard, who is the Director of Joint Plans and Training, has shared the information about the ISU's DRC with the National Guard units in the states surrounding Idaho. He stated that the DRC at ISU "is a unique opportunity that, with some thought and input, the National Guard can leverage and fill a gap in available high-quality training sites in the western US without expending DoD funding".

- The project personnel worked with ISU's facilities to find a suitable location on the campus for the development of the outdoor facility. The unoccupied land behind the Idaho Accelerator Center (IAC) in Pocatello (Figure 1) was deemed suitable for the outdoor facility. The site had uneven

slopes with a pile of yard waste in the center. Soil composition is mostly silty sand with potential for erosion. A full engineering investigation of the site was carried out prior to breaking ground.

Figure 1. Location of the outdoor training facility for the DRC project

- In the first half of the year, the project personnel carried out the following tasks:
  - Surveyed the site (Figure 2).
  - Collected soil samples (Figure 3) from four test pits.
  - Performed lab tests on the soil samples to determine mechanical properties for cut and fill.
  - Developed cut and fill drawings and data (Figure 4).
  - Worked with ISU's Facilities to obtain the required work permits and identify the contractor (Starr Corp) for the earth work.
  - Developed the scope of work for Phase I of the construction that included obtaining DBS/erosion permits, obtaining estimates for construction, selecting the contractor, relocating all existing soil materials on site, moving, spraying, and compacting the existing bark and brush pile to help cover the exposed soil.
  - ISU Facilities subcontracted some design aspects such as "Erosion Control" to private firms and obtained all necessary permits for earth work from the City of Pocatello.
  - Held conversations and visited Teton Prestress Concrete in Idaho Falls (Figure 5), Oldcastle Infrastructure in Idaho Falls and Ogden, and Forterra Structural Precast in Salt Lake City (Figure 6) to obtain rubble and concrete sections for construction of the collapsed structure and the training lanes.
  - Visited several suppliers of heavy equipment in Montana and Utah to identify appropriate heavy equipment for purchase.

- Purchased heavy equipment that included a telehandler and backhoe (Figure 7). This equipment will be used to build basic training lanes, maintain the outdoor facility, and add new lanes based on the training scenarios and the client's need.
- Despite the frozen ground, ground was broken on Monday, Dec 30, 2019 (Figures 8-9).

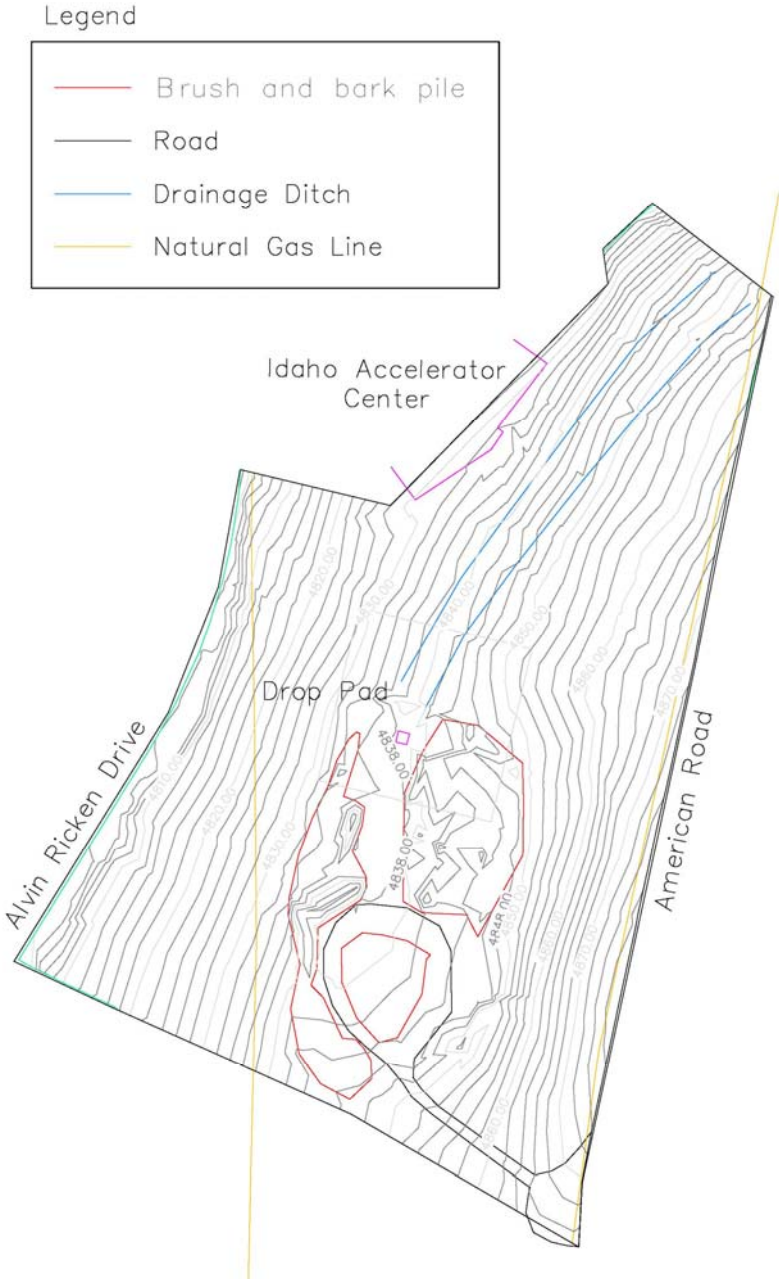


Figure 2. Surveying map of the outdoor training facility, surveyed in October 2019

