



## EXPLORING CHALLENGES ASSOCIATED WITH LARGE-SCALE AIR TRANSPORTATION INFRASTRUCTURE PLANNING AND EXECUTION

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**Abstract:** Several U.S. airports are currently engaged in large-scale, multi-year capital improvement programs. For many airport councils, these programs are once-a-career occurrences. Although these large programs present many of the same issues as smaller scale airport construction projects, they also present specialized environmental, financial, and legal issues. Therefore, the aim of this study is to provide an overview of the challenges presented by large-scale airport construction programs and to suggest various strategies to address these problems. To fulfill the objectives of this study, three in-depth structured interviews with subject matter experts (SMEs) from both academia and industry were conducted and analyzed. In these interviews, detailed qualitative data regarding several aspects of airport development and construction challenges, as well as potential strategies for overcoming them, were collected. This study provides a detailed analysis of airport construction difficulties pertaining to the following challenges: environmental permitting issues for large capital improvement programs, increasing legal difficulties due to multiple sources of funding challenges, local issues that need to be addressed through public outreach and education, transitioning tenants and operations from existing to new facilities, phasing and staging the construction process, and using incentives (both liquidated damages and bonuses) to accelerate the progress of airport construction projects. This study also collected and analyzed several case studies of each of the described airport transportation development challenges. The outcome of this study will help policymakers appropriately plan the construction of large-scale air transportation modes and accurately allocate the required funding.

### 1 INTRODUCTION

Airports that are engaged in large-scale, multi-year capital improvement programs have significant legal issues that are above and beyond those of normal construction projects. They also have a myriad of differences from construction projects in other transportation modes. For example, projects funded by the Federal Aviation Administration (FAA) under the Airport Improvement Program (AIP) must be AIP eligible under the rules set forward in the authorizing legislation. On very large AIP projects, portions of the entire scope of the project are often not considered AIP eligible, must be accounted for separately in the planning and implementation process, and must be funded separately from AIP grant funds.

Funding for multi-year capital improvement plan (CIP) projects is usually unique. The FAA never contributes 100% of the funding needed for large-scale, multi-year projects, which inevitably results in

the need for local funding, usually in the form of bonds. One often-used type of bond is a revenue bond, which is sold by the sponsor with a pledge to repay it from future revenues, based upon future operations at the airport. There are many legal issues related to multi-year projects, including schedule delays and uncertainties related to bonds sold by the airport sponsor. Many of the legal issues are related to the bonding authority of the airport sponsor and the types of bonds and may be limited by local or state legislation.

Once a contract is finalized and in place, there are almost always legal issues related to dispute resolution. One of the complicating issues in dispute resolution with large-scale, multi-year airport projects is that the construction must be completed to a standard that complies with FAA regulations, often even with specific FAA specifications of materials, such as P-501 (Portland Cement concrete) for concrete pavements. However, the FAA, while providing funding and requiring compliance with their established standards, is not a party to the construction contract.

As mentioned above, these are a few of many legal challenges associated with the construction of large-scale airport projects. Over the years, many researchers have focused on the construction constraints of an airport. The majority of them have investigated the challenges associated with the construction of new airports and/or expansion of existing airports; however, few of them discussed legal challenges inherent in airport construction projects. Therefore, the aim of this study is to identify the most common areas which cause legal challenges for the construction of large-scale airports. Examples of real cases are provided for each of these legal challenges. The outcome of this study will help policymakers and contractors gain knowledge about potential areas of stakeholders' conflicts and prepare a plan to address the associated construction challenges.

