Board of Regents Program Action Request
University of Alaska
Proposal to **Add or Change** a Program of Study

1a. UA University	1b. School or College	1c. Department or Program
UAF	College of Engineering & Mines	Geological Engineering BS

2. Complete Program Title: Geological Engineering BS

3. Type of Program:

Undergraduate Certificate		Associate		Baccalaureate	x
Master's		Doctorate		Post-Baccalaureate Certificate	

4. Type of Action: [ ] Add [x] Change

Implementation Semester: Fall Year: 2021

6. Projected Revenue and Expenditure Summary:

Provide information for the 5th year after program change approval if a baccalaureate or doctoral degree program; for the 3rd year after program approval if a master's or associate degree program; or for the 2nd year after program approval if a graduate or undergraduate certificate. If information is provided for another year, specify () and explain in the program summary attached. Note that revenues and expenditures are not always entirely new; some may be current (see 7d.)

Projected Annual Revenues in FY25 (Combined BS & MS)		Projected Annual Expenditures in FY25 (Combined BS & MS)	
Unrestricted		Salaries & benefits (faculty and staff)	$ 300,000.00
General Fund	$ 330,000.00	Other (commodities, services, etc.)	$ 2,000.00
Student Tuition & Fees	$ 80,000.00	**TOTAL EXPENDITURES:**	$ 302,000.00
Indirect Cost Recovery	$ -	One-time Expenditures to Initiate Program (if >$250,000)	
TVEP or Other (specify):	$ -	(These are costs in addition to the annual costs, above.)	
Restricted		Year 1	$ -
Federal Receipts	$ -	Year 2	$ -
TVEP or Other (specify):	$ -	Year 3	$ -
TOTAL REVENUES	$ 410,000.00	Year 4	$ -

Page # of attached summary where the budget is discussed, including initial phase-in: Cost savings will be 2 faculty positions

7. Budget Status. Items a., b., and c. indicate the source(s) of the general fund revenue specified in item 6. If any grants or contracts will supply revenue needed by the program indicate amount anticipated and expiration date, if applicable.

Revenue source	Continuing	One-Time
a. In current legislative budget request	$ -	$ -
b. Additional appropriation required	$ -	$ -
c. Funded through new internal UA university redistribution	$ -	$ -
ftn1	$ -	$ -
e. Funded all or in part by external funds, expiration date	$ -	$ -
f. Other funding source (specify type):	$ -	$ -

8. Facilities. New or substantially (>$25,000 cost) renovated facilities will be required. [ ] Yes [X] No

If yes, discuss the extent, probable cost, and anticipated funding source(s), in addition to those listed in sections 6 and 7 above.

9. Projected Enrollments (headcount of majors). If this is a program discontinuation request, project the teach-out enrollments.

Year 1: 30 Year 2: 30 Year 3: 30 Year 4: 30

Page number of attached summary where demand for this program is discussed: N/A

10. Number[2] of new TA or faculty hires anticipated (or number of positions eliminated if a program discontinuation):		**11. Number[2] of TAs or faculty to be reassigned:**	
Graduate TA	0	Graduate TA	2
Adjunct	0	Adjunct	0
Term	0	Term	0
Tenure track	2 (Eliminated)	Tenure track	2 (Retained)
		Former assignment of any reassigned faculty:	MinGeo
		For more information see attached summary page:	

12. Other programs affected by the proposed action, including those at other campuses (please list):

Program Affected	Anticipated Effect
Civil & Environmental Engineering	Civil engineering curriculum will be modified to promote shared concepts/courses between CE and
Mining Engineering	Mining will be in a smaller department, but can still share courses with GE

Page number of attached summary where effects on other programs are discussed: N/A

13. Specialized accreditation or other external program certification needed or anticipated. List all that apply or	**14. Aligns with University or campus mission, goals, core themes, and objectives (list):**
Seek to maintain ABET accreditation for GE program	Educates undergraduate students
	Research creates and disseminates new knowledge - Arctic focused
	Page in attached summary where alignment is discussed:

15. State needs met by this program (list):	**16. Program is initially planned to be: (check all that apply)**	
Promotes development of resource extraction industry	Available to students attending classes at campuses	X
Promotes development of infrastructure statewide	Available to students via e-Learning	
Develops responses to arctic-related geohazards	Partially available to students via e-Learning	X
Develops a well-trained engineering workforce	Page # in attached summary where e-Learning is discussed:	

17. If this program is an addition, would program be eligible for State's Eligible Training Provider List program?

Yes [ ] No [X] (Click here for more

Submitted by: DocuSigned by: Daniel M. White AE6B50A79CA648C... Chancellor/Provost Date: May 6, 2020

Consensus support of AC [X] Not supported by AC [ ]

Recommend **approval** by VPASR DocuSigned by: E807E63EC77D4B8... Date: May 8, 2020

Recommend **disapproval** by VPASR Date:

[2]Net FTE (full-time equivalents). For example, if a faculty member will be reassigned from another program, but his/her original program will hire a replacement, there is one net new faculty member. Use fractions if appropriate. Graduate TAs are normally 0.5 FTE. The numbers should be consistent with the revenue/expenditure information provided.

Attachments: [X] Summary of Degree or Certificate Program Proposal [ ] Other (optional)

Revised: 11/11/2019

ftnref1

This request generated considerable discussion at the Academic Council meeting. Questions were raised about the long-term viability, accreditation, and mission of the Geological Engineering degree programs if they are separated from Mining Engineering and incorporated into Civil Engineering with a reduced faculty level. The points raised are also reflective of numerous external letters from stakeholders voicing opposition to the proposal. Many of these letters were also directly shared with the Board. The request was unanimously supported by the three Provosts on the AC and unanimously opposed by the three Faculty Alliance members who also raised the point that the potential projected savings of two faculty positions is small in relation to the possible loss of industry support and the impact on training geological engineers for the state.

UAF Geological Engineering Restructure – Summary Report and Initial Program Plan

1 May 2020

Executive Summary

At the direction of UAF administration, a GE Restructure Task Force was formed to provide the Board of Regents more detailed information regarding the UAF-recommended plan to restructure the Geological Engineering (GE) program. The task force was chaired by CEM Associate Dean for Academics Charlie Mayer, and included Dr. Margaret Darrow (GE faculty) and Dr. Dave Barnes (CE faculty) as additional members. CEM Dean Schnabel oversaw the task force's activities, reviewed their findings, and made final edits to their report (this document).

Per the restructure plan, GE will reduce the number of faculty dedicated strictly to GE from four to two, and GE will be situated in a new department shared with the Civil Engineering (CE) program within the College of Engineering and Mines (CEM). The restructured program will be grounded in the geological sciences, and will afford an opportunity for GE students to specialize in mining, petroleum, geotechnical, or water resource applications by leveraging technical electives offered by other CEM programs.

During the past several weeks, the GE Restructure Task Force sought and received guidance from stakeholders of both the GE and CE programs, as well as from other quality GE programs in the U.S., including some who are organized within civil engineering departments at their own universities. The GE Restructure Task Force recognized the opportunity to remove legacy constraints from the existing curriculum and created a more modern and efficient curriculum that better addresses the needs of the State of Alaska regarding geological engineers. The strengths that are foundational to the restructured curriculum include:

- Geotechnical engineering expertise, including: soil sampling, testing, and analysis to interpret subsurface conditions and to determine strength of materials to guide design and construction; geohazard analysis; slope stability analysis; Alaska-specific knowledge, including permafrost and frozen ground engineering.
- Applied near-surface geophysics expertise for site assessment related to infrastructure and resource development applications; expertise in the use of Geographic Information Systems (GIS) to conduct terrain analysis to interpret changes in surface geomorphology, identify geohazards, and conduct the first step in site investigations.

Following Chancellor White's guidance to create a program requiring fewer resources, it is essential that the faculty retained to teach the curriculum have the expertise necessary to deliver the restructured program. Educational degrees in Geological Engineering, additional background in Geology, and expertise in the areas listed above would ensure that all necessary courses in the proposed curriculum could be effectively delivered.

With the constraints imposed upon the GE Restructure Task Force, including the UA budget projections, we believe this plan to promote more effective course sharing and modernize both the CE and GE curricula based upon the foundational needs of the State of Alaska, is a positive step forward.

Timeline of Proposed GE Program Modification Process

Currently the Geological Engineering (GE) programs (BS and MS) are housed along with the Mining Engineering (MIN) programs within the Department of Mining and Geological Engineering. The following is a short summary of the proposed GE programs' modification over the last several months, presented to provide context for this document and the proposed formation of a joint department containing geological and civil engineering programs. This summary includes information related to MIN, as it is germane to how this process has evolved.