Figure 3. Test pits for soil sampling

Figure 4. Cut and Fill plan of the outdoor training facility

Figure 5. Precast concrete waste pile at Teton Prestress Concrete in Idaho Falls

Figure 6. Precast concrete waste pile at Forterra Structural Precast Concrete in Salt Lake City

Figure 7. Heavy equipment for the maintenance of the outdoor training facility

Figure 8. Panoramic view of the outdoor training facility location before the start of ground preparation

Figure 9. Ground breaking on December 30, 2019

- In the second half of the year, despite the COVID 19 and lockdown restriction, the project personnel were able to work on the following tasks:
    - Completed construction of an approximately 2.5-acre compacted gravel base pad with eight inches of pit-run gravel topped with four inches of ¾ inch road mix. This created a year-round accessible area for training and exercises (Figure 10f).
    - Construction of a short gravel road to the facility and a perimeter fence with main entrance and pedestrian gates (Figures 10a-b).
    - Transported hundreds of tons of concrete sections from Idaho Falls and Ogden to the DRC site (Figures 10c-d). Prepared an inventory of all sections on-site for future use.
    - Purchased and transferred multiple conex boxes and various materials and supplies that will be used for outdoor and indoor training lanes (Figure 10e).
    - Carried out cost estimate, design, and drawings for the three basic lanes (Figure 11).
    - Completed construction of a complex subterranean lane (Figures 12-13).
    - Purchased a pick-up truck and 10-kip forklift for the DRC project.
    - Hosted visits and open houses during construction of the facility to gather more feedback from the potential users which included Public Safety, Emergency Management from ISU, Idaho State Police, Idaho Falls Fire Department, Pocatello Fire Department, Office of Emergency Management, Pocatello Police Department, INL, Department of Energy, Idaho National Guard, Idaho Civil Support Team, INL Oversight Program, and many others from public/private entities (Figure 14).
    - In addition to the outdoor training facility, the project personnel worked with ISU's Facilities to identify an appropriate indoor space for year-round training. After considering several options, the Armory Building (Figure 15) was selected. This selection was based on the feedback from INL, Idaho National Guard, and other clients. The Armory Building was an ideal place for smaller-scale training and offering special focused courses. The Armory Building was built in 1939 and originally housed the National Guard Armory. It was subsequently used by ISU for the Diesel Technology program. With the move of the Diesel Technology program in August 2020 to another location on campus, the Armory Building will be re-purposed to be used toward serving the National Guard units again. The building has a high-bay area as well as classrooms and vaults. ISU's Facilities worked diligently with relevant state entities to transfer this building to the DRC. The building is suitable for the expected activities without any major improvements. Together with the outdoor facility, the Armory building will provide substantial support for all three pillars of the DRC. The project personnel have prepared extensive designs and drawings for the

indoor facility, which will house a mock-up city block for indoor training scenarios (Figure 16).

(a) Perimeter fence under construction

(b) Gravel road to the entrance

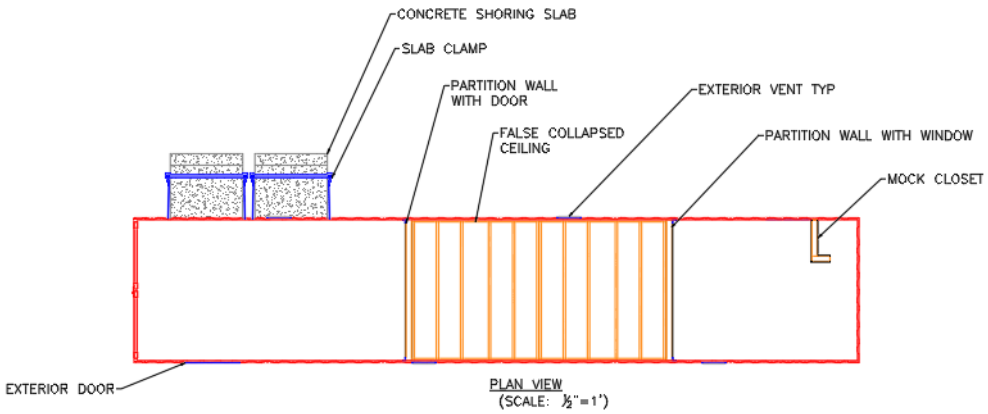
(c) Transfer of precast concrete sections