## **2 BACKGROUND**

Whether it is a small airport with the simpler structure or a large airport with a much more complicated structure (Cheek & Associates, 2009), new airport construction, or a project of development work in an existing airport, always faces many challenges. Fulfilling the requirements of the entities that provided funding is one of them. The sources that provide funding for an airport project are federal, state, and local governments; and the internal revenue system of the airport itself. Each of the funding entities has its own requirements, which sometime conflict with each other. For this reason, an airport construction or development contract can be signed only after resolving the conflicts regarding these requirements. Generally, if any state or local law explaining a requirement creates a conflictual situation with the federal law explaining a requirement, the federal law overrules the state or local law (Alfert et al., 2012). In addition, there have been cases in which federal funding was provided for the airport, but the revenue of the airport was spent in the improvement of non-aviation activities, which indirectly transferred federal funds into the local treasury. This phenomenon discourages federal funding for airport development (Dempsey, 2008).

Airport construction is known as one of the most complex construction projects. Resource allocation is considered as one of the important areas which affects the execution process of complex construction projects (Safapour et al., 2018). In this regard, Dao et al. quantified and assessed complexity issues (2016 and 2017) and developed a quantitative tool to manage the complexity of construction projects (2016). As part of this project, Kermanshachi et al. (2017) collected a comprehensive list of complexity management strategies that address financial and human resource challenges of complex projects. As there are several uncertainties associated with the scope (Kermanshachi et al., 2017) and execution of complex projects (Kermanshachi, 2016 and 2017), several studies focused on the identification of best practices which improve communication among stakeholders of complex projects (Kamalirad, 2017) and optimize performance of projects with adversarial relationships (Safapour et al. 2017; Habibi et al. 2018). However, before continuing further, the definition of conflict should be established. Conflict can be defined as a situation where mutually dependable parties (Assel, 1969) come together to perform a task about which they have a different judgment (Amason et al, 1994) and the parties have a mutually exclusive wish to occupy a potential future position (Boulding, 1962). The conflictual situation has both trust and distrust among the parties at the same time (Lau, 2011).

Local communities and municipalities create quite a few challenges for the Federal Aviation Administration (FAA) and airport proprietors, including federal environmental and local zoning challenges. Some major airport proprietors have suggested that working with stakeholders proactively would be helpful in avoiding these community challenges (Johnson, 2010). Excavation and filling of a significant amount of material is an essential part of the construction of airports, which eventually causes an unstable new geographic configuration that requires special engineering works (Douglas & Lawson, 2003).

The demand for airports is increasing rapidly, and it is assumed by the FAA that it will increase by 50% in one decade (Khalafallah et al., 2006). This increasing demand will result in the construction of new airports or expansions of existing airports (Min, 1994; Khalafallah et al., 2006). Expansion work is very sensitive, as there is a possibility of increased risk since the construction site and materials can be very close to the aviation area. To avoid any unnecessary risks, the FAA enforces some constraints related to the height and weight of the construction material and equipment, and restricts some areas. These constraints make the construction of an airport expansion project more complicated (Khalafallah et al., 2006). Furthermore, if an expansion is carried on in an airport which is near human habitation, the noise and environmental pollution will create hazards on human life, and the high compensation cost for the effects of the pollution must be borne by the authority. On the other hand, if the expansion project is far from an area of human habitation, there might be no need for compensation, but the project might lose money, as it will be less accessible to potential passengers. For this reason, researcher Min (1994) concluded that choosing the site for an airport, before investing in its construction, is also a matter for analysis. In this regard, Alfert (2016) mentioned that while agreeing on a contract for construction work in the airport, claims always arise from three sources, namely, sources that create risks of escalated cost to the airport, sources that negatively impact operations, and sources that compromise the safety of users of the airport.

### 3 RESEARCH METHODOLOGY

In order to successfully accomplish the objectives of this study, a five-step methodology was defined and implemented (Figure 1).

