UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

ELITE Master's Program

APS1025H1F2023 Infrastructure Protection Planning

Course Outline

Protection and adaptation address anticipated hazards and threats, the things we think might cause us to fail. Resilience allows us to survive and quickly recover from failures we could not have predicted. In practice, we need both to cost-effectively preserve future operational value and capability.

Introduction

Our world is changing. The trends in technology have fundamentally changed the way we live, work and play. These trends cause a steady concentration of value, such that an extreme event can result in a far more significant impact on operations and businesses than previously. Infrastructure defines the world we live in and encompasses the natural, built and virtual domains. We need to think of infrastructure as systems that fulfil a service to our operations, whether municipal, corporate, national or even international. Some infrastructure enables the essential functions that define our ability to operate, live and thrive. These are known as Critical Infrastructure, and it is vital to protect their purpose. Critical Infrastructure Protection (CIP) is not about protecting assets, though this is part of it. It is about protecting capability – life, property and economy. This is all the more relevant when we consider the health and economic impact on communities and individuals when these systems are interrupted and fail. We can't deliver the UN Sustainable Development Goals (SDGs) if there is no confidence in the essential services. Yet, in this rapidly changing world, so many familiar protection processes and procedures are based on less and less valid assumptions. We need to work from the first principles to protect our infrastructure now and into an uncertain future effectively. Our experience with the COVID-19 pandemic and its socioeconomic impacts demonstrate this.

Extreme events come in many forms, from natural to human-caused. However, they do not happen in isolation. For example, flooding can cause an extended power failure. Under the right conditions, this can make looting more likely. Thus, we can't separate threats and hazards into convenient single risk events. Instead, we must consider a broad spectrum of hazards, identifying the changing likelihood and severity of coincident and correlated hazards to the threat we focus on. This is known as a hazard profile and one of the key products of all-hazards analysis that we must investigate when considering how to protect infrastructure.

Join us as we explore the first principles of CIP, the risk management frameworks that provide the structure and auditable processes that we use, and how we identify the right tools for a given operation and situation. This course builds on many of the same principles and concepts taught in APS1024 Infrastructure Resilience Planning, but that course is by no means a pre-requisite. Instead, we will build our understanding, drawing upon the existing experiences and perspectives of the class body, apply these protection principles and concepts, and discuss how we might use them in practice. The course is practice-based, with a walk-through/talk-through followed by real

protection consulting projects for real clients in real-time. Students can add these projects to their experience portfolios. As is common in practice, so in class and after the first day, you will form into project teams for the remainder of the course.

When you complete this course, you can direct CIP planning in engineering projects, conduct the analysis and develop and present strategy proposals.

Course Designation

APS1025 Infrastructure Protection Planning, starting Saturday, 14 October 2023. The course will be full days, from 09:00 to 17:00 with 30mins for lunch. It will run over four consecutive Saturdays, in class. The schedule will be advertised on Quercus.

A foundation course of the CRCI that is recognized by the international Register of Security Engineers and Specialists; http://www.crci.utoronto.ca/education/academic/infrastructure-courses.

Calendar:

14 Oct 23   Course introductions and administration. Issue Assignment and Project
We begin with a brief exploration of strategy, the role of infrastructure and the purpose of protection, focussing on the need for protection and resilience to be in balance in order to deliver effective protection of the operation that the infrastructure facilitates. We will then explore the evolution of protection through a review of poliorcetics to modern-day CIP, leading to a series of principles and 'rules of thumb.' We then analyze the physical environment and broader risk context. We finish the day exploring the concept and practice of security integration, drawing together the different aspects discussed throughout the day.
Your assignment will be in groups, with a group answer to be posted on the Quercus discussion board.

21 Oct 23   Picking up from the previous day's discussion and the assigned reading, we will investigate the site survey and the performance criteria we require of the different security systems.
Site Survey The class will break into syndicates for a tutored walk-through / talk-through of a site with particular security integration issues. The problems will be analyzed as syndicates and solutions discussed in open forum. If we are unable to conduct the survey in person, we will use the building plans.

28 Oct 23   **Tutorials** Each syndicate will have the opportunity to arrange a tutorial with the professor to discuss their approach and developing concept for addressing the specific identified security requirement.

4 Nov 23   **Group submissions of projects and presentations** Each syndicate will present its project concept solution to the clients' representatives in class.
Examination.

Evaluation

There are two group discussion assignments, each carrying 10% of the total course marks. You will be assigned to project groups. You will need to discuss the topic in your groups and agree a common answer that you can all defend when quizzed in class.

Students are assigned to groups, each with real clients, conducting real protection and security assessments in real-time, with those clients assessing the product quality. The risk is always that a client withdraws their project because the timings do not work. (We have a some stand-by client projects for this eventuality). However, it may not be possible for all students to conduct a direct client project. In that case, the project will be a remote protection assessment of a proposed facility in an austere environment (an actual past project). The project carries 50% of the total course marks.

The Final Exam represents 30% of the total course marks. The two-hour written examination comprises three essays selected from five possible titles. The examination is "open book." Throughout, credit is given for demonstrating a clear understanding of the concepts, principles and application over the repetition of specific processes or formulae.

Materials

You are expected to read "After the Flood: Exploring Operational Resilience" and "Before the Storm" by Hay. *After the Flood* was written for the APS1024 Infrastructure Resilience Planning course. It explains and references all the core principles and concepts used for a systems-level understanding. You may wish to obtain it in hardcopy so that you can add notes and marginalia from the class discussions. *Before the Storm* was written for the APS1025 Infrastructure Protection Planning course. It builds on the concepts in *After the Flood*, to provide the core content for this course. You should also review "The Edge of Disaster" by Flynn. These books and other recommended references are available through the UofT Bookstore.

Address course questions and (correspondence) course work submissions to me at alec.hay@utoronto.ca