(d) Precast concrete sections for training lanes

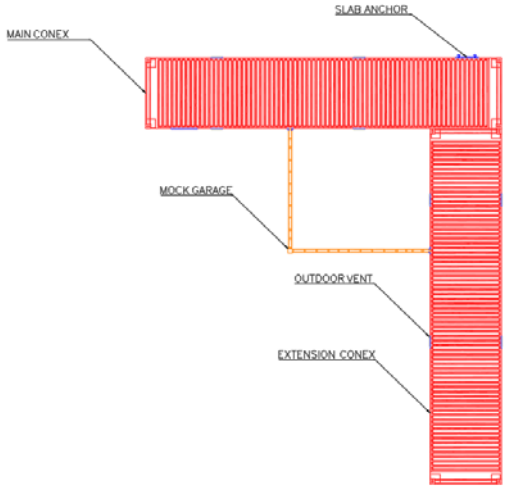
(e) Conex boxes and heavy equipment

(f) Gravel pad for staging area

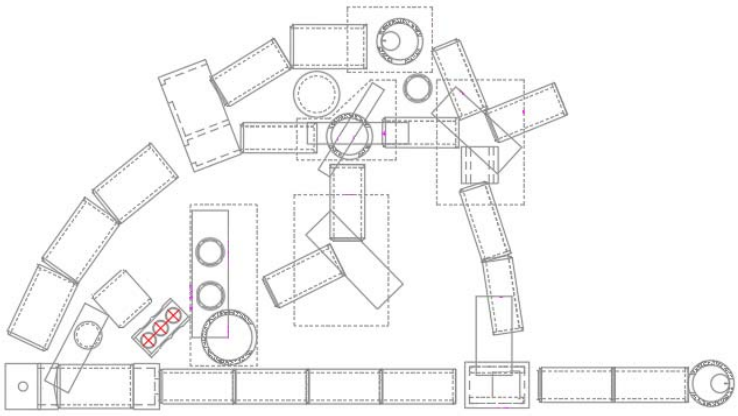
Figure 10. Construction photos from the outdoor DRC facility



(a) Main conex shoring lane details



(b) Mock garage details for the vehicle rescue lane



(c) Confined space rescue and subterranean lane layout

Figure 11. Details for the three basic lanes

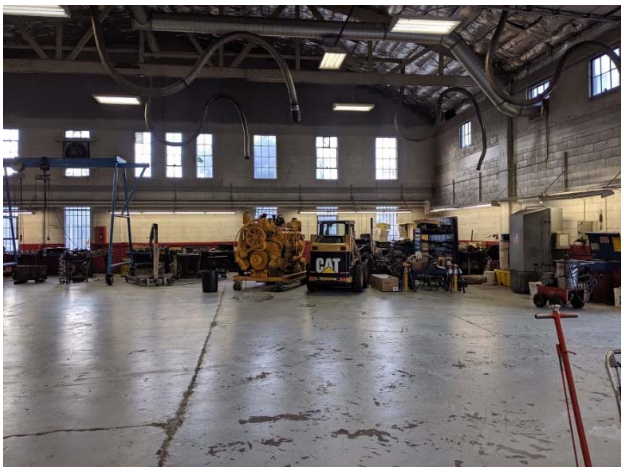
Figure 12. Photos from construction of subterranean lane

Figure 13. Completed subterranean lane

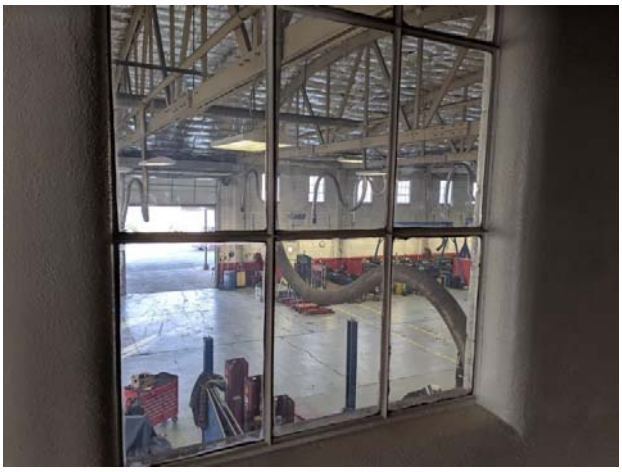
Figure 14. DRC Open House (August 2020)