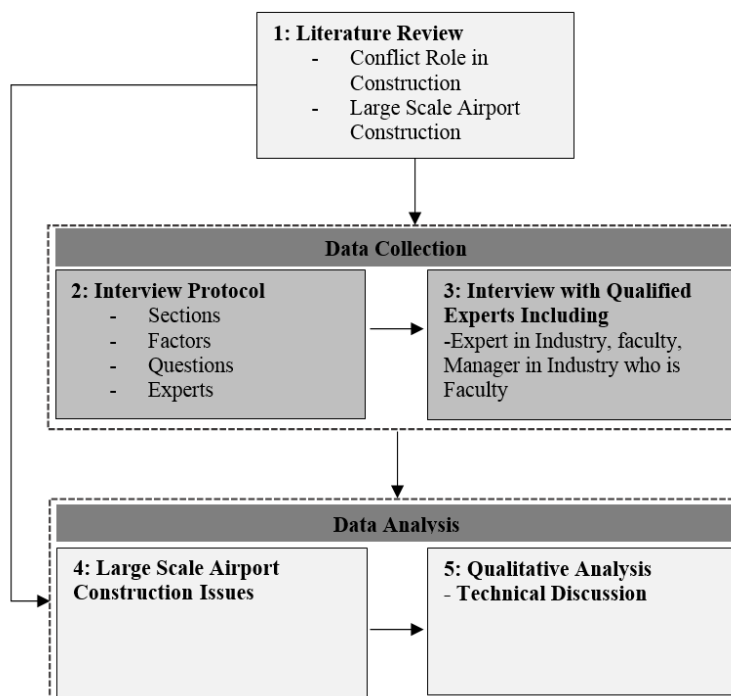


Figure 1: Methodology chart

In the first step, literature review, this study reviewed the existing literature on challenges associated with large-scale airport construction which could potentially lead to conflictual relationships among project stakeholders. In the second step, interview protocol, based on the findings of the literature review, the authors developed an interview protocol that followed a semi-structured data collection process. In the third step, interview with subject matter experts (SMEs), the authors conducted interviews with a mixture of academic and industry professionals to collect a diverse and inclusive set of qualitative data. In the fourth step, large-scale airport construction issues, the team identified the areas which most commonly lead to adversarial relationships among the construction stakeholders of large-scale airport projects, based on the collected data. In the fifth and last step, the data collected from interviews was analyzed to ensure the inclusion of all of the knowledge related to airport construction legal challenges.

#### **4 DATA COLLECTION**

Based on the thorough literature review and the knowledge of the authors, the team arranged interviews with three professionals and followed the semi-structured interview process. In the semi-structured data collection process, the interviewer has the freedom to decide how he/she will ask the questions, yet has some standardized questions to ensure that the correct material has been covered (Harrell et al., 2009). The interviewees were chosen based on their long-term experience and extensive acquaintance with the conflicts and disagreements in the construction of large-scale airports. One interviewee was a professor at a Tier 1 research university, one was an executive construction manager of airport projects, and one was a FAA senior employee who had been involved in several research projects in the area of airport construction management.

#### **5 DATA ANALYSIS and CASE STUDIES**

After conducting the above-mentioned interviews, the authors identified the areas that are most commonly responsible for legal conflicts, disputes, and challenges in construction work on airport projects. They are discussed individually below, and several case studies of relevant information are given to facilitate greater understanding, where needed. Some preventive and curative suggestions are also provided, based on the shared knowledge of the interviewees.

##### **5.1 Incentives and Bonus**

The use of incentives and bonuses in large-scale, multi-year airport construction projects has not been well chronicled. Liquidated damages are allowed in the AIP handbook, but the income earned from the liquidated damages reduces the amount of the grant. One famous case of a contractor's failure to deliver on time was the automated baggage system that delayed the opening of the new Denver International Airport and resulted in a nearly half-billion-dollar impact

One recent dispute resolution that the research team participated in concerned a runway constructed in the FAA's Southwest region. The airport was not satisfied with the quality of the concrete construction, demanded replacement of large portions of the runway that had been placed into service, and decided to withhold final payments. The contractor sued the airport for the payments, and the FAA regional and national offices were invited to discussions between the airport and the contractor's legal representatives.