- November 11, 2019: Dean Schnabel, in response to pending budget cuts, recommended "...the immediate suspension of admissions into, and subsequent deletion of, the undergraduate and graduate Mining Engineering and Geological Engineering programs."
- March 9, 2020: The UAF Expedited Academic Program Review Committee recommended the following:
    - BS Mining Engineering - Suspension
    - MS Mining Engineering - Delete
    - BS Geological Engineering - Revision or Restructure
    - MS Geological Engineering - Delete
- March 16, 2020: The UAF Faculty Senate voted on the expedited review committee's recommendations:
    - BS Mining Engineering suspension: 6 votes in favor, 29 votes against suspension
    - MS Mining Engineering deletion: 3 votes in favor, 32 votes against deletion
    - BS Geological Engineering revision/restructure: 16 votes in favor, 14 votes against revision/restructure, 1 vote for "program should be kept with an improvement plan"
    - MS Geological Engineering deletion: 6 votes in favor, 29 votes against deletion
- March 20, 2020: Chancellor White announced his preliminary recommendations:
    - Separate the Mining and Geological Engineering programs.
    - BS and MS Mining Engineering - keep in their current form.
    - BS Geological Engineering - eliminate and only offer a GE-emphasis in Civil Engineering.
    - MS Geological Engineering: Delete.
- March 23, 2020: After further feedback from program stakeholders, Chancellor White announced his final program review recommendations:
    - Separate the Mining and Geological Engineering programs.
    - BS and MS Mining Engineering - Maintain.
    - BS and MS Geological Engineering - Merge Geological Engineering with Civil Engineering in order to offer an ABET-accredited GE program with fewer resources than currently needed.
- April 14, 2020: Following the UA Board of Regents' (BoR) Academic and Student Affairs (ASA) committee meeting, Provost Prakash charged Dean Schnabel to create a GE Restructure Task Force to gather the information requested by the BoR ASA. Further constraints include Chancellor White's communication to reduce the number of GE faculty members to two. Dean Schnabel convened a GE Task Force of Charlie Mayer (Associate Dean of Academics and Professor of Electrical Engineering), David Barnes (Institute of Northern Engineering Acting Director and Professor of Civil and Environmental Engineering), and Margaret Darrow (Professor of Geological

Engineering). Following the BoR ASA's request, the GE Restructure Task Force was asked to develop "a plan that describes how we will deliver an ABET-accredited geological engineering program with only two of our current GE faculty members."

- May 1, 2020: The GE Restructure Task Force delivered this document to Dean Schnabel for distribution to GE and CE faculty for feedback.

This summary illustrates that the Task Force's efforts are directed at maintaining an ABET-accredited GE program versus the alternative of reducing it to a concentration or deleting it completely. Despite the limited time available, the Task Force produced a plan to meet the BoR ASA's request, incorporating feedback from surveyed stakeholders, and describing a viable restructure for GE that will meet Alaska's needs while maintaining ABET accreditation.

GE Program Description

Geological engineers apply their strong background in geology and engineering science to solve problems at the intersection of the natural and built environments. They use their knowledge and interpretation of the Earth's surface and near-subsurface to: recognize and mitigate geohazards, such as landslides, floods, and earthquakes; identify, develop, and protect groundwater resources; locate and investigate potential sites for infrastructure and property development; and locate and harvest natural resources, such as minerals, coal, oil, and gas, in an environmentally-sustainable way. As America's Arctic University, UAF's Geological Engineering program provides training in recognizing and mitigating problems associated with frozen ground, such as frost heaving, thaw settlement, and slope stability in a permafrost environment. Geological engineers receive different academic training and address different problems than civil engineers; however, there are some areas of overlap between the two disciplines where geological and civil engineers collaborate to solve engineering problems.

CE Program Description

Civil engineers focus on the design, construction, and maintenance of the built and natural environment. Examples of civil engineering products include bridges, roads, structural components of buildings, water and wastewater treatment facilities, dams, pipelines, and building foundations. Civil engineers require in-depth knowledge of mathematics, structural mechanics, dynamics, fluid mechanics, soil mechanics, hydrology, chemistry, project management, among other topics. ABET program requirements for civil engineering state that the program must prepare graduates to solve problems in at least four technical areas appropriate to civil engineering. Civil engineering technical areas emphasised in UAF's bachelor of science in civil engineering (BSCE) program are structural engineering, geotechnical engineering, environmental engineering, water resource engineering, and transportation engineering. All of these technical areas are critical to Alaska. The BSCE degree program at UAF has a strong cold regions focus. The program emphasises design and analysis of infrastructure in environments that are impacted by arctic and sub-arctic conditions such as freezing and frozen ground (permafrost), ice flows, and long periods of below-freezing atmospheric temperatures. The program also considers design and construction for remote communities. Emphasis on hands-on learning is built into the program through teaching laboratories in key courses such as fluid mechanics and properties of materials as well as in non-course related activities such as national student competitions in bridge design and construction and environmental design. Many of the courses taught in the civil and geological engineering programs are either required or beneficial to students in both programs.

Steps Taken by the GE Restructure Task Force

1. Constituent Survey

The Task Force developed a survey on GE curriculum, and widely distributed it among stakeholders and graduates of the CE and GE programs, as well as their respective faculty. There were 31 respondents to the survey, mostly alumni from the GE program, and/or employers of GE or CE graduates (Figure 1). The survey asked our stakeholders the following questions:

- In your opinion, what are the two most important skills or knowledge sets held by graduates of the UAF geological engineering programs?
- What are the topical areas of overlap between geological engineering and civil engineering that you believe should be leveraged in the restructured curricula?
- What are the most important ways by which UAF geological engineering graduates provide value to the Alaska workforce?
- In what way or ways might a closer association with the geological engineering programs impart a positive impact upon the civil engineering programs?
- In your opinion, what are the potential strengths of the proposed restructure?
- In your opinion, what are the potential weaknesses of the proposed restructure?

It must be stressed that given the time constraints, the stakeholders were asked to evaluate a general proposed plan without any specifics; thus, concerns raised in many of the responses could have been addressed by providing a proposed curriculum (which was not yet developed). This illustrates the need for multiple iterations of this process (i.e., (1) ask for stakeholder input; (2) develop a curriculum based on input; (3) ask for additional stakeholder input on proposed plan; (4) revise, etc.).

Figure 2 illustrates the results in the form of “word clouds,” in which the most repeated key words have the largest size (all survey results - from which any identifying information has been removed to ensure anonymity - are included in Appendix A). Respondents felt that GE graduates from UAF contribute most to Alaska and to the engineering profession through their knowledge of geology, soil and rock mechanics, geohazards, geophysics, frozen ground engineering, and natural resources (such as oil and minerals), as well as technical writing skills. Multiple respondents indicated that geological engineers demonstrate excellent critical thinking skills, given their ability to work with uncertain data (which is typical of natural environments). The respondents indicated that moving the GE program into the CEE department would result in stronger collaboration and professional relationships between these disciplines. Areas of overlap that could be leveraged with this restructuring include soil mechanics, groundwater hydrology, geohazards (such as slope stability), and general design and construction knowledge. The survey results indicated that the major weaknesses with the proposed restructuring include potential loss of ABET accreditation, less exposure to natural resources industries such as mining and petroleum, and losing geological engineering’s identity within the larger civil engineering department. The Task Force made a concerted effort to address constituent comments and concerns with the proposed GE curriculum. The comments and concerns presented below are paraphrased to address the most frequent responses to the survey.

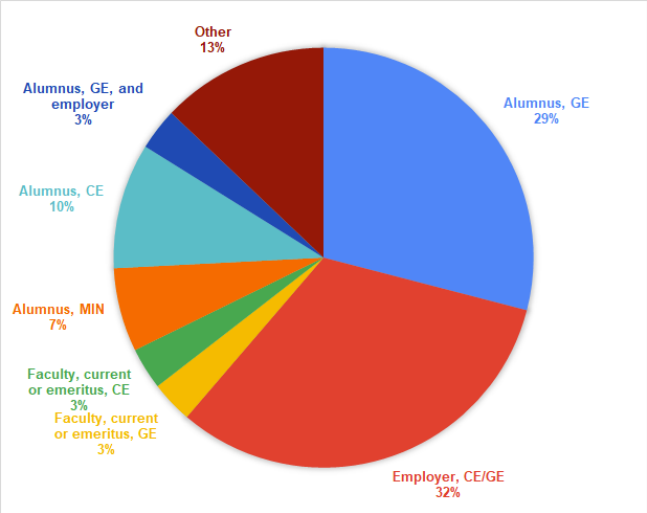


Figure 1. Distribution of survey respondents (31 total).

Figure 2. Survey respondent results (range of number of responses per word given in parentheses): (a) two most important GE traits (1-16); (b) areas of GE and CE overlap (1-16); (c) how GEs add value to Alaska (1-10); (d) positive impact of GE and CE in one department (1-10); (e) potential strengths of plan (1-9); (f) potential weaknesses of plan (1-8).