(a) Front View

(b) Parking Lot on the West Side



(a) High Bay Area



(b) Lookout for High Bay area

(e) 360 view of the High Bay Area

Figure 15. Armory Building at ISU

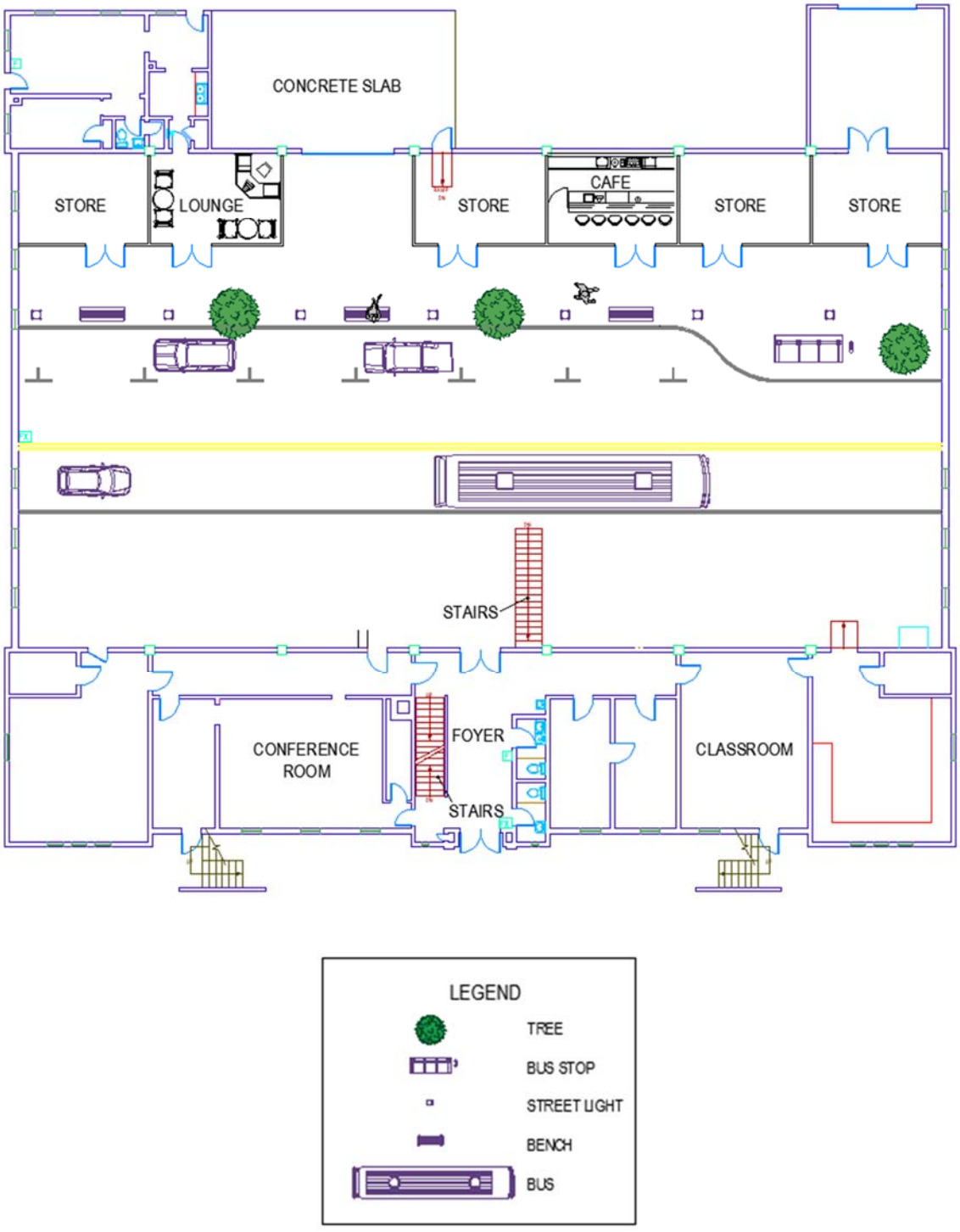


Figure 16. Indoor Facility: Mock City Street

- Besides the outdoor and indoor facilities, there are several other structures (e.g. Holt Arena and Stephens Performing Arts Center) owned by ISU which could be used to host training events. These structures offer state-of-the-art training in a realistic environment. The leadership at ISU is supportive of making the facilities available for the DRC project based on the schedule of the events.
- In 2020, multiple training events hosting more than 100 military and civilian responders were scheduled at ISU. Unfortunately, due to the lockdown, travel/gathering restrictions, spread of the virus, civil unrest and deployment of National Guard units in the locations where the participants were supposed to come to ISU, all these training events had to be canceled.

4.0 Plans for the Upcoming Reporting Period

Plans for each pillar of the DRC project are discussed below.

A. Research Pillar

- Continuing collaboration with ISU and INL researchers and exploring funding opportunities in different areas such as AR/VR, instrumentation, and new technologies for disaster response.
- Publishing more papers and highlighting DRC capabilities.

B. Curriculum and Certification Pillar

- Development of materials, identifying the instructors, and procuring the resources (e.g. advertisement, payment system etc.) for 1-2 short classes in partnership with private and public entities.
- Obtaining input from stakeholders on Federal Emergency Management Agency (FEMA) Certification requirements and processes. Reaching out to FEMA for potential partnerships.

