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Research Article

# Assessing Good Practices in Construction Safety and Phasing Plans

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## Abstract

Construction Safety and Phase Planning (CSPP) is a crucial document to have an impact on normal airport operations for any airport construction project. The basic intent of every CSPP is to minimize risk and to ensure that airport operations are not hindered at the time of construction activities taking place on the site. It is important to have such documents readily planned and prepared before initiating any construction activity at the airport. However, the requirements for such documents vary significantly around the world. International Civil Aviation Organization (ICAO) helps to create a mutual understanding of aviation policy, framework, and guidance. There is a lack of data identifying the differences between ICAO and CSPP. This can be challenging in terms of participating in the overseas market for consultancies and engineering firms for the very first time. Eventually, to perform the best practice for CSPP development, a lot of practicing firms find it arduous as there is little data available on understanding the best practice. This paper provides data that discusses and questions the possibility of best practices for CSPP development within the current industry and is further bolstered by case studies, surveys, and other empirical research found in project management research. The paper also confers the key differences present in the current practicing CSPP developments and the requirements published in ICAO states.

## Introduction

Airports contribute to a productive national economy and are critical for the national transportation system and international competitiveness [1]. All airfield operations take place in a complex environment, and it is critical to have arrangements for these operations to protect the safety and security of everyone involved. Construction activity at an airport may vary from runway extension, resurfacing of a taxiway, construction of a new Air Traffic Control tower, gate areas, or updating of facilities. Construction activity at an airport will involve contractors, airport planners and engineers, and inspection personnel. It also includes numerous measures and construction specifications, accompanying construction-related equipment on the airfield, detailed measures to alleviate Foreign Object Debris, and so forth [2]. It is essential to understand the risks involved during these construction operations and the ways to deal with them.

The primary considerations of the airports are aviation safety. It is a topic that airport authorities and consultants desire to know more about, yet around the world, little can be said about its best practice. The Federal Aviation Administration (FAA) explains Construction Safety and Phase planning (CSPP) as a document that provides information concerning the overall plan for safety and planning of construction projects in phases. It gives us a brief understanding of the way; airport certification requirements need to be maintained and the management of the projects, ensuring there will be no hindrance to the existing airport operations and construction activities till the project execution. This becomes paramount, especially during construction. The construction safety and phasing plan (CSPP) serves as a companion -document to the construction plans and specifications. A CSPP is defined as a document that outlines procedures, coordination, and control of safety issues during construction activity in an airport [3]. Essentially, it provides the minimum safety requirements to be met by the contractor for the operational safety of airports during construction. It must be developed for all construction projects funded by the Airport Improvement Program (AIP) [3]. The CSPP is developed by the most recent version of the advisory circular issued by the Federal Aviation Administration (FAA).

The CSPP addresses 19 important elements, such as coordination, contractor access, foreign object debris, inspection requirements, etc., related to the safety and phasing of the project. Typically, an airport consultant is responsible for the creation of a CSPP based on their familiarity with the specific airport. The contractor needs to submit a Safety Plan and Compliance Document (SPCD) 10 days before any preconstruction conference. The SPCD details how the contractor will comply with the CSPP [3]. It must be tailored for the specific project, and the construction activities cannot begin until the SPCD is approved. International Civil Aviation Organization (ICAO) helps to create a mutual understanding of aviation policy, framework, and guidance. In Annex 14 Volume 1 Aerodrome Design and operations, ICAO has described the specifications and standards for the planning of construction at an airport.

The interest in research related to construction safety has been very high in the past few decades [4]. Hallowell and Gambatese [5] provided a framework for a risk-based model for construction safety management to improve safety management in construction. In a study on Safety Program elements in construction in 2004, it was found that companies reporting better safety performance as measured by EMR also reported a high number of safety management practices [6].

Mitropolous et al. [7] investigated the factors that generate hazardous situations and proposed a model for reducing task unpredictability to reduce the likelihood of accidents. Despite the abundance of literature on construction safety, the concept of airport construction safety is not widely documented in the research literature. Covering the relevant literature was done in two categories. The first category covered the current practices being employed in the Construction Safety and Phasing Plans. This was done after reviewing the CSPP of 26 different airports, the recent versions of FAA advisory circulars, and other relevant documents to the CSPP.

### Research Goal and Objectives

The goal of this research is to explore the best practices at an airport for the creation, implementation, and management of Construction Safety and Phasing Plans. This goal can be achieved by meeting the following objectives:

Identify the state of the practice of Construction Safety and Phasing Plans in the airport construction industry.