Another legal situation arose during the grant close-out of the construction of the largest commercial service runway in the US. In reviewing the grant close-out documentation, the FAA insisted that the runway grade exceeded the construction tolerances and that the airport would have to forfeit reimbursement of \$11 million in payments to a paving contractor that had long since been paid. The airport hired a consultant to measure the runway grade and evaluate the surface roughness of the runway. It turned out that the runway was smooth and met grade very well, but the digital file provided by the designer and used to evaluate the runway grade was incorrect.

## **5.2 Phasing and Staging of Construction**

All large-scale, multi-year construction projects on airports are broken down into discrete segments or phases for ease of management and scheduling. Usually, certain stages of construction must be completed before the next stage of construction can begin. The legal aspects of these stages of construction may not be fully defined during the drafting of the construction contract. There must be some built-in flexibility in the schedule to allow for schedule delays during a phase of construction that depends on the completion of a separate phase of construction. In reality, almost no large-scale airport project is completed without scheduling or phasing adjustments. During the design/bid/build process, these adjustments, which impact the contractor, have to be adjusted in price and schedule through a change order process.

The Construction Safety and Phasing Plan (CSPP) and Safety Plan Compliance Document (SPCD) were instituted with the release of the AC in September 2011 and became a requirement for projects started after that date. Therefore, there have not been a lot of multi-year projects completed under this guidance. The legal issues related to changes in project phasing and their impacts upon airports and contractors with this formal process may or may not have been tested in court yet. However, very recently, the Seattle airport received a court decision that awarded the plaintiff millions of dollars because the court ruled that the airport is responsible for the safety that could be considered the responsibility of the tenants.

## **5.3 Environmental Issues-Legal Issues CIP**

Large projects with more than two years of scheduled life are often known as multi-year projects. The long life might be due to reasons related to design, construction, and/or completion. These large projects face a handful of political and environmental issues which are acknowledged below.

### On the Political side:

1. The political climate can change with the election of different leaders, e.g. U.S. President, especially if of a different party. This causes a change in leadership at the U.S. DOT, the FAA, the EPA, the TSA, and other government departments that are required to approve and/or review the project.
2. Local changes in mayors and the makeup of the city council/commission can create policy issues and result in previous decisions affecting the project being reviewed and changed.
3. Changes in the city manager, or changes in departmental heads may affect the city's procedures/policies and can affect the project.
4. Changes in the governor and other state-elected officials and departments can also cause problems with the project.

### On the Environmental side:

1. An environmental impact statement (EIS) usually requires a year or two to complete, depending on the complexity of the project and its effect on the environment. Examples would be a first-time ALP or a new air carrier runway. A Part 150 Noise Study may be conducted parallel to the EIS and, upon completion, will be included in the EIS.
2. An environmental assessment (EA) will be required if certain conditions occur, such as airport site selection; a new runway construction; a major runway extension; runway strengthening/noise increase; roadway construction with public road impacts; land acquisition; and/or actions which will have a specific potential environmental impact.
3. An EA will also be required if there are regulatory concerns covered by the National Environmental Policy Act (NEPA) Federal Environmental Regulations: Endangered Species Act;

Clean Water Act; Clean Air Act; Executive Order 11990-Protection of Wetlands', or other state environmental regulations. These may be different from federal requirements and must be contended with and adhered to.

4. If the project will be constructed on a "green site," meaning one without many problems, the process will be easier than if the project will be constructed on a "brown site," which is one with previous structures and/or operations, e. g. a fuel farm or a manufacturing facility. The brown site environmental process will be more complicated and costly due to remediation costs.

Legal Issues that may occur during the environmental study, or issues raised by the report itself must be resolved before the project can obtain financing or begin construction. Issues raised may require recommendations for approval by a governing body (e.g. city council, airport authority, and/or federal agencies). These issues could also require modification of the project, increased costs, time delays, or all of these factors. Before proceeding, the EIS could require the additional purchase of land; houses, which often incur relocation costs; construction of noise barriers; relocation of highways/roads; and requirements that have an effect on costs and phasing.