C. Training and Exercise Pillar

- Completing construction of vehicle rescue, shoring lanes, and conex boxes.
- Starting construction of the city mock-up for the indoor training facility.
- Scheduling training events for potential partners and events, pending COVID-19 development.

5.0 Summary of Budget Expenditures

The project expenditure until August 31, 2020 is presented in Table 1. The allocated budget for the 1st year ($525,100) was spent for the full amount.

Table 1. Summary of Budget Expenditures

Salaries (faculty, graduate students, research engineer)	$172,154
Fringes (faculty, graduate students, research engineer)	$31,318
Travel	$1,552
Capital Expense	$122,117
Services and Supplies	$178,107
Tuition Remission (graduate student)	$19,852
Total Expenditure posted through August 31, 2020	**$ 525,100**

6.0 Partnerships and Impact

The project personnel have had discussions with the interested individuals and entities listed in Table 2 on this project on one or more pillars of the DRC project. The impact of the partnership has been creating opportunities for collaboration for everyone, especially for students and faculty at ISU.

A full-time Research Engineer/Lab Manager position was created for this project. The position was filled and the Research Engineer/Lab Manager started on November 4, 2019. The Research Engineer/Manager helps with all three pillars of the DRC project as well as co-supervising the students.

Table 2. Collaborators and Entities

No	Entity Name
1	Idaho National Laboratory • National and Homeland Security Directorate • Energy and Environment Science and Technology • Nuclear Science and Technology
2	The Center for Advanced Energy Studies
3	Department of Energy • Idaho Operations Office
4	Idaho Department of Environmental Quality • INL Oversight Program
5	Idaho Office of Emergency Management • Southeast Idaho • East Idaho • Boise Area
6	Idaho National Guard • Homeland Response Force • Civil Support Team
7	Idaho Falls Fire Department
8	Pocatello Fire Department
9	Pocatello Police Department
10	Idaho State Police
11	Qal-Tek Associates, LLC
12	Technical Resources Group, Inc.
13	Snake River Search, Inc.
14	Idaho State University • College of Technology • Kasiska Division of Health Sciences • Department of Mechanical Engineering • Department of Computer Science and Informatics • Health Physics • Physics • Department of Chemistry • Electrical Engineering • Environmental Monitoring Laboratory

- Department of Public Safety
- Emergency Management
- GIS Center

7.0 Faculty and Student Participation

Through August 31, 2020, the numbers of faculty, students, and other researchers who participated in one or more areas on the DRC project at ISU are listed in Table 3. Appendix 2 provides sample student activities for some of the students working on the project.

Table 3. Participating Researchers

Position	**Numbers**
Faculty	7 (including the PIs)
Graduate Students	6
Undergraduate Students	10
Researchers	6
Total	**29**

8.0 Metrics for Establishing Project Success and Economic Impact

Table 4 presents a summary of the metrics for establishing project success and economic impact for the first year of the project.

Table 4. Summary of the Criteria for Measuring Success for Year 1

Criteria	**Pillars of the Disaster Response Complex**		
	Research	Curriculum & Certification	Training & Exercise
Original Proposal	1. Detailed design/construction of the Phase I rubble pile. 2. Development of a website for the DRC and marketing using social media campaign. 3. Publication of two papers. 4. Hiring two graduate students who will work under joint supervision of ISU/INL.	1. Development of one class in emergency training in collaboration with INL/CAES. 2. Offering training courses to 50 students/first responders.	1. Training of 200 DoD CBRN Enterprise Elements (CRE) customers for radiological/nuclear response training. 2. Procurement of indoor space for CBRN and other training.
Actual Performance	1. Detail design and construction of the rubble pile was completed. 2. Logos were created, a website is almost ready to be launched. 3. Several posters were presented; a journal paper is ready for submission. 4. Two graduate students were hired to work on the DRC project under the	1. Course description and topics were developed for a class in gamma spectroscopy. The class was scheduled to be offered in December 2020. Given the pandemic situation and other approvals from the Department of Energy, the class content and schedule will be revised.	1. Multiple training events were scheduled at ISU under the DRC project in 2020. The number of emergency responders in these training events was projected to be more than 100. Unfortunately, the pandemic, lockdown, and travel/gathering restrictions did not allow for holding training events. This was beyond the control of the project personnel or ISU. The

	supervision of ISU/INL researchers. These students have made the DRC their topic for their PhD/MS dissertation/project. In addition, several other graduate students worked on the project as student employees and assistants.	2. A training for building safety culture (LOSA) was piloted to 30 students/faculty/staff at no-cost under a contract with BEA. LOSA is planned to become a curriculum that will be offered under the DRC at ISU.	project personnel are actively looking to schedule training events as the condition in Idaho and the national situation with COVID19 would allow. 2. An indoor facility was identified for the DRC. Preliminary design and drawings were completed for the indoor DRC.