- a) Identification of key stakeholders involved in the process.
- b) Identify the current best practices of the CSPP.
- c) Relationship of CSPP to different project delivery methods.
- d) Provide recommendations for future research.
- e) Construction Safety and Phasing Plans

The FAA Advisory Circular 150/5370-2G defines a CSPP as a document that outlines procedures, coordination, and control of safety issues during construction activity at an airport. In this section, various elements of CSPP present in the current literature are discussed. This section also includes the approval process of a CSPP, a review of 26 CSPPs from airports across the U.S., and studying aircraft accidents due to construction operations at the airport. Though the modulation process of the CSPP is the same around the world, the formation of CSPP changes a lot depending on the intricacy of the project needs of the operator and the regulating environment. The formal layout of a CSPP can be detailed considering the following parameters (Figure 1).

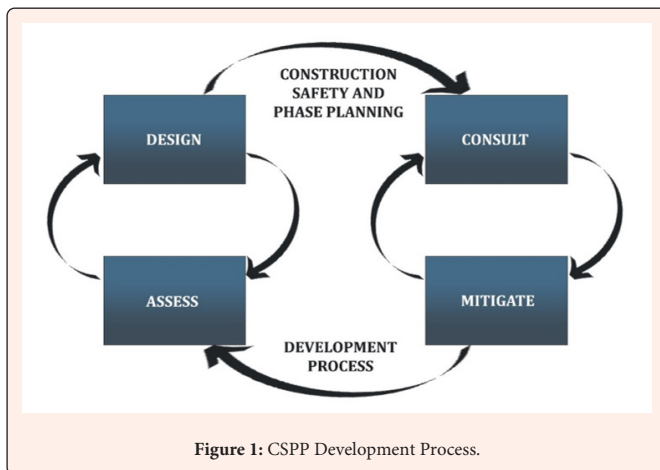


Figure 1: CSPP Development Process.

### Design Assess and Mitigate

Before creating a final CSPP and providing it to the involved key stakeholders and the regulator, multiple factors need to be contemplated to proceed further, minimizing the impact on airport operations. A summary of the existing operational conditions and physical requirements is generally produced. The project needs to explain the initial design phase and conceptual planning, further evaluating its influence of it on the ongoing operations at the airport. Before stepping into consulting phase, the project needs to identify and evaluate the existing influence of and preliminary phasing of the project. Multiple informational meetings need to be introduced and conducted among the involved key stakeholders to understand the associated impacts of the project on operations at the airport. Although multiple parameters in terms of mitigation have been considered while designing and phase planning, to maintain the necessary course of the project concerning its safety, phase planning, and execution, further mitigation measures need to be considered.

### Good Practices

ICAO guidelines help to understand the standards maintained for the CSPP over a few places. In terms of CSPP policy formation, the entire phase can be summarized by acknowledging the classification of CSPP, initiating from Legislation that is supported by policies. This develops a foundation for proper decision-making and leads to actions, giving an understanding of what is to be considered as a minimum for airport construction to be safely managed. Post policies layout leads to procedures that need to be undertaken to define the intent and safety planning for construction on the site

while airports are operating. Guidelines are introduced to the phase for inhabiting all the safety planning and need to execute the project on-site smoothly without disturbing the airport operations. This process involves the introduction of advisory circulars and other official documents to ease the entire process. The last level in this taxonomy contains protocols. This level is an evolution of the guidelines previously established. It provides a more detailed framework and process for CSPP development.

### Importance of creating a CSPP

The Two primary tools, CSPP and Safety Plan Compliance Document are important to ensure safety on Construction sites in airports at the time of operation. These documents help to understand the threat to airport operations at the time of construction by considering the safety measures to execute the on-site airport construction activities swiftly without interrupting the airport operations. CSPP and SPDC should be comprehensive enough to give clarity on airport safety provisions by including the required details, such as project drawings and all related documents. CSPP shall be created concurrently with the project design and needs to be submitted to the FAA for approval. FAA approvals are cost-effective to the CSPP in terms of contract cost hence it's required to complete the process in time. Further, if any revisions are made to the approved CSPP, then it needs to be sent back to the FAA again for the review, which will decide whether the revisions shall be approved or not.

### Coordination and Phasing

#### Coordination

- a) **Contractors progress meeting:** This comprises the information on the meetings and conferences to be conducted before, during, and at the end of the project. Operator safety is the primary consideration in such meetings.
- b) **Scope and Schedule changes:** The owner and engineer conduct these conferences to coordinate work covered by the contract or schedule changes.

**Phasing:** This provides information on how the project is phased and the location and duration of every phase of the project. This section also consists of the drawing indicating the safety procedures in the phased areas.