#### **5.4 Funding**

Large-scale projects usually require a mixture of financing vehicles to bring the project on line. Normal financing usually uses the bond market, with the selling of:

- Airport Revenue Bonds, where the revenues are identified and pledged to pay the principal and interest (debt service) on the bonds. Some government agencies may still issue General Obligation Bonds, where the government pledges the full faith and credit of the city, county, and state, including setting taxes to pay the debt service.
- Letters of Credit (LOC) received from a financial institution, which are sometimes issued in anticipation of a bond sale that will reimburse/retire the LOC or are issued with the understanding it will be repaid from a federal grant, e. g. FAA AIP funds or grants from other government agencies.
- Airport Passenger Facility Charges (PFC), where fees placed on enplaning passengers at an airport. The PFC program requires approval by the FAA, and the funds can only be used on approved projects or the debt service related to the approved projects. Funds are returned directly to the airport by the airlines that collected the fees.
- Special Facility Revenue Bonds that provide funds that are used to construct a facility, and the revenues generated are pledged to pay the debt service. Currently, many rental car consolidated facilities are financed by this method. Usually, a customer facility charge is established with the approval of the airport authority or the airport's governing body. No federal approvals are required since this is a local charge.

A bond ordinance/bond contract must be approved by the governing body, city, county, state, or airport authority. This is a contract between the bond issuer (airport/city, etc.) and the bondholder. An assessment of the project to determine the ability to repay the debt is usually provided by a financial consultant that certifies, based on the information provided and reviewed, that there is a sufficient revenue stream to pay the debt service and operating expenses, and to meet other requirements.

The bond ordinance, financial feasibility study, information on the project, statements from the program managers, and other reports are included in the official statement (OS). The OS becomes a contract between the issuer and the bondholder and usually falls under the purview of the Securities Exchange Commission. Bond attorneys provide an opinion with respect to the legality and validity of the bonds/ notes under the constitution and laws of the state and whether the interest on the bonds/notes is taxable for federal income tax purposes. The OS is a legal document, and all information contained therein should be true and all assumptions explained.

## 5.5 Transition to a New Site

A delay in the transition from the old airport or facility to the new airport or facility can have severe impacts on tenants, the airport, and the traveling public. When the new Austin-Bergstrom Airport was planning to transition from the Austin Robert Mueller Airport, lessons learned in Denver and Atlanta were studied. Comprehensive planning of the transition with the tenants is probably the best way to prevent legal action. There are a lot of legal documents to prepare and execute for transitioning tenants from one facility to the new facility, and the transition is further complicated because of the many uncertainties related to completion schedules, such as weather and other unforeseen events.

If the move involves tenants of the airport, their lease agreements should set the value of the asset if termination of the agreement occurs. In relocating to a new site, the old agreement will be terminated, and a new purchasing agreement will be necessary to lay out the terms and conditions, based on the language in the lease that sets the value of the assets to be acquired. The purchasing agreement establishes how the airport acquires and disposes of the property, the requirements of the tenant for relocating to the new site, remediation of the old site, and other items as needed. If the tenant is not going to the new site and their lease term is up, then there is no responsibility to negotiate a buyout. If the tenant is moving to the new site, then in addition to the purchase agreement, a new lease agreement for the new site must be prepared and executed before the tenant can begin construction on the new site. There could be delays if the tenant disagrees with the purchase offer, the airport's records on cost improvements by the tenant are not up to date, or an appraisal of the assets is required to establish values. The tenant may file suit to go to court if there is a disagreement of the values of the assets. Before the transition, the team must establish contact with all the parties that may have to relocate so that everyone understands the plan and requirements.