9.0 Future Plans

The intent of the DRC was originally to be a self-sustaining entity by the end of the three years of funding. The pandemic and lockdown have put limitations on hosting training events in Pocatello. Several planned training events for 2020 had to be canceled. Given the uncertainty with the pandemic and how the situation for the rest of 2020 and 2021 will be, it is possible that DRC will need more than three years from the start of the project in August 2019 to become self-sustaining. Future improvements and renovations, adding new training lanes, maintenance of the facility and equipment, and salaries/fringes are intended to be funded through training, research, and certification revenue generated by both the indoor and outdoor facilities. Additionally, future grants and collaborators will be pursued to further develop the facilities for project continuation and expansion.

10.0 Expenditure Report

A detailed breakdown of the expenditure posted through August 31, 2020 is attached in Appendix 1.

11.0 Commercialization Revenue

The DRC aims to become self-sustaining through revenues collected from training, curriculum, and certification. Additionally, research funding from different opportunities and agencies are planned to be pursued to benefit the students, faculty, and other researchers.

Appendix 1: Summary of the Expenditures

Data_Description				Accounted Budget	Year-to-Date														Encumbrances	Total by ROWS
Fiscal_Month				Temporary Budget	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	August	Subtotal	YTD	
				Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount	Amount
Index Only	Account			Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
AHRC48_APPR IGEM Response	Labor																		0.00	
Complex for Emeregency Responders		610_Salaries		263,800.00	0.00	0.00	(2,692.31)	(5,384.62)	(5,384.62)	(8,828.58)	(8,828.58)	(8,828.58)	(11,520.89)	(8,615.39)	(2,153.85)	(5,384.62)	(67,622.04)	0.00	196,177.96
		620_Irregular Help		0.00	0.00	(868.00)	(5,909.00)	(10,100.27)	(10,904.19)	(7,912.04)	(7,138.04)	(6,802.04)	(12,720.00)	(33,880.12)	(429.84)	(7,583.31)	(104,246.85)	0.00	(104,246.85)
		630_Fringe Benefits		0.00	0.00	(4.07)	(579.97)	(4,286.58)	(3,370.22)	(2,961.97)	(3,037.77)	(3,032.76)	(4,252.05)	(7,540.76)	(125.68)	(2,126.31)	(31,318.14)	0.00	(31,318.14)
	Direct Expenditures																		0.00	0.00
		700_Travel		0.00	(56.00)	(545.85)	(894.75)	0.00	0.00	0.00	(55.59)	0.00	0.00	0.00			(1,552.19)	0.00	(1,552.19)
		720_Services		112,200.00	0.00													0.00	112,200.00
			721_Employee Development Services	0.00	0.00	0.00	0.00	(272.69)	0.00	(26.63)	0.00	0.00	(26.63)	(53.26)			(379.21)	0.00	(379.21)
			722_General Services	0.00	0.00	(75.00)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			(75.00)	0.00	(75.00)
			724_Professional Services	0.00	0.00	(663.90)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(36.00)			(699.90)	0.00	(699.90)
			727_Administrative Services	0.00	0.00	0.00	0.00	0.00	0.00	(16.80)	0.00	0.00	0.00	(5,901.03)			(5,917.83)	0.00	(5,917.83)
			728_Computer/Tech Services													(88.88)	(88.88)		(88.88)
			729_Repair and Maintenance Services	0.00	0.00	0.00	0.00	(60.00)	0.00	0.00	0.00	0.00	0.00	0.00		(839.68)	(899.68)	0.00	(899.68)
			741_Rentals and Operating Leases	0.00	0.00	0.00	(135.00)	0.00	0.00	0.00	0.00	0.00	0.00	0.00			(135.00)	0.00	(135.00)
		730_Supplies		0.00	0.00													0.00	0.00
			733_Computer Supplies													(125.96)	(125.96)		(125.96)
			734_Repair and Maintenance Supplies	0.00	0.00	0.00	0.00	(3,035.63)	0.00	(53,631.84)	0.00	0.00	0.00	(105,075.82)	(560.95)		(162,304.24)	0.00	(162,304.24)
			736_Institutional/Specific Use	0.00	0.00	(211.59)	(118.34)	(199.00)	(87.82)	(8.50)	(184.05)	(59.47)	(3,496.58)	(2,381.39)	(537.94)	(196.84)	(7,481.52)	0.00	(7,481.52)
		800_Capital Expense		149,100.00	0.00													0.00	149,100.00
			820_Buildings and Improvements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(16,500.00)			(16,500.00)	0.00	(16,500.00)
			820C_> $5K Buildings and Improvements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00
			830_Computer Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(630.54)	0.00		(7,545.25)	(8,175.79)	0.00	(8,175.79)
			840_Motorized Equipment														0.00		0.00
			850_Specific Use Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(2,620.00)	(2,821.00)			(5,441.00)		(5,441.00)
			850C_> $5K Specific Use Equipment	0.00	0.00	0.00	(51,000.00)	(41,000.00)	0.00	0.00	0.00	0.00	0.00	0.00			(92,000.00)	0.00	(92,000.00)
		870_Educational and Training Assistance		0.00						0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00
			871_Educational and Training Assistance	0.00	0.00	(4,962.98)	0.00	0.00	(9,925.96)	0.00	0.00	0.00	0.00	0.00		(4,962.98)	(19,851.92)	0.00	(19,851.92)
	Subtotal																		0.00	
Total by COLUMNS				525,100.00	(56.00)	(7,331.39)	(61,329.37)	(64,338.79)	(29,672.81)	(73,386.36)	(19,244.03)	(18,722.85)	(35,266.69)	(182,804.77)	(3,808.26)	(28,853.83)	(524,815.15)	0.00	284.85