- a) **Phase Elements:** Following parameters need to be detailed for a given phase Areas near the aircraft operations:
  - i. Taxi routes for transportation purposes.
  - ii. ARFF (Aircraft Rescue and Fire Fighting) access routes need to be defined.
  - iii. Construction Staging areas need to be demarcated.
  - iv. Construction access and haul routes shall be construed and well-identified.
- b) **Construction Safety Drawings:** Safety drawings with very specific details need to be shown, which shall be comprehensive to the operators and the other stakeholders (Figure 2).

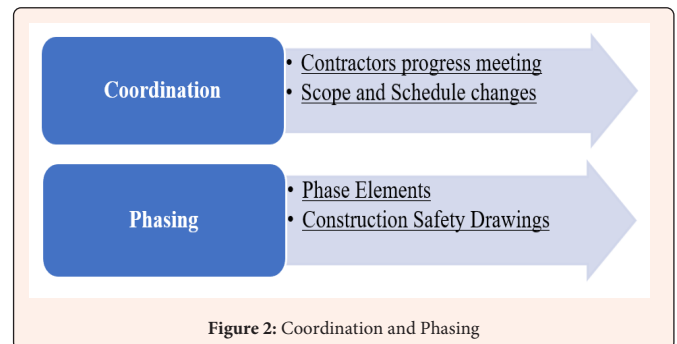


Figure 2: Coordination and Phasing

### The Approval Process of a CSPP

Once the project need is identified, the airport sponsor (airport owner) submits the project nomination form. The program manager (PM) receives a copy of the CSPP from the sponsor. The PM conducts a brief review of the Sponsor's CSPP to establish whether the Sponsor has sufficiently addressed the principal CSPP elements. If the CSPP is incomplete, the sponsor is notified of it, and the sponsor needs to revise the CSPP until it conforms to the FAA requirements satisfactory to the PM.

When the CSPP sufficiently addresses the principal CSPP elements, the PM must forward the copy of the CSPP to the Airport Certification Safety Inspector (in the case of a part 139 airport). A part 139 airport refers to an airport that hosts scheduled passenger-carrying operations using aircraft designed with more than nine passenger seats. For non-federally funded projects, an internal FAA review is sufficient for CSPP approval. The FAA review of CSPP is a systematic process with the ultimate objective of assuring that the sponsor has established an effective CSPP that is acceptable to the FAA. Once the FAA approves the CSPP, a notice to proceed can be initiated (Figure 3).

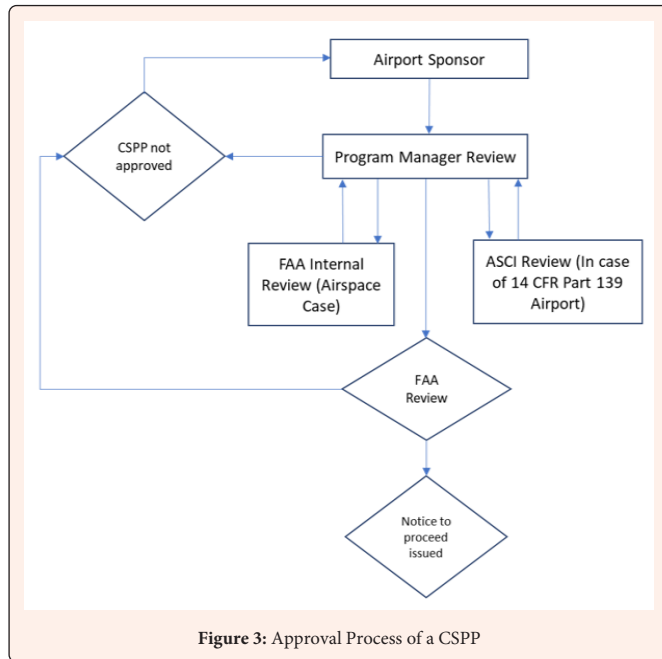


Figure 3: Approval Process of a CSPP

### A Case Study: Air Crash at Blue Grass Airport, Lexington, Kentucky

After the analysis of the CSPP, a few airfield accidents from the past were reviewed for construction. This case is about the Comair flight 5,191 crash. The flight was a regularly scheduled flight from Lexington, Kentucky, to Atlanta, Georgia. At the time of the accident, the airport was nearing the end of a construction project. The construction project included improvement to the runway to accommodate a longer runway safety area and several other taxiway modifications. A notice to airmen had been issued concerning these changes. The flight was instructed to take off from runway 22 but used runway 26 instead. Runway 26 was 3500 ft long and was designated for daytime use only. It had no runway lighting and was painted to indicate a 75 ft width, and was primarily used for general aviation operations. Runway 22 was 7000 feet long and was used by commercial transport operations, and was equipped with runway lighting, which was on at the time of the accident. Runway 26 was too short and caused the aircraft to overrun the runway before it could become airborne.

