Engineering Science Infrastructure Option

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Introduction

The Engineering Science Infrastructure Option has been offered since 2001. Since then, high quality students have graduated from the program with a unique and highly marketable set of skills. The program is focussed on two traditional subdisciplines of Civil Engineering, transportation and structural engineering. However it seeks to go well beyond the core Civil Engineering curriculum in these two sub-disciplines by:

- Providing access to some of the most relevant courses from other programs (such as AER372-Control Systems and CHE 374 – Economic Analysis and Decision-making),
- Offering several dedicated courses that are intended to cover the basics of structural and transportation engineering at a faster pace than is covered in the general stream of Civil Engineering, that cover more "cutting edge" material, and that attempt to integrate the knowledge from subdisciplines of transportation and structural engineering.
- Offering a wide range of challenging technical electives that include both graduate and undergraduate courses.

While the infrastructure option can clearly be deemed to be a successful option, based on the success of engineering graduates that have come through the program, there is opportunity to further improve the curriculum. Suggestions for improvement have been made by both students and the faculty involved in the option.

The resources required to mount the option are high. Since its inception, the Infrastructure Option has attracted a relatively small number of students, yet it offers a greater number of dedicated courses than most other options (currently the option delivers eight courses dedicated to Engineering Science students). It is a challenge to provide a large number of dedicated courses to a small number of students.

For these two reasons, a task force of faculty members involved in delivering the option (in coordination with the Academic Planning Committee of the Civil Engineering Department) has been discussing possible improvements to the Infrastructure Option. The outcome of these discussions is a proposed revised curriculum that attempts to maintain the strengths of the current option, but take advantage of some significant opportunities for improvement.

Strengths of the Infrastructure Option

- The curriculum offers a unique combination of content, focused on structural and transportation engineering and planning, and the interaction between these two subdisciplines. This leads to Engineering Science graduates with a unique and marketable set of skills.
- The curriculum is challenging. Part of the intent of the current curriculum is to provide a fast-paced and intense learning experience that takes full advantage of

the abilities of high-quality Engineering Science students with strong scientific background from the first two years of the program.
- Students receive a strong core offering of both transportation and structural related courses in Year 3, which provides the necessary background for technical electives in Year 4.
- There is significant flexibility in the option, with seven technical electives and a complementary studies elective.
- Class sizes are small, and all students in the Infrastructure Option are together in at least one course per term. This adds to the cohesiveness of the class and ultimately to the student experience.

Opportunities to Improve the Infrastructure Option

- Many students that enrol in the program develop a primary interest in either transportation, or in structural engineering. There is an opportunity to provide more flexibility for students to further specialize in either transportation or in structural engineering than is possible in the current curriculum.
- The focus could be improved. Better guidance could be provided as to how technical electives should be packaged to result in a coherent and useful skill set. If a coherent set of courses are chosen, an official minor in Transportation or Structural Engineering could be offered.
- Flexibility to customize the option to emphasize related fields (for example, structures/architecture or transportation/sustainability), could be provided.
- The Infrastructure Design Project (CIV356F) is currently offered at the beginning of the third year, before students have taken courses related to either transportation or structural engineering. The design course could be improved by offering it at the end of the program, thus providing an opportunity to synthesize material from other courses.
- There are opportunities to reduce the resources required to deliver the option, by combining infrastructure option courses with graduate courses (for example, Infrastructure Economics). While class sizes increase, there are also clear benefits for infrastructure option students to be interacting with graduate students.
- There is an opportunity to increase the number of students that enrol, and thereby increase the overall impact of the option.

PROPOSED CHANGES TO INFRASTRUCTURE OPTION

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Sequence	Course name	Enrollment	Core
Transpo 1	CIV 355F Urban Operations Research	Infra + CIV grad	X
Structures 1	CIV 352F Structural Design 1 (see Note 1)	Infra only	X
Transpo 3	CIV 531F Transport III Planning	CIV elective	X
Structures 3	CIV 321F Soil Mechanics	CIV core	X
Economics	CHE 374F Economic Analysis and Decision Making	EngSci only	X
Praxis V	ESC 301Y Engineering Science Option Seminar	Infra only	X

Note 1:

In 08-09, the name of CIV 352F will be changed from Bridge Design to Structural Design 1. Content will remain the same. In 09-10, content of the course will change. Course will be team taught by members of the Structures Section in several short modules (structural analysis, steel structures, concrete structures).

3W

Sequence	Course name	Enrollment	Core
Transpo 2	CIV 359S Intelligent Transportation Systems	Infra + CIV grad	X
Structures 2	CIV 357S Structural Design 2 (see Note 2)	Infra only	X
Transpo 4	CIV 516S Public Transit Operations and Planning	CIV elective	X
Structures 4	AER 372S Control Systems	EngSci only	X
Complementary Studies Elective			
Praxis V	ESC 301Y Engineering Science Option Seminar	Infra only	X

Note 2:

In 08-09, the name of CIV 357F will be changed from Building Design to Structural Design 2. Content will remain the same. In 09-10, content of the course will change. Course will be team taught by members of the Structures Section in several short modules (structural dynamics, building systems, bridge systems).

4F

Sequence	Course name	Enrollment	Core
Economics	CIV 1310 Infrastructure Economics	CIV grad	X
Specialty 1	See Note 3	CIV and others	
Specialty 2	See Note 3	CIV and others	
Technical Elective	See Note 4		
Thesis	ESC 499F		X

Note 3:

Students taking Transportation as their specialty take any two courses from the following list:

CIV 427F Fundamentals of Geomatics Engineering I

MIE 512F Air Pollution

JPG 346F Urban Planning

MIE 515F Alternative Energy Systems

Students taking Structures as their specialty take any two from courses the following list:

CIV 416 Reinforced Concrete II

CIV 510F Solid Mechanics II

CIV 514F Concrete Technology

CIV 517F Prestressed Concrete

CIV 519F Structural Analysis II

CIV 575F Building Science

++++ Architecture course: to be determined ++++

Students who do not wish to declare a specialty take any two courses from either of the above lists.

Note 4:

The Technical Elective may be freely chosen from any 400, 500, of 1000 level course offered in Engineering provided students have taken the pre-requisite course. Other courses may be taken with prior approval.

4W

Sequence	Course name	Enrollment	Core
Specialty 3	See Note 5	CIV and others	
Specialty 4	See Note 5	CIV and others	
Specialty 5	See Note 5	CIV and others	
Free Elective			
Design	CIV 4XX S Collaborative Design Project	Infra only	X

Note 5:

Students taking Transportation as their specialty take any three courses from the following list.

CIV 1508S Airport Planning (offered every other year)

CIV 1337S Simulation (offered every other year)

CIV 1506S Freight Transportation and ITS Applications

APS 304S Preventive Engineering and Social Development

CIV 1538S Transportation Demand Analysis

Students taking Structures as their specialty take any three courses from the following list.

CIV 518S Behaviour and Design of Steel Structures

CIV 523S Urban Excavations

CIV 529S Rock Engineering

CIV 1164 Bridge Engineering

CIV 1171 Structural Dynamics

CIV 1174 Finite Element Methods

++++ Architecture course: to be determined ++++

Students who do not wish to declare a specialty take any three courses from either of the above lists.