Note: The remaining $284.85 will be spent by August 31, 2020. The Pay period was not run when this spreadsheet was generated on August 26, 2020.

Appendix 2: Sample Student Activities

Week No.	Dates	Graduate Student # 1	Graduate Student #2	Undergraduate Student #1	Graduate Student #3
Week 1	8/18/2019	Project Intro Meeting with Mashal (19th) Research DRC	Summarize and Review Literature Review		
Week 2	8/25/2019	Research DRC Completed Research Summary DRC Team Meeting (30th)	DRC Team Meeting (30th)	DRC Team Meeting (30th) Literature review on DRC plan Natural hazards in the USA to add with DRC plan Research on the key professional conferences to present DRC and journal papers	DRC Team Meeting (30th) Research DRC background information and other emergency training facilities in the U.S.
Week 3	9/1/2019	Start Preparing TOPO Survey Meet Darren to Discuss Survey (4th)	Continue Development of Concept Design	Prepare TOPO survey & map of the outdoor collapsed structure site Continue research on possible conferences to attend	Meeting with Darren Leavitt and Dan Garz to plan for topographical survey
Week 4	9/8/2019	First TOPO Survey of Project Location (11th) Second TOPO Survey of Project Location (13th) Draw Site TOPO Map DRC Team Meeting (13th)	Construction cost estimations DRC Team Meeting (13th)	DRC Team Meeting (13th)	DRC Team Meeting (13th) Field data collection of points for topographical map Create topographical map of DRC building site using Civil 3D
Week 5	9/15/2019	Study Civil 3D Begin Work on Site Plan	Develop Poster presentation for CAES Conference Redefine physical model	Literature review on the bleachers/stadium seating's Working on site plan	
Week 6	9/22/2019	Work on Site Plan MkII (24th)	Improve and add to physical model		
Week 7	9/29/2019	Attend CAES Energy Conference (29th-1st) Create Power Point for Meeting with INL	Finish Physical model improvments and additions	Reviewed skill sheets that are used by Idaho Technical Rescue Team provided by IOEM	
Week 8	10/6/2019	DRC Meeting with INL & Others (7th) Work on Site Plan	DRC Meeting with INL & Others (7th)	DRC Meeting with INL & Others (7th)	DRC Meeting with INL & Others (7th) Research possible training courses and seating options for training observation
Week 9	10/13/2019	Work on Site Plan Submit Plan Set MkVI to Jared (19th)		Review and go over possible training associated with Urban Search and Rescue Task Forces Research on overview of the facilities that were discussed in the meeting Went through the drawing of the Structural Collapsed Venue site of Idaho Army National Guard Camp	
Week 10	10/20/2019	DRC Meeting with Idaho National Guard (22nd) DRC Team Meeting Site Pad Design (23rd) TOPO Survey Piles on Project Site (24th) Update TOPO Map	DRC Meeting with Idaho National Guard (22nd)	DRC Meeting with Idaho National Guard (22nd)	DRC Meeting with Idaho National Guard (22nd)
Week 11	10/27/2019	Work on Site Plan Test Pit Excavation (30th) CAES Presentation (1st)	CAES Tour and Presentation	CAES Tour Working on site plan Test Pit Excavation	CAES Tour Geotechnical investigation by excavating test pits at DRC building site and collecting soil samples
Week 12	11/3/2019	Work on Site Plan Submit Plan Set 2019.11.8 to Jared			
Week 13	11/10/2019	Lab Testing of Test Pit Samples Scan & Upload Brochure		Lab Testing of Test Pit Samples	Performed Laboratory testing of soil samples to determine mechanical properties for proposed cut and fill
Week 14	11/17/2019	Prepare Points for Construction Staking (20th) Lab Testing of Test Pit Samples Construction Staking Survey (22nd)	Begin container drawings for fabrication		
Week 15	12/1/2019	Lab Testing of Test Pit Samples	Draft initial concepts for container lanes	Develop concept layout for indoor cityscape	
Week 16	12/8/2019				
Week 17	12/15/2019				
Week 18	12/22/2019				
Week 19	12/29/2019				
Week 20	1/5/2020				
Week 21	1/13/2020	Meet Dr. Mashal (13th) Meet Shankar (17th) Write Abstract (19th)	Develop overall outdoor facility layout Continue container drawings	Submit plans for cityscap for review	Develop subterraean lanes draft concept
Week 21	1/20/2020	Write Abstract (20th) Create DRC Poster for Presentation at CAES (21st) Poster Preperation for CAES Presentation (22nd) Visit Diesel Shop (22nd) Present Poster at CAES (23rd) Cost Estimate for City Block Mock Up (24th)			