- *CONCERN: Combining with the CEE department will result in less focus on geologic aspects of engineering concepts, and less opportunities for graduates to be employed in mining industries.* The proposed GE curriculum continues to include four courses offered by the Mining program, either as options or required courses (Rock Mechanics (required), Surveying, Statistics, Economics). Students interested in working in the mineral industry can take mining-specific courses for their two technical electives, as well as complete a minor in Mining Engineering. These required and optional courses have been in place for the last decade, and will continue to exist for the students. Thus, the GE program will continue to provide the needed knowledge and training for GE graduates who pursue jobs in the mineral industry.
- *CONCERN: The geologic background that GE students have will be reduced, resulting in a "watered-down" GE curriculum.* The proposed GE curriculum continues to include the same number of geology courses (General Geology for Engineers, Mineralogy, Petrology, Structural Geology, and Sedimentology), as well as several required GE courses that address elements of geology (Terrain Analysis and GIS; Field Methods; Groundwater). Concerted effort will be made to retain the same level of geology training, as that is one of the strengths of practicing geological engineers.
- *CONCERN: The ABET accreditation of the GE program may be compromised*. Members of the GE Restructure Task Force contacted faculty members associated with other GE programs within the U.S. to investigate other curricula and identify potential problem areas for ABET accreditation (discussed below). The GE Task Force also worked from the "bottom up" to ensure that all of the ABET criteria were met with the revised program. Ultimately, obtaining ABET accreditation occurs during the ABET review cycle, which will not occur until 2023. Should the GE program restructure be approved by the BoR, faculty will work with an advisory board of program stakeholders to modify the program mission, educational objectives, and student outcomes, and develop new courses and modify existing courses to ensure that all educational objectives and student outcomes are satisfied.
- *CONCERN: Reducing the number of GE faculty will reduce the level of expertise needed to deliver the curriculum to the students*. This is indeed a concern, as ABET also requires that faculty must "...understand professional engineering practice and maintain currency in their respective professional areas." Any faculty teaching courses for GE are "counted" for ABET purposes as serving the GE program. Currently, multiple required and elective courses in the existing GE program are taught by faculty in other programs or departments, including Geosciences, Civil Engineering, Mining Engineering, Petroleum Engineering, and Natural Resources Management. Additionally, there are a number of courses/topic areas taught in both GE and CE that have significant overlap, including Surveying, Soil Mechanics, Statistics, Economics, and Groundwater. Efficiencies can be gained for both programs through combining these courses into only one taught for both programs. This coverage of courses by faculty with the necessary expertise in other programs will help to meet the ABET requirements.
- *COMMENT: Topical areas that can be strengthened by moving GE into CEE include geotechnical engineering/soil mechanics, geohazards, groundwater hydrology, and frozen ground engineering*. Moving the GE program into the CEE department will facilitate increased awareness of the areas where the GE and CE disciplines have commonality. This may result in more CE students taking GE courses as technical electives, and vice versa. Examples of courses include: Slope Stability, Geohazard Analysis, Design of Earth

Dams and Embankments, Foundation Engineering, Introduction to Permafrost Engineering, Environmental Engineering, Water Resources Engineering, and Arctic Engineering.

2. Discussions with Other Universities with GE Programs

The College of Engineering and Mines (CEM) currently has eight ABET-accredited BS degree programs in six departments. Hence two of the departments each house two programs, which is not an uncommon occurrence in engineering colleges in the U.S. Following the April BoR ASA meeting, GE Restructure Task Force members had conversations with faculty in three of the 10 other ABET-accredited GE programs in the U.S. to seek guidance regarding modern GE curricula and advantages/disadvantages of partnering with CE. Discussions were with two programs that are housed in a department with Civil Engineering (University of Wisconsin-Madison and University of Minnesota) and one GE program within its own department (Montana Tech). Similar to the majority of UAF's GE graduates, most of the graduates from these programs work in consulting or for state and government agencies. Valuable advice was received from these peer colleagues, including their experience in reducing the total number of program credits and subsequent ABET accreditation. In addition to these discussions, the Task Force obtained further information by investigating most of the other U.S. GE programs' curricula to help identify the defining GE courses.

3. GE Curriculum Development

Additional motivation was driven by the opportunity to view this as a clean slate approach. Curricula are often developed to benefit one faculty member's favorite area, at the expense of a more balanced approach. Once a legacy has been established, it is difficult to vary or modernize the curriculum. To avoid these issues, the GE Restructure Task Force chair was chosen to be a neutral party, not being a member of GE or CE. The chair is the Associate Dean of Academics for the college and the college ABET liaison, and has experience creating several new engineering programs at UAF. The approach taken by the GE Restructure Task Force, with the valuable guidance of GE stakeholders via survey responses, let us focus on our college strengths and emphasize skills and knowledge necessary to meet the most important needs of the State, which include:

- Geotechnical engineering expertise, including: soil sampling, testing, and analysis to interpret subsurface conditions and to determine strength of materials to guide design and construction; geohazard analysis; slope stability analysis; Alaskan-specific knowledge, including permafrost and frozen ground engineering.
- Applied near-surface geophysics expertise for site assessment related to infrastructure and resource development applications; expertise in the use of Geographic Information Systems (GIS) to conduct terrain analysis to interpret changes in surface geomorphology, identify geohazards, and conduct the first step in site investigations.

With these underlying principles as a road map, the GE Restructure Task Force set out to create an improved and modernized GE curriculum. Additionally, the curriculum needed to: 1) meet the requirements for continued ABET accreditation; 2) have a reduced overall number of credits of 126, which is closer to the total number of credits advised by the UA BoR; and 3) address the concerns raised by our stakeholders. Table 1 contains the proposed revised GE curriculum, the result of several iterations involving college strengths as well as State needs. A revised proposed CE curriculum also is included (Table 2) to illustrate efficiencies created by

offering common courses required for both programs; these common courses were identified by the stakeholder surveys.

To ensure that the GE curriculum meets the general ABET criteria for engineering programs (such as a minimum of 30 semester credit hours of mathematics and basic sciences, a minimum of 45 credit hours of engineering topics), as well as specific criteria for Geological Engineering programs (see Appendix B for the detailed ABET criteria), the GE Restructure Task Force worked from the "bottom up," ensuring that the bare minimum requirements were met before adding additional courses that focus on topical areas within geological engineering. One specific *ABET requirement for GE is "the ability to apply elements of geophysics" to engineering problems*. Stakeholder survey results also identified the need for geophysics to characterize the subsurface. It must be stressed that geophysics applied to near-surface problems, such as locating mineral resources, analyzing embankment structure, characterizing groundwater, or determining depth to the permafrost table, is *markedly different than solid-earth geophysics. Thus, the proposed GE curriculum includes Engineering and Environmental Geophysics, which is a modernized version of an existing course taught by a GE faculty member.*

Reducing the total program credits was accomplished through (1) combining two existing GE courses (Principles of Terrain Analysis and Engineering Geology and Remote Sensing) into one new proposed course (Terrain Analysis and GIS); (2) dropping the requirement of Thermodynamics; and (3) reducing the number of credits for the summer Field Methods courses from 6 to 4. The proposed new course (item 1) has the added benefit of incorporating the use of geographic information system (GIS) software as a program requirement, which helps to modernize the GE curriculum with needed software skills.

Following Chancellor White's guidance to create a program requiring fewer resources, it is imperative that the smaller number of faculty to teach the curriculum must have the expertise necessary to cover the broad aspects of Geological Engineering. Educational degrees in Geological Engineering, additional background in Geology, and expertise in the programmatic focus areas would ensure that all necessary courses in the proposed curriculum could be properly delivered. Table 1 contains the proposed curriculum to satisfy all ABET accreditation requirements, to address the foundational state needs, designed to be taught with a reduced faculty size, to take advantage of course sharing opportunities with CE, and to incorporate modern topics.

Table 1. Proposed Geological Engineering curriculum, with a total of 126 credits. Underlined and italicized courses may be co-taught with CE; * denotes choice of courses with either CE or MIN focus; AF indicates Arctic focus.