It was not known by the crew that the airport signage was not consistent with the most recent airport diagram charts of construction at the airport. Several other taxiway and runway lighting systems were also not in operation, and the crew did not have information on all these changes.

### Airport Construction Safety

The presence of construction activity and temporary facilities near airport operations increases the risk of various types of hazards. Some of these hazards will be discussed in this section. Most of the accidents that take place near the runway are due to landing and takeoff overruns, landing undershoots, and landing and takeoff veer-offs. According to accident statistics from Boeing, from 1959 to 2009, 55% of aircraft accidents in the world took place during the takeoff and landing stages of the flight and accounted for 51% of all onboard fatalities (Boeing, 2010).

The traditional approach to reducing the risk of accidents/incidents in airfields is to expand the runway safety area. One of the issues is that many airports do not have enough land area to accommodate FAA or ICAO standards for runway safety areas [8]. This study on airport undershoots and overruns suggested that substantial enhancement to airport operational procedures can be attained by dealing with the operational factors for both runway safety area planning and during aircraft operations.

The safety issues at an airfield vary in nature. It could be a simple issue of debris being found on the runway through a daily inspection. Such an issue can be resolved immediately. The safety issue could also be complex, like a construction project needing a more detailed analysis. Many major changes are presented to an airport by a construction project. It is essential to recognize and address any new hazards the changes introduce.

To deal with such hazards, the concept of a Safety Management System (SMS) has been introduced in recent years. An SMS is defined as a proactive, orderly, and integrated method of dealing with safety for airport operators [8]. Essential to an SMS are safety risk management (SRM) procedures that provide risk analysis and assessment (AC 150/5200-37, 2007). In its essence, an SMS program determines related risks, identifies the severity and likelihood of associated risks, develops mitigation strategies, applies mitigation strategies, and assesses and modifies those strategies if needed. Safety Risk Management is the core component of SMS. An SMS program requires an SRM that identifies and documents hazards in the airport (AC 150/5200-37, 2007). The five phases of the SRM consist of describing the system, identifying hazards, determining risks, analyzing risks, and treating risks. The best approach is to conduct the SRM process for each project or event phase, as the hazards linked with each phase can be different [8].

In conclusion, the process of SRM stakeholders should be self-critical and should help make their department as safe as possible. There is a need for agreement between the airport and the stakeholders or a clause in this lease contract when these safety assessments are performed. This is because there is currently no regulatory basis for the procedure [9-13].

### Visual Aids and Communication

In Air Traffic Control (ATC), the officials use certified communication protocols to have a concise transmission. The discrepancy and faulty standards in visual aids created confusion which has led to some serious accidents in the aviation industry. Due to this FAA has closely worked with the industry to develop and redraft the design and implementation of the visual aids. Along these same lines, the development and implementation of CSPP need to consider the broader audience and choose languages that will be readily understood without ambiguity. Therefore, in monitoring the implementation of CSPP, attention needs to be drawn to ensuring that the original message conveyed is the same message received and that any actions required are implemented as originally intended. Constant monitoring of a CSPP's implementation is essential to ensuring safety.

### Balance needed for CSPP Development

The implementation of systematic measures must be followed to ensure safety, protocols have been developed and considered very authoritarian. Industries have adopted outcome (Performance) based regulation as major significance in terms of the environmental and social statute. Performance-based regulation has been in demand in today's aviation industry and is popularly noticed where Safety Management systems have been fully implemented. This transition has occurred from the prescriptive regulation but still needs to define stability in these two approaches at the time of CSPP development. The NRC (Nuclear Regulatory Commission) has analyzed a few shortcomings in the prescriptive approach, such as erratic safety levels, paucity of proper analysis and reliable strategic decisions, and lack of innovative ideas for safety planning.

### Conclusion

International Civil Aviation Organization (ICAO) helps to create a mutual understanding of aviation policy, framework, and guidance. There is a lack of data identifying the differences between ICAO and CSPP. This can be challenging in terms of participating in the overseas market for consultancies and engineering firms for the very first time. Eventually, to perform the best practice for CSPP development, a lot of practicing firms find it arduous as there is little data available on understanding the best practice. This paper provides data that discusses and questions the possibility of best



practices for CSPP development within the current industry and is further bolstered by case studies, surveys, and other empirical research found in project management research.

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