Appendix 2: Sample Student Activities

Week No.	Dates	Graduate Student # 1	Graduate Student #2	Undergraduate Student #1	Graduate Student #3
Week 22	1/27/2020	Continue Cost Estimate	Finalize outdoor layout	Prepare detailed description of indoor facility	
		Draw Stud wall	Submit first drawings of containers for review		
		Submit Abstract & Bios for ASCE Conference (30th)			
Week 23	2/3/2020	Meet Chad Gross to Discuss Set Design (5th)			
		Continue Drawing City Block			
		Construct Geo Report Outline			
		Input Completed Labs from Fall into Excel			
		Prepare for Meeting with Mahar			
Week 24	2/10/2020	Meet Dr. Mahar (11th)	Review feedback for container drawings	Literature review of existing similar facilities	
		Prepare for Geo Lab			
		Lab Work (13th)			
		Strart Writing Geo Report (14th)			
Week 25	2/17/2020	Lab Work (17th)	Prepare poster for presentation	Assist with as built survey	Assist with as built survey
		As-Built Survey (18th)			
		Begin Drafting As-Built Survey (19th)			
		Look for Accelerator Building Geo Report			
		Continue Writing Geo Report			
		ASCE Presentation Planning (23rd)			
Week 26	2/24/2020	Draft As-Built Survey			
		Foundation Bearing Design (26th)			
		Foundation Bearing Design (27th)			
		Slope Stability Analysis (27th)			Continue outdoor design and drawing
		Geo Design Report (28th)	Visit Teton Prestress inf Idaho Falls for material selection		
Week 27	3/2/2020	DRC Meeting (2nd)			
		DRC Report Outline			
		DRC Geo Design Report			
		DRC Survey Report			
Week 28	3/9/2020	None (Sick)			
	3/13/2020	Campus Closed Due to Covid			
Week 29	3/16/2020	DRC Report Outline	Conex drawings	Prepare indoor cityscape drawing begin rework after review	Literature review of existing facilities
		Scan Meeting Notes			
		Write Meeting Outlines			
Week 30	3/30/2020	DRC Geo Deisgn Work (No Access to Geo Lab)			
		Investigate correlation of n-values and friction angles			
Week 31	4/6/2020	Discuss DRC With Dr. Mashal (7th)	Conex drawings continured submit for review		
Week 32	4/13/2020	Review Design of Wood Structure Notes & Begin Design			
		Zoom Meeting With Jared at Automotive Tech Facility (17th)			
Week 33	4/20/2020	Loading Calculations for DRC City Block			
		Beam Design for DRC City Block			
Week 34	4/27/2020	Bearing Wall Design for DRC City Block			
Week 35	5/4/2020	Earthquake Loading Calculation			
		Diaphragm Design for DRC City Block			
		Chord Design for DRC City Block			
Week 36	5/11/2020	Chord Design for DRC City Block			
		Collector Design for DRC City Block	Return to outdoor site for inventory		Inventory of outdoor site
		Shear Wall Design Calculation			Finalize outdoor layout
Week 37	5/18/2020	Shear Wall Design Calculation	Assist with receiving loads of materials from Idaho Falls and Ogden	Finalize indoor cityscape draft 1	Inventory of materials arriving on site
Week 38	5/25/2020		Begin drafting CWMD Journal Paper		
			CWMD Paper		
Week 39	6/1/2020			Assist with construction of outdoor lanes	Assist with construction of outdoor lanes
Week 40	6/8/2020			Assist with construction of outdoor lanes	Assist with construction of outdoor lanes
Week 41	6/15/2020			Assist with construction of outdoor lanes	Assist with construction of outdoor lanes
Week 42	6/22/2020			Assist with construction of outdoor lanes	Assist with construction of outdoor lanes
Week 43	6/29/2020		Submit first draft of Journal Paper		
			Submit conex drawings	Assist in preparing informational sheet for indoor facility	
Week 44	7/6/2020		Finalize conex drawings and estimate materials/costs		
Week 45	7/13/2020		Revise Jouranl paper	Rework indoor facility layout with INL suggestions and input	
Week 46	7/20/2020		Prepare white page for distribution		
Week 47	7/27/2020				
Week 48	8/3/2020		Submit for second draft of Journal Paper		
Week 49	8/10/2020	Return to project	Revise Jouranl paper		
		Update meeting			
Week 50	8/17/2020	Outdoor timber roof design	Revise Jouranl paper		
Week 51	8/24/2020	Indoor cityscape timber design	Submit for final review		
Week 52	8/31/2020				