YEAR	Fall	Credits	Spring	Credits
Year 1	Intro. to Geological Engr	1	Calculus II	4
	Calculus I	4	Gen'l Geology for Engineers	3
	Chemistry I	4	Chemistry II	4
	* *Surveying*	3	Oral Communication	3
	Writing Across Contexts	3	Writing and the Sciences	3
	Library Info. and Research	1		
	TOTAL CREDITS	**16**	**TOTAL CREDITS**	**17**
Year 2	Calculus III	4	Differential Equations	3
	Mineralogy	4	Mechanics	4
	Physics I	4	Physics II	4
	GER	3	Petrology	4
	TOTAL CREDITS	**15**	**TOTAL CREDITS**	**15**
Year 3	Mechanics of Materials	3	Fluid Mechanics	4
	Soil Mechanics AF	3	Structural Geology	4
	Sedimentology	3	Rock Mechanics	3
	* *Statistics*	3	Terrain Analysis and GIS AF	3
	GER	3	**TOTAL CREDITS**	**14**
	TOTAL CREDITS	**15**	Field Methods AF - SUMMER	**4**
Year 4	Engineering and Environmental Geophysics AF	3	Senior Design	3
	Groundwater AF	3	<<Technical Elective>>	3
	* *Economics* AF	3	GER	3
	<<Technical Elective>>	3	GER	3
	GER	3	GER	3
	TOTAL CREDITS	**15**	**TOTAL CREDITS**	**15**

Technical electives may be chosen from the following courses depending on a student's interest (classes taken from different programs may require additional prerequisites):

MINING OPTION:	Computer-aided Mine Design - VULCAN Ore Deposits and Structure
WATER RESOURCES OPTION:	Environmental Engineering Water Resources Engineering Environmental Engineering Design Hydrologic Design and Analysis
PETROLEUM OPTION:	Reservoir Rock and Fluid Properties Well Logging Drilling Engineering

GEOTECH/ARCTIC OPTION:
Slope Stability
Geohazard Analysis
Foundation Engineering
Introduction to Permafrost Engineering
Arctic Engineering
Geomechanical Instrumentation
Design of Earth Dams and Embankments

We note that the GE curriculum described above is associated with the BS in geological engineering rather than the MS. However, both the BS and the MS programs will be retained. The BS program was the primary focus of the Task Force's work because the BS program development is driven by factors related to ABET-accreditation. CEM, similar to most other engineering colleges nationwide, does not seek program-level accreditation for its graduate engineering programs, therefore the graduate program offerings are more flexible. We anticipate that two faculty members with geological engineering degrees could deliver the program described above, leveraging resources from faculty associated with other programs, by teaching approximately three GE-specific undergrad courses per year, each. As the current standard faculty courseload in CEM is four courses per year, the above design would provide for two graduate level or grad/undergrad stacked technical electives delivered by GE-degreed faculty per year. Other graduate offerings could be leveraged/shared with other programs in CEM (e.g., mining, petroleum, or civil) or elsewhere on campus, which is the common practice.

In addition to changes in GE, the CE curriculum will be restructured to both modernize and take advantage of course sharing with GE. For illustrative purposes, Table 2 is an early draft of how the CE curriculum might be restructured to take advantage of the course sharing opportunities afforded by a closer alignment with GE. While Table 2 provides initial directions, we expect to continue working with the CE curriculum to identify additional modifications.

Table 2. Proposed Civil Engineering curriculum, with a total of 128 credits. Underlined and italicized courses may be co-taught with GE; [AF] indicates Arctic focus.

YEAR	Fall	Credits	Spring	Credits
Year 1	Intro. to Engineering [AF]	3	Calculus II	4
	Calculus I	4	Gen'l Geology for Engineers	3
	Chemistry I	4	Chemistry II	4
	Surveying/CAD/Programming	3	Oral Communication	3
	Writing Across Contexts	3	Writing and the Sciences	3
			Library Info. and Research	1
	TOTAL CREDITS	**17**	**TOTAL CREDITS**	**18**
Year 2	Calculus III	4	Differential Equations	3
	Physics I	4	Physics II	4
	Statics	3	Dynamics	3
	GER	3	Environmental Engr [AF]	4
	GER	3	GER	3
	TOTAL CREDITS	**17**	**TOTAL CREDITS**	**17**
	Mechanics of Materials	3	Structural Analysis	3

Year 3	*Soil Mechanics* AF	4	Transportation Engr AF	3
	Engineering Analysis	3	Water Resources Engr AF	3
	Statistics	3	Properties of Materials	3
	Fluid Mechanics	4	Thermodynamics or Electrical Engr	3
	TOTAL CREDITS	**17**	**TOTAL CREDITS**	**15**
Year 4	Steel Design	3	Senior Design	3
	Economics AF	3	<<Technical Elective>>	3
	<<Technical Elective>>	3	GER	3
	<<Technical Elective>>	3	GER	3
	GER	3		
	TOTAL CREDITS	**15**	**TOTAL CREDITS**	**12**

Technical electives may be chosen from the following courses depending on a student's interest (classes taken from different programs may require additional prerequisites):

STRUCTURAL EMPHASIS:	Reinforced Concrete Design Timber Design
WATER RESOURCE EMPHASIS:	Hydrologic Analysis and Design Groundwater Dynamics
GEOTECHNICAL EMPHASIS:	Foundation Design Permafrost Engineering
ENVIRONMENTAL EMPHASIS:	Environmental Engineering Design Air Pollution
OTHER:	Arctic Engineering Construction Bid Preparation

Conclusion

In conclusion, the curriculum plans outlined in this document provide a well-considered roadmap to a successful future for the geological and civil engineering programs. This roadmap was developed by experienced GE and CE faculty members working together with CEM administrators, and was informed by considerable stakeholder input. Detailed curriculum development is an iterative an ongoing process, however, requiring significant input from the faculty delivering the programs. Thus, we expect all faculty retained in these programs to continue modernizing and adapting their curricula in the coming years, and to ensure that GE and CE leverage resources where possible, while retaining separate identities as individually-accredited engineering programs.

APPENDIX A: ONLINE SURVEY

Invitation Letter to Stakeholders

16 April 2020

Dear UAF Geological Engineering / Civil Engineering Stakeholders:

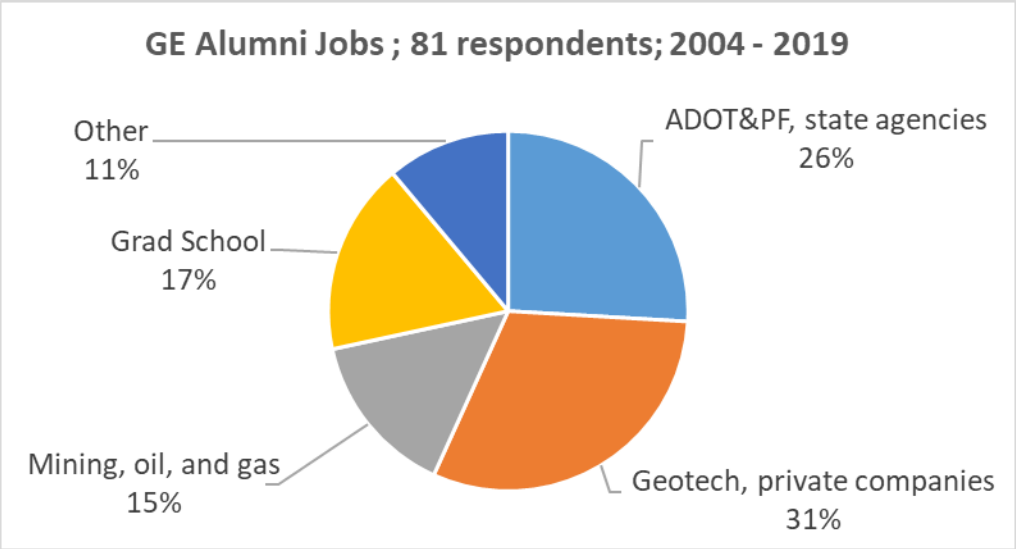
As you are likely aware, UAF is engaged in an Expedited Program Review process in response to ongoing and predicted future budget reductions. Detailed results of the review to date and plans for further actions can be found at the UAF Expedited Program Review Website.

Most recently, Chancellor White has recommended that UAF's Geological Engineering (GE) BS and MS programs be restructured, reduced in faculty numbers, and housed within the same department that houses the civil engineering program. The chancellor also specified that the BS program in GE would be structured in a way that it will maintain ABET accreditation. Thus, the recommendation is for a more focused GE program that delivers ABET-accredited geological engineering BS degrees as well as associated geological engineering MS degrees.

The rationale for developing a single department housing CE and GE is to promote sharing of similar classes and leveraging of resources, under the conditions that we will have fewer faculty members. While civil engineering and geological engineering are distinctly different degree programs, they share numerous topical areas within their listed programmatic requirements that can be leveraged into a suite of courses that fulfill some of the requirements for both programs. Of course, each program would also retain a suite of courses that are program-specific. Moreover, even in the restructured program, GE would continue to share teaching resources where appropriate with other programs such as mining engineering, petroleum engineering, and the geology program.