If the airport is responsible for the moving of equipment, etc., an inventory must be provided and/or taken describing whether the equipment is mobile (can move on its own) or requires assistance (placing it on a truck to be moved). The transition plan should start as early as possible once the areas have been identified that require either temporary or permanent relocation. Relocating an airport on the Airport to a different location is much easier than having the new site 8 miles away, as was the case in the Austin airport move from Mueller to Austin-Bergstrom. Road closures had to be secured, and the move had to be coordinated with city, county, and state agencies since it involved areas under their jurisdictions. The night of the move, a high school band and some other marching units led the way, with the large motorcade of vehicles, trucks, etc. following. TV reporters and citizens turned out on the parade route to watch. This was done at night to have the least disruption to traffic. The parade began at 10 pm, and it took about two hours for the move from the old airport to the new one.

Planning for the new airport began in 1993, construction began in 1995, and the new airport, ABIA, opened in May 1999. All elements, from the beginning to the end, were entered on flow charts so that everyone involved could see how their area's timeline affected other parts of the project. If an area fell behind, meetings were held to discuss 1) bringing it back on schedule, 2) what caused the delay, and 3) alternatives if the schedule had to be adjusted. Weekly design and construction meeting always ended with a discussion of the schedule. Reports were made monthly to the Airport Advisory Board and the city council so that the elected officials and the public were aware of the schedule and any changes.

Any multi-year project, whether big or small, requires planning and coordination of many parties: airport staff, tenants, consultants, contractors, elected officials, and others who are all working together for a common goal of completion of the project on time and on budget. Large-scale airport construction projects often have unusual circumstances, resulting in interactions with other federal, state, or local transportation agencies. For example, the \$1 billion runway extension at Fort Lauderdale International Airport extended an existing runway over an active interstate highway, and the runway extension at the Fort Worth Alliance Airport required the realignment of an existing rail line. These are examples of complex multi-jurisdictional planning and development problems that can have legal complexity. Another example of a legal issue is the development of the metro line into Washington Dulles International Airport, where the proposed track alignment clipped the edge of the

runway safety area. This is not permitted under FAA rules and is not something the FAA can waive, so it resulted in legal reviews within the FAA.

## 5.6 Airport Public Outreach and Education

Airport projects involve public outreach from the earliest stages of planning, through design development and construction, to post construction. This is true for constructing new airports, as well as for remodeling or expanding existing ones. A number of different tactics are used to educate and engage the public and are presented in Table 1.

Table 1: Airport public outreach and education methods

<b>Airport Public Outreach and Education Methods</b>	
<i>Workshops, focus groups, and meetings (i.e., public, community advisory, community leaders)</i>	<i>Soundproofing initiatives (i.e., window replacement programs for residents in flight paths)</i>
<i>Public fly-ins</i>	<i>Multi-lingual information sources</i>
<i>Pancake feeds</i>	<i>Media contact representatives</i>
<i>Public visit days</i>	<i>Tours</i>
<i>Training courses (i.e., CPR/AED, first aid, fire extinguisher)</i>	<i>Site visits</i>
<i>Open houses</i>	<i>Websites/social media presence</i>
<i>Dedication ceremonies</i>	<i>Phone tip/helplines</i>
<i>Attendance at booths at local trade shows or farmer markets</i>	<i>Publications (i.e., brochures, newsletters, utility bill stuffers)</i>

## 6 CONCLUSION

The construction of complex large-scale airports is a very challenging process. If the government and other project stakeholders do not accurately and proactively prepare a strategic plan, the ultimate performance of these projects may suffer due to the emergence of adversarial relationships. Therefore, this study identified potential areas of conflict in the planning and development phases of airport construction projects. It was concluded that funding, environmental concerns, and transitioning to new job sites are the three primary causes of legal issues in airport construction. In this regard, several in-depth, real case study analyses were analyzed and presented. This study also investigated various methods of airport public outreach and education which can lead to greater involvement of communities in the development phase and foster the execution process of airport construction projects.

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