

## Chapter XI

# Security Inspection Model of Critical Infrastructure

### INTRODUCTION

*This chapter presents an approach that can be used to assist in border patrol and security management. On August 12, 2005, New Mexico governor Bill Richardson announced a state of emergency in four counties along the New Mexico-Mexico border in response to the booming smuggling of drugs and illegal immigrants, kidnapping, murder, and destruction of property and livestock (CNN, 2005). Three days later, Arizona governor Janet Napolitano issued a similar declaration (Media, 2005). Both states immediately released emergency funds to help patrol their borders by hiring additional law enforcement officers and paying them overtime. In addition to building fences along the US-Mexico border (Media, 2006) and drawing attention to the political issues involved, such as immigration law, these two announcements indicate the urgency and importance of planning and implementing an effective border patrol.*

*The border patrol, an important component of the nation's security system, requires daily, around the clock operation and is frequently overt while illegal border-crossings and other criminal events are covert. When an illegal crossing is discovered, a decision must be made immediately whether to track the illegal crossers, to continue patrolling the rest of the assigned areas, or to attempt to do both together. This decision is based largely on whether the unit of border agents itself, or the border patrol station to which it belongs, has an adequate number of guards at the time of the incident. With sufficient forces, both pursuing and patrolling can be handled immediately. Otherwise, a dilemma arises as either the assigned area of the border is left unguarded (i.e., out of control) if the choice is to track the illegal crossers only, or if the decision is to continue patrolling without interruption the team neglects its duty. The border counties mentioned in the two announcements have expressed a desire to expand the number of patrol agents on the border in addition to needing different detection devices. For example, one proposal from Arizona Senator Jon Kyl in a bill is to authorize 10,000 new Border Patrol agents (Carroll & Gonzalez, 2005). On May 15, 2006, President George W. Bush announced sending 6,000 National Guard troops to help secure the southern border (CNN, 2006).*

*According to the Department of Homeland Security's report on border and transportation security (DHS Portfolios, 2005), the U.S. has over 95,000 miles of coastline, and over 7.5 thousand miles of border spanning Canada and Mexico. Over 500 million people enter the United States each year by crossing*

the borders, passing through the ports, or arriving on overseas airlines. Although it is difficult to know the exact annual number of illegal crossings along the whole border, the following figures indicate the situation is very serious. From October 1, 2004 (i.e., the start of the federal fiscal year) to August 16, 2005, the U.S. Border Patrol in the Yuma and Tucson sectors reported more than 510,000 arrests, an average of about 1,616 a day, roughly on par with last fiscal year (Carroll & Gonzalez, 2005). Given such a long border with booming illegal crossers, the number of agents required to prevent or reduce the increasing illegal entries to the U.S. with limited resources has become a critical issue. Moreover, it is uncertain whether some specific proposed number of new forces discussed in the media can achieve the reduction of illegal border crossings.

In this chapter, we propose an approach to tackle this problem<sup>1</sup>. Using classical mathematics, we build a model to capture the relationships between the effects of border patrol, the number of guards, and the rate of the border being “out of control” or the patrol teams “neglecting their duty”. Doing so allows us to analyze the impact of resource expenditure on patrol effectiveness in order to help strategically plan the needed total or additional forces, and make pursuit and patrol both effective and efficient. Due to the covert nature of illegal border crossing, the number of illegal crossings is modeled as a stochastic process in a defined area of patrol and a given time period. We assume that the expected illegal crossings through the border can be prevented by pursuit and patrol. Then we calculate the expected inspection load of the border patrol team using the duties of searching for illegal crossers or continuing its patrol to complete the inspection of the assigned section of the border during the same time period. Then, the probability of the occurrence of either the section being “out of control” or the team “neglecting its duty” is computed and the minimum number of required border patrol teams is derived.

To illustrate the model, we apply it to an example of protecting important infrastructure such as securing an 890-mile long high voltage energy network. The result shows that by increasing the number of inspection workers by only four members, the rate of failure to secure the network will be reduced from one in ten thousand to one in a million given uncontrolled incursions.

The illustration demonstrates the high effectiveness of our proposed approach. Moreover, the model is simple and easy to use. It can be applied to different areas without being constrained by their geographic conditions. Most importantly, the model, as a decision aid, has a wide variety of potential applications such as protecting critical infrastructure (e.g. energy networks, gas pipelines, reservoirs, etc.) and securing the coastline. Planning and organizing an effective and efficient inspection system is necessary and important. The proposed method can help authorities involved in budget decision-making analyze how enforcement forces impact patrol effectiveness. That is, given a desired patrol effect such as an accepted minuscule level of the rate of the border being out of control or the patrol teams neglecting their duties, the model shows the minimum required enforcement forces for budgeting.

For convenience, we have transformed the results of the calculations into a table which shows the different expected inspection loads (e.g., patrolling miles or duration) associated with the number of required patrol teams, and the effectiveness achieved. Using the table, users can determine the required number of teams immediately by plugging the inspection load and desired patrol effectiveness.

The remainder of this chapter is organized as follows. In next section, Model Formulation, we describe the model formulation and analyze the impact of resource expenditure on patrol effectiveness to derive the minimum number of required border patrol teams. We then use an example of protecting important infrastructure to illustrate how to use the proposed model. We give a processing algorithm that implements the proposed approach step by step and offer some discussions of managerial implications in last section.

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