I am writing this letter to solicit stakeholder input regarding the restructuring of the geological engineering BS and MS programs. I seek input from the civil as well as the geological engineering communities because the civil curriculum will also need to be modified such that more of its components will meet the needs of the geological engineering students as well as its civil students. In order to gather input, we have designed a survey intended to help us understand your views regarding what should be the primary focus area of the restructured program.

In order to provide context regarding geological engineers in the Alaska workforce, I am attaching a graph depicting survey results from UAF GE graduates between 2004 and 2019. Specifically, the graph depicts where our students went to work following graduation. The graph represents all of our graduates between 2011 and 2019, and a some of the graduates dating back to 2004 (the graduates for whom we have data).



We would appreciate hearing your input as we move forward on the restructure. We have developed a Google survey form, and hope to receive your input by April 24th, 2020. You should be able to access the form by clicking this Google Survey Link. If there are other stakeholders you believe we should hear from, please feel free to pass this letter along to them as well. We do ask for the names and affiliations of respondents, but that is the only question on the survey that specifically requires an answer.

I note that the Board of Regents will be hearing testimony on all programs impacted by expedited program review, so you will have opportunities to provide testimony regarding this topic or others if you would like. Information regarding testimony to the BOR or the UA statewide administration can be found at the UA Statewide Expedited Review Website.

I recognize that many of you are working under challenging conditions at the moment, and most of us are worried about what the future holds for Alaska's physical and economic health. Thus, I really appreciate you taking the time to consider and provide input on how we can best serve the needs of the state by developing successful programs.

I believe that our students, our university, and our state will create a bright future.

Kind regards,

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Survey Responses

To ensure anonymity, responses to questions revealing respondent names, affiliations, or identified relationships to UAF programs have been omitted from these survey results. All other responses are presented verbatim. Each separate line entry represents an individual response from a single survey respondent.

Survey Question: In your opinion, what are the two most important skills or knowledge sets held by graduates of the UAF geological engineering programs?

Versatility and soil mechanics

specific experience with Alaska conditions

Field methods (drilling, sampling, instrumentation), soil mechanics

Comprehensive knowledge of geology and geo-engineering and multidisciplinary training in pertinent engineering disciplines

Geo-environmental engineering (geologic hazards assessment) and engineering site selection

Ability to interpret site subsurface geologic conditions and hazards and apply knowledge to the design of earth/rock structures and structure foundations

Students with strong critical thinking, math, and technical writing skills

basic engineering thinking, curiosity and love of learning, desire for excellence

1. Basic quantitative problem-solving ability 2. Located in Alaska

1) Identifying geologic hazards (such as landslides, rockfall, swelling/collapsible soils) as a mechanical process and how geologic hazards can be destructive to assets such as roads, highways, pipelines, etc.

2) Understanding the importance and implications of geological engineering in various aspects of the industry such as: asset management, transportation corridor assessments, environmental assessments, foundation design, and city/county geohazard assessment to name a few.

Ability to understand geomorphology, in situ properties, and structure of geology for applications in engineering design.

Knowledge of Alaska's mineral resources for development through geophysical investigation and water management requirements.

Properties of Materials, Soil Mechanics

GE is a program that incorporates two separate fields, geology and engineering. A GE graduate can in the simplest terms apply knowledge from both engineering and geology which covers a broad range of applied knowledge and applications. By this nature, GE tends to be a field of study that promotes and encourages a multi-disciplinary outlook. This skill set transfers to a graduate’s professional careers in which a broad outlook is generally needed.

Their background in geology and understanding terrain and depositional settings. This knowledge enables geological engineering graduates to predict subsurface conditions, identify geologic hazards, and better understand the engineering properties of both foundation soils and aggregates.

Their understanding of permafrost, including its distribution, engineering properties, and methods to preserve it. This is particularly important knowledge considering the miles of linear infrastructure and multitudes of buildings that are currently founded on permafrost in Alaska. This knowledge will likely be more so important with maintenance and future development of Alaska's infrastructure in a warming climate.

Alaska- specific focus

Strong knowledge of soil and rock mechanics. Strong knowledge of Geology.

Foundation Materials, Geotech Engineering

Geological knowledge of rock types, knowledge of soil properties

Knowledge of geological processes and the ability to extrapolate conditions beyond the drill hole or escarpment. Also, incorporating geological processes encourages the engineer to think outside the realm that everything is solved by an equation. Extrapolation of time and point specific data must be applied to anticipate and appropriately design for changing conditions.

1) Working knowledge of basic soil mechanics and lab testing procedures related to developing geotechnical material properties (modified proctor, uniaxial compression, triaxial compression, etc.). This provides a great foundation to build from in the professional world by allowing one to recognize some of the basic attributes that play roles in modeling and design elements that easily progress from simple to complex. Information utilized comes directly from field programs performed or provided by clients, and being able to discern credible/non-credible results aids the overall modeling and design effort.

2) Basic understanding of geologic processes and structures -- mineralogy, weathering, faulting, deposition mechanics, etc. With respect to field programs, some information is obtained by performing background research that aids with anticipating what is to be found by drilling, excavating, and monitoring. These assumptions are then tested by completing the field program, and ultimately wind back into development of project deliverables whether it be reporting, modeling, of design recommendations. By understanding the geologic processes, one is better equipped to ascertain the interworking elements that lead to providing a well-rounded recommendation.

Knowledge and understanding of frozen-ground dynamics. Knowledge and understanding of Alaska geology.

Engineering Geology and geohazards knowledge

1) Alaskan geological circumstances, and 2) 50 years of practical results from wide array of Alaska/northern projects

Understanding of subsurface heterogeneity, analytical skills.

Cold climate expertise and subsurface knowledge

Bring together the geology and the engineering skills. Similarly, bring together geophysical and geochemical with the engineering skills.

Thorough understanding of Geology and how it impacts engineering projects. Engineering of earth materials in all aspects from soil mechanics, groundwater, slope stability, economics, earth material properties to economics.

Geology (Terrain Analysis, structural geology, geology for engineers) and Geological Materials Engineering.

Understanding geological processes to be able to identify hazards that can pose a threat to infrastructure, etc. and then also being able to mitigate these hazards.

The single most unique geologic feature in Alaska is permafrost, and PF is, arguably, the single biggest challenge and geohazard in Alaska. While universities around the US (and the globe) have become enamored with studying permafrost recently, UAF is undoubtedly the leader in permafrost research and engineering in the US. UAF GE graduates get exposure to fieldwork, training and world-renowned expertise that is simply not available elsewhere. The GIS and technical writing skillsets UAF GE graduates come with is invaluable. Obviously the geologic and geotechnical training is the foundation, but we can teach someone with some geologic experience how to log boreholes, but we can't teach them how to write well, and we don't have time to teach them to be proficient in GIS. It is one thing to be technically knowledgeable and competent (they are), and another to be able to convey data in a logical and coherent manner so that an audience of various backgrounds can use that information to make intelligent engineering decisions.

Survey Question: What are the topical areas of overlap between geological engineering and civil engineering that you believe should be leveraged in the restructured curricula?

Soil mechanics, some geo classes, engineering statistics

Hydrological and Soil Mechanics

Geotechnical engineering including frozen ground engineering, soil mechanics, geo-hazards (earthquakes, slope stability, etc.), foundation engineering, surveying, underground water, and basic geology.

Geotechnical science and environmental studies specialties

geotechnical foundation design, structural aspects of foundation design, frozen ground engineering as related to civil site development and foundation design

Soils... especially as they pertain to permafrost, liquefaction, and other local conditions for roads and foundations of critical facilities and public infrastructure - including homes.

engineering design thinking, cold regions engineering,

Basic ES and structures, probably transportation, since most GEs go to work in transportation.

Geographic Information Systems (GIS), Soil Mechanics, Foundation Design, Geologic Hazard Mitigation Systems

Studies in slope stability, hydrology (both surface and subsurface), survey, and soil mechanics.

Properties of Materials, statics

The continuum of applied earth sciences can generally be stated as Engineering–Civil Engineering–Geotechnical Engineering– Geological Engineering–Engineering Geology–Geology. The primary overlap would be would be geotechnical and geological engineering. Geotechnical engineering deals with the mechanics of Soil/Foundation/Rock/Groundwater Engineering. A component of geological engineering is also geotechnical engineering, but a greater emphasis is placed on understanding the geologic systems which influence geotechnical engineering. Geological engineering is a broader more "integrative" version of geotechnical engineering. If GE and CE at UAF would leverage more resources together, it might be a chance to offer a "geotechnical" emphasis within the CE program. A course such as MIN370 Rock Mechanics, is generally taught in the civil engineering disciplines as it has broad application for civil infrastructure problems. GE 365 (Geological Materials Engineering) and CE 326 (Introduction to Geotechnical Engineering) as a whole are very similar and are an introductory geotechnical engineering course. There can be an overlap in ground water courses, GIS, and remote sensing between the two. CE offers a water resources course. GE currently only offers ground water hydrology, however a surface water hydrology course would benefit GE students as they will likely encounter this in real practice. MIN 408 (Mineral Valuation and Economics) is essentially an economics course as applied to earth sciences, this can be adapted to a CE based course which could cover a similar range. It is possible that an environmental engineering course could benefit GE as well, as environmental concerns (i.e. permitting) have become such a large part of engineering projects. Surveying can be grouped together with a small module in the CE based surveying which incorporates below ground methods. The GEOS courses for GE are critical for the program. It is important that the core nature of each program is not compromised however.

Soil engineering; including soil classification and characterization, and engineering. The geological engineering program compliments the student's understanding of soil engineering

with an understanding of soil geneses and distribution not presented to students by other branches of engineering.

Soil Mechanics and Rock Mechanics.

Rock mechanics, use of geophysical methods

Soil/Rock Mechanics, Foundations, Slope Stability

Cost estimating, survey

Soil properties and testing methods for construction

Geotechnical and environmental

Overlapping Areas: Engineering Surveying; Mechanics (Statics and Dynamics); Engineering Economics; Geotechnical Engineering and Soil Mechanics (to an extent); Hydrology and Water Resources (to an extent); Basic Mathematic and Statistics requirements

Geological engineering does not lean into the design and drafting specifics that the civil engineering curriculum does, but basic skills related to AutoCAD/Civil 3D, reading and understanding an engineering plan set, and developing a broader exposure to materials testing (concrete) would be overall beneficial to an aspiring geologic engineer. Many of the basic math and engineering requirements for both curriculums overlap, with geologic engineering keeping geology related courses early and tending towards a more geotechnical-heavy engineering aspect later on.

geology, surveying, some modeling (i.e., rocscience, geostudio suite)

Civil Engrs learn "Soils" and ground strength. GEs go way beyond that to awareness of ground conditions and problems caused by geological realities

Rock mechanics, geotechnical engineering, environmental fluid mechanics

Hydrology/water resources

Strength of materials and possibly surveying.

The ability of staff to co-teach classes to reduce the faculty cost to the college. However, this applies to all the engineering disciplines, and not just the referenced areas. This also applies between campuses in Fairbanks and Anchorage. It appears to be a viable cost-saving measure.

Soils mechanics/testing, foundations, slope stability

Both geological engineering and civil engineering have geotechnical engineering/soil mechanics, hydrology, and permafrost topics that overlap. The geological engineering program would benefit from the more extensive hydrology and permafrost instruction offered by the civil engineering program.

Several of the GE program technical electives are already CE classes-environmental, water, etc. Some of the GE classes involving earthwork and civil construction might be combined with or transferred to the CE curriculum-e.g., Dams, Slope Stability, Surveying. Perhaps some courses can be cut back and/or consolidated, such as Surveying, Mineral Economics and Software Training. DOT&PF is embracing improvements in geophysics technology and interpretation software. Giving CE students exposure to geophysics would help them understand it capabilities and limitations and improve the efficiencies of civil project design.

Survey Question: What are the most important ways by which UAF geological engineering graduates provide value to the Alaska workforce?

We are a versatile workforce bringing our expertise to a multitude of engineering sectors. We are able to function in geotechnical, environmental, civil, and mining professions, among many others.

Knowledge of northern specific challenges (permafrost, construction constraints). Currently fills the gap of geotechnical knowledge that may exist for newly graduated Civil students.

Geological engineering graduates often time work for firms in geotechnical firms, oil and gas industry, mining companies, and government agencies

Produces highly skilled graduates who can contribute to the safety and well-being of Alaskans and the infrastructure that supports the state's industry and communities, with specific capacity in cold regions (frozen environment and the behavior of frozen soil as an engineering material) and geologic hazards assessment.

Knowledge of geology and geologic hazards as they relate to and impact site or project development

Proper input for designs of roads and building infrastructure, as well as petroleum/mineral development.

knowledge of geologic hazards, solid engineering training

Good basic engineering skills and the ability to live and thrive in Alaska.,

Geological Engineering provides the student to wear two hats: one for a geologist and one for an engineer.

We provide the necessary skill set industry requires for development of Alaska's resources and engineering design in cold regions.

Engineering and analysis for foundations, utilities, roads and Airports.

Alaska is a state that requires a workforce that is strong in applied earth sciences as many of its major industries are related earth based resources. Alaska workforce applications range from infrastructure work (e.g. AKDOT), geologic hazards, resource development industry, consulting professions, and management.

Graduates from the UAF geological engineering program get hired. They work in the mining, petroleum, and infrastructure industries. Many of these graduates get hired locally and stay. The agencies that hire graduates from the UAF geological engineering program include the Alaska Department of Transportation and Public Facilities, United States Army Corps of Engineers, Kinross, and local engineering consulting firms. Geological engineering graduates apply their uniquely combined knowledge of geology and engineering to help their agency better maintain and develop infrastructure, and safely develop resources.

Providing Geotechnical analysis and guidance.

Home grown talent that wants to continue to live and work in Alaska. Students at UAF develop strong connections and relationships with others in similar fields that will eventually be colleagues, coworkers, and clients.

Applying geological engineering principles to evaluate project material sources for suitability and cost effectiveness, and analyzing foundation integrity and stability of embankments and drainage structures.

Strong background in geology and Petrology are a tremendous aid in both mineral exploration and construction in the challenging and diverse climate and soil conditions in Alaska.

GE's provide invaluable insight to planning and overall design of horizontal and vertical infrastructure projects. Most specifically by recognizing cryo/geo hazards to be addressed, and providing alternatives which typical trained geotechnicals and site civil engineers would otherwise not see. This is an undervalued strength in light of the changing climate and the impacts to the landscape, existing and proposed infrastructure.

The program is very Alaska-centric. The problems and concepts explored in class relate specifically to Alaskan locales and issues with frozen ground. This provides graduates a leg-up in finding work specifically in Alaska as they are better equipped with a basic suite of knowledge to tackle the adverse environments and issues present around the state.

Not only this, but the call for geological (and geotechnical engineering) continues to grow as measures are taken to assess and improve foundations in the face of earthquake hazards or provide designs and recommendations for roadways, public, industrial, and private developments through construction projects and field reconnaissance programs. GE graduates have the ability to step into a variety of roles about Alaska, whether it be a state industry, construction, mining, or oil and gas. As arctic environments continue to experience change, there will be greater stress on reviewing ground stability, water quality, and erosional problems that GE grads are given insight on during their course work and provide an extra tool in their repertoire for securing employment and providing solutions across the state.

Locally educated graduates with strong understanding of Alaska geology and frozen-ground engineering. UAF GE graduates have the technical knowledge that is directly applicable to the projects, clients, and markets my company serves.

knowledge of diverse geological features within Alaska

A number of UAF GE graduates are and have provided major help to Alaskan heavy construction projects, and mining programs, for decades

GE grads are versatile professionals employed in a number of industries important to Alaska.

Creating solutions for cold climate and permafrost regions.

GE provides an engineering degree that has an in-depth understanding of the geology, geophysical and geochemical areas. The top positions in most mines and mineral companies are held by individuals with mining or geological engineering degrees.

The wide variety of sectors which Geological Engineers can be employed provides value to the Alaskan workforce.

There are many geological engineering graduates working in different areas at DOT&PF. The many jobs these graduates hold as engineers; for example in Design, Construction, and Maintenance and Operations, proves that graduates of geological engineering can provide value to the workforce in Alaska that requires many different skill sets.

UAF’s GE program has produced many highly effective engineers and engineering geologists.

Survey Question: In what way or ways might a closer association with the geological engineering programs impart a positive impact upon the civil engineering programs?

Civil engineers and geological engineers always need to work together for cost effective solutions to make project work. Start that work in school. They are always connected.

Increase exposure to geotechnical and soil mechanics areas (slopes, foundations, etc.)

The current CE program will be enhanced with a more in depth curriculum in geotechnical engineering

Provide opportunity for civil engineering students to gain a better understanding of the geological-geotechnical context in which structures are built.

The unique geologic/frozen ground conditions in Alaska impact civil design and are significant concerns in project development, construction cost, and operation. Civil engineers would benefit from more knowledge of these concerns.

It could better foster a working relationship between the two disciplines.

familiarity with geological and geotechnical hazards that affect designs in Alaska

A geological engineering focus implemented within the civil engineering program would help to boost education and knowledge of soils and rock as it pertains to infrastructure and design. Additionally, implementation of educating students in software such as ArcGIS, Rocscience, and gINT will increase value to students graduating from this program.

This association will provide a greater knowledge base for students, or future grads, to incorporate what they learn from both disciplines to become better engineers. Working with GE students will offer CCE students a different outlook on what they do and how both can benefit from each other's skill sets.

The two disciplines work very closely in the design and construction industries. Close association at the undergraduate level would reinforce collaboration and awareness.

GE incorporates both the principles of geology and geotechnical (geo-mechanical) engineering for application to earth science work. A major deficiency for many geotechnical engineers in practice, is the lack of understanding (or use of understanding) of the geologic systems when applied to their design work. This tends to be a strong point for GE programs. CE students that have a geotechnical engineering interest or emphasis would benefit from this increased knowledge source. You would also retain GE assets in terms of facilities (labs), faculty (all though a bit reduced), and knowledge to benefit CEM and UAF that would be lost if the program were terminated.

From 2020-2021 Criteria for Accrediting Engineering Programs For programs with Geological Engineering Programs: "" engineering knowledge to design solutions to geological engineering problems, which will include one or more of the following considerations: the distribution of physical and chemical properties of earth materials, including surface water, ground water (hydrogeology), and fluid hydrocarbons; the effects of surface and near-surface natural processes; the impacts of construction projects; the impacts of exploration, development, and extraction of natural resources, and consequent remediation; disposal of wastes; and other activities of society on these materials and processes, as appropriate to the program objectives."" The reality is this also applies to a great number of CE based emphasis such as environmental, geotechnical, hydrology, and ground water hydrology, etc. The only CE field that it may not apply directly to is structural engineering. This suggests many possible sources of overlap and a positive influence of GE based curriculum on CE programs.

The geological engineering program could compliment the civil engineering program by emphasizing the importance of geologic knowledge in geotechnical engineering.

Critical exposure to slope stability mechanics pertinent to Alaska mining operations and Civil/Marine construction projects.

Civil engineering graduates will have a better understanding of soil/rock properties that influence design.

Applying localized geologic conditions to design concepts.

Short answer is the additional geology and geotechnical classes that GE students take. This may not be practical though if the GE professors are cut. Eventually faculty with only geotechnical would end up at UAF. And then Alaska's mineral industry, which is one of the top industries in the state, would not be able to hire UAF grads and would be forced to bring out of state engineers with no Alaska specific training. Seems very short-sighted.

It would provide more involvement of earth processes in the engineering curriculum, providing an engineer the ability to think also like a scientist. Much in the way the biological knowledge aids sanitation and water treatment engineers.

A closer association would provide a broader outreach to prospective students about entering the geotechnical field. A fair portion of the work early on in the career is related to performing field duties in places like large construction sites, roadways and bridges, remote mine sites, as well as oil and gas fields. The information provided to a civil design team for development of a structure is first obtained by someone who completes a field program attaining information on foundational settings and performing tests on what loads and footings may be required for vertical construction. Exposure to this realm ultimately broadens the horizons of prospective engineers by showing the entire process in motion, from reconnaissance to design to construction.

If a Civil student wanted to go the geotech route, offering GE courses would definitely be beneficial to his/her skill set.

Most UAF CE students would/could gain from enhanced GE focus. But the reality is that most would choose (as they do now) other paths, without the geological focus. To the detriment of Alaskan future

It would provide CE students with more course options and exposure to relevant geoscience subjects.

CE program may be positively impacted by collaborating on a wider set of problems, possibly with greater emphasis on subsurface.

I do not know of any.

Most civil engineers have an inadequate understanding of earth materials and processes and so cannot adjust designs appropriately.

A closer association with the geological engineering would better prepare civil engineers working in the consulting industry by providing more "tools" to their kit. Helping them see the bigger picture through understanding of the geological history of the project sites they are working on.

There are topics that are covered in geological engineering that would be beneficial for civil engineering students to learn. Civil engineering could benefit from learning more about terrain analysis, slope stability (and other geohazards), and GIS instruction.

The GE program places a high emphasis on GIS, Remote Sensing, Geophysics, and other recent and developing technology. In the transportation industry, we are embracing these technologies, and the GE experience may be directly transferrable to many CE applications. Civil and Mechanical Engineering students are inclined towards “hard numbers”. Mining and Geologic Engineering students are forced to accept and work with natural variability in their medium. E.g., -Bridge design involves known dimensions, geometry and material properties, and “the answer” is either correct or not. Rock mechanics involves a range of materials properties and subjective determination of conditions, and “the answer” can be “fuzzy”. Appreciating these different perspectives is important for practicing engineers, and more interaction between GE and CE should foster that understanding.

Survey Question: In your opinion, what are the potential strengths of the proposed restructure?

Civil engineering is a very common and sought out engineering degree, so mixing GE classes will open up the geological engineering field in Alaska

Greater understanding of both sides of the practical impacts of design or construction decisions.

Geological students gain exposure to civil subjects such as design, foundations, pipelines, water, and structures (dams, roads, etc.) that are sure to be part of future work. Civil gains exposure to soil mechanics and slope knowledge that applies in the same way.

Better integration of two curricula and better utilization of faculty resources

The GE program is small, which amplifies its vulnerability to relatively small disruptions---for example, the loss of a single faculty member has disproportionate negative impact. Being partnered with a larger program such as Civil Engineering may help GE better able to weather such disruptions. The proposed restructure should also reduce costs by consolidating duplicated or redundant administrative, facility, and staffing needs.

Both CEs and GEs would benefit from the combined classes and both would have better capabilities for working as EIT geotechnical engineers.

Cost savings.

cross-training is always beneficial, most innovations come from cross-trained individuals who see things from several perspectives and think outside the box

The proposed restructure could boost interest in the civil engineering department while simultaneously making the department and research more well-rounded. Civil and geological engineering cross paths in a lot of different ways from initial site investigations to final design. Merging these two programs would make students more desirable to employers and also enrich the ongoing research.

Shared resources and a closer association between faculty to structure curriculum to become more competitive with other universities for enrollment.

Collaboration and awareness in civil projects.

The proposed strengths reduces faculty in GE to help address some budget issues. The restructure allows the GE program to adjust its program to modernize its offerings. Inclusion of the GE program can strengthen the geotechnical offerings of the CE program. There is also the possibility of GE program attracting more students when linked to the CE program. This may or may not be feasible or possible, but with a restructure it may be beneficial to look into the potential of offering a minor in the GE program. This may be attractive to geology (GEOS) students for whom a link to engineering may be beneficial for future careers and for CE students who want a stronger emphasis in geotechnical aspects than what is currently offered (which is minimal) at UAF.

I understand an alternative to the proposed restructure is deleting the geological engineering program from UAF. Deleting this program would be a mistake. The proposed restructure's greatest strength, therefore, is providing an avenue to retain the geological engineering program.

More exposure of Civil students to pertinent Geological aspects.

Civil engineering graduates will have a better understanding of soil/rock properties that influence design. Geological engineers should benefit from exposure to more design principals/direct applications for their knowledge of soil and rock mechanics.

Higher focus in transportation engineering and other infrastructure construction type aspects. Stronger applicants for transportation engineering positions.

Seems like it would only benefit the Civil Engineering Dept.

Providing geotechnicals and environmentals with much greater insight to overall site conditions and alternatives to design. This is very important with regards to climate warming, warming and degrading permafrost, and changing hydrological regimes.

The restructure allows for a partial reorganization of the program and a streamlining of efforts that could make the GE program more approachable and ultimately more successful due to exposure and work with the CE department and program. Reorganizing will help with costs and future budget restrictions that may befall the university, and provides a way to keep the ABET-accredited program alive in Alaska, serving the interests of Alaskans as the state continues to weather coming change. It will also work in the favor of the GE students by hopefully exposing them to more of the CE program and some of the coursework thereby, such as drafting and/or modeling which are industry utilized tools where even a small amount of familiarity is useful.

This is a fiscally driven restructure. The potential strength of the restructure is to continue to provide a GE degree in an accredited program. Without the restructure, it is likely the accredited GE program would not survive.

More diverse background for civil engineering students and vice-versa for GE students. Would allow tailoring of education to personal interests.

Strengths? That GE would not be totally unavailable, as a practical civil project focus. But it would be a distinct step back from previously available class selection focus of GEs.

It would provide more options for students and reduce redundancy in course offerings

Lower cost is the primary benefit, of course, but CE program with geological engineering course offering and degree program may attract interest from oil company employers.

I see none. I have not been made aware of any benefit to either program that cannot be accomplished with the degrees in the departments where they are now. If changes need to be made to these degrees I see no reason they cannot be made where they now reside.

CE students will benefit from a better understanding of geology.

There is a lot of overlap in the programs and reducing the redundancy through the restructure would make a stronger program.

Keeping the geological engineering program ABET accredited, being able to combine classes that overlap between the two programs, introducing geological engineering topics that would benefit civil engineering students

In an ideal world with adequate funding, a more loose association between GE and CE, with full GE staffing, would be ideal. But in light of funding realities, the proposed reorganization is a good compromise, and the sharing of staff should realize some efficiencies and savings. Having GE and CE students interact more will reduce the “silo” effect that can occur when programs are separated, and hopefully increase collaboration and appreciation for each other’s specialties.

Survey Question: In your opinion, what are the potential weaknesses of the proposed restructure?

GE was previously mixed with mining, so the same mixing of classes is occurring, but with a larger group of students.

Potential concerns related to ABET accreditation of the Geological Engineering BS program due in part to reduction of GE faculty

GE runs the risk of being diluted to extinction within Civil Engineering, losing its programmatic robustness in the effort to consolidate the disciplines. Reduction in faculty will mean loss of critical content-area expertise that may be difficult or impossible to substitute or reconstruct within the remaining faculty pool.

As long as the classes were available to focus either on the GE or CE pursuit I do not see a weakness.

Loss of important/valuable staff.

Weaknesses within this restructure would be associated with the expertise teaching the material. Obviously the professors would need to be educated and have experience with geological engineering within a civil engineering environment (design). Additionally, the individuals would need to be flexible enough to relay geological engineering materials to civil engineers and civil design.

None

Potentially less exposure to mining and petroleum applications.

There are also very few GE programs in the nation and it is important in restructuring not to the lose the essence of a GE program when including it within a CE offering. GE is not CE, but they do have the potential for a lot of commonalities which can enhance each other. It is important to build on the strengths of both so that a restructuring improves both programs. There could be a tendency to make GE essentially a civil engineering program. I would encourage all involved not to allow that to happen. Make both better and retain their strengths.

Biggest concern would be the curriculum. The geological engineering program's curriculum should maintain its uniqueness and emphasis on geology.

I understand there may be a reduction of the program's required credits. I am concerned that key courses in terrain analysis, structural geology, petrology, etc., may be removed in order to meet reduced credit load. Such cuts in the curriculum would be a mistake and detract from the valuable and unique knowledge provided by the program.

Potential for dilution of specific knowledge development in Geological Engineering aspects.

too few faculty will reduce the quality of the graduates

Combining the GE with CE will likely water down the geology and geological engineering base of knowledge that GE grads currently have.

Less focus on geologic aspects of engineering concepts, and less opportunities for graduates to be employed in mining industries (which many have been). May just become a Civil Engineering degree one the future with an emphasis.

It would have long term detrimental effects to the mineral industry of Alaska. Which given that the oil market is in such bad shape, one would think the University system would instead be

trying to improve the Mining and GE department. Graduating a few civil engineers with above average geotechnical background does not seem like a worthwhile trade off.

Possible compromise of the ABET accredited GE program.

Restructuring allows the GE program to continue, but I am hesitant to what extent the restructuring will take. The GE program would continue to integrate with the PE, MIN, and GEO departments as it presently does, although this seems slightly counterintuitive to the idea of a restructuring to bring the CE and GE departments closer together in topical areas. The areas of overlap generally fall within the realm of engineering science and some relations in geotechnical engineering and hydrology, otherwise the GE program is specifically distinct from the CE program. In restructuring, I'm concerned that the GE program will be relegated to a "specialized" sect of CE as opposed to maintaining its independent identity. Ultimately, I support the decision of restructuring, but I am curious to see what specific outcomes result from this decision.

Fewer faculty devoted to the GE, fewer elective opportunities for GE students.

Does not benefit CE students that are not interested in geology/geological engineering. Possible dilution of specific strengths within respective degrees.

I fear that our new ""restructured"" Civil Engrs, with GE ""specialization"" would not really have had access to all of the class content that has enabled past graduates to do such marvelous work, as real Geological Engineers.

Too much breadth at the expense of depth and a more focused curriculum

Geological engineering may not attract resources to remain a viable program.

A GE degree within CE will have a diluted focus. The distinction of GE and that skill set will be weakened.

The proposed plan calls for moving GE into CE and reducing GE faculty to two. I am concerned that two faculty will not be enough to meet the needs to deliver the required courses and therefore maintain accreditation.

The basic concept of the proposed plan is cost reduction through co-delivery of classes by faculty in all the engineering programs, and between campuses, coupled with enhanced recruitment effort for CE and GE. I applaud these cost reduction ideas and notes they should be happening in all the engineering programs, not just in justification of this proposal. In terms of cost reductions, these are low-hanging fruit across the CEM, and probably other parts of the university system too.

I am concerned that enhanced recruitment efforts are needed for ALL of the engineering disciplines, and not just for CE & GE as part of this proposed re-alignment.

As the name suggests GE it at the intersection of geology and engineering, with geology the discriminating element that differentiates between GE and CE.

Reliance on CE/EE faculty will reduce the strength of the very element that defines the program, as geology is not their area of expertise. Merging with CE will degrade the strong geology component necessary to provide this understanding.

Program placement undeniably flavors the program emphasis. Placing GE in CE vs ME, will also degrade the GE education in the areas of resource development, mining, rock mechanics, earth-moving, and economics, which are so important in all engineering involving the earth.

None of the points in the proposed plan to merge GE with CE only apply if GE is merged with CE. They all apply regardless of the location of GE, therefore a move to CE is not necessary to implement any of these proposals.

I am concerned regarding the level of outreach by the college, and the level of external input into the proposed plan. I am concerned that the survey sent out by the CEM is not a wide angled review of the structure of the CEM to find the best path forward, and encourage greater outreach and engagement.

none

Having to potentially eliminate positions

One of the great features of an engineering education at UAF is the relationship between students and faculty in small class settings, and the transfer of personal and professional experience beyond the official curriculum. Reducing GE faculty will narrow that experience and expertise that students can draw from, at least in the “hard” GE courses that require GE faculty to teach effectively. This will be mitigated somewhat by students increased exposure to CE faculty.

The University of Alaska’s objective should be to ensure that standardized education in Geological Engineering is available to minimize the impact of geological, geochemical and geophysical changes and any related incidents that might impact public and environmental health and safety. Moving the Geological Engineering program away from science, especially as a subordinate program of Civil Engineering is very likely to cause problems or to have adverse consequences. Rarely, in civil works has an original design NOT been modified. Geological Engineers consider the changes that might affect material strength, design of slope and pits, including potential for material alterations, the expected forms of exposure, the interaction of the different exposures and new developments. This is critical work that is required for responsible social and economic development in our Great State of Alaska. Science is based upon hypothesis, the best interpretation of the scientific facts available, but the Earth is dynamic, conditions are dynamic, change is constant, nothing remains stable in the long term. Civil Engineers demand numbers for design purposes from a Geoscientist. Geological Engineers work with designers to provide safe and reliable long-term solutions based upon the best interpretation of the facts provided by Geoscientists. Civil Engineers only want to know if the material is classified as clay, silt, sand, gravel or rock and the average material strength when placed in construction. They do not understand nor consider changing chemistry, physical stresses, and the effect of water, air temperature or pressure, natural erosion, the impact of asphalt pavement, and other urban and industrial developments. Civil Engineers rely upon scientific facts to design structures, but Civil Engineers are not trained to understand science, and they are certainly not forward thinking. Relegating the Geological Engineering degree program as a subordinate division in the Civil Engineering program, is a dangerous recommendation.

APPENDIX B: ABET CRITERIA

To maintain accreditation with ABET (https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2020-2021/), the following conditions need to be met.

- The General Criteria for Engineering Programs include:
  a. a minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.
  b. a minimum of 45 semester credit hours (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools.
- The Program Criteria for Geological Engineering Programs include:
  1. Curriculum - The program must prepare graduates to have:
     1. the ability to apply mathematics including differential equations, calculus-based physics, and chemistry, to geological engineering problems;
     2. proficiency in geological science topics that emphasize geologic processes and the identification of minerals and rocks;
     3. the ability to visualize and solve geological problems in three and four dimensions;
     4. proficiency in the engineering sciences including statics, properties/strength of materials, and geomechanics;
     5. the ability to apply principles of geology, elements of geophysics, geological and engineering field methods; and
     6. engineering knowledge to design solutions to geological engineering problems, which will include one or more of the following considerations:
        - the distribution of physical and chemical properties of earth materials, including surface water, ground water (hydrogeology), and fluid hydrocarbons;
        - the effects of surface and near-surface natural processes; the impacts of construction projects;
        - the impacts of exploration, development, and extraction of natural resources, and consequent remediation;
        - disposal of wastes;
        - and other activities of society on these materials and processes, as appropriate to the program objectives.
  2. Faculty - Evidence must be provided that the program's faculty members understand professional engineering practice and maintain currency in their respective professional areas. The program's faculty must have responsibility and authority to define, revise, implement, and achieve program objectives.