

The Essential Principles for Airport Circulation

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Abstract

Nowadays airports play important roles in forming architectural features in the city. Each day thousands of passengers are heading airports to leave for designated destinations or physically present in airports for varied purposes. Although, there are a wide range of airports, users are the main characteristics of the architectural purposes. A well-designed circulation in the airport can help passengers benefit from available services efficiently and before their flights, they experience such a calm atmosphere. Moreover, it can help passengers familiarize themselves with atmosphere. Airports' users are diverse as some of them are departing, the other groups are arriving and people who work there should be added to numbers of passengers, therefore, the lack of proper circulation may cause serious problems and inconvenience for passengers who need to stay calm and relaxed before their travels.

Keywords: Airport, circulation, passenger, interior space

Introduction

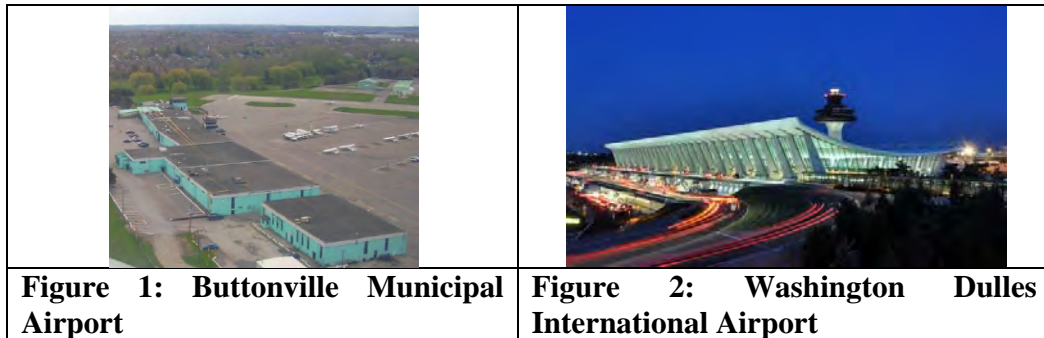
Airport is a mobile system that includes a variety of services to passengers, cargo, maintenance, control and other related services. The features of the airport and its complexity requires that different spaces are considered separately but in advance it should revise the quality of presenting the airport services (for different groups of passengers) must be revised, thus the categorization of airport is a great help to achieve this goal.

The categorizations of airports are carried out by International Civil Aviation Organization (I.C.A.O) and Federal Aviation Agency (F.A.A). In order to present the designing standards for different kinds of airports and its functions at first, different kinds of airports are introduced. It is worth mentioning that circulation is tightly related to architectural forms and it can improve the function of the airport as disorganizations and improper arrangement may increase the stress and discomfort that usually common in the airport. Thus, the type of airport can help the interior designing in such a way that the function and accessibility to different spots become easier.

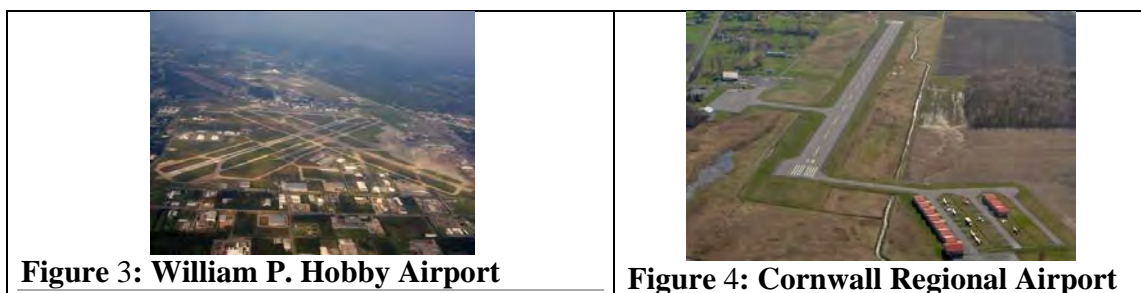
Different airports, different circulations

The first categorization is based on tower in the airport. A none towered airport does not mean that the air plane during landing and taking off is uncontrolled but it follows the recommended procedure while in towered airport is a typical airport, navigated by a tower control. These kinds of airport usually have smaller size, resulting a limited interior space including a big hall and probably related functional spaces. Furthermore, the numbers of users are limited and it does not need a complicated circulation (figure 1 and 2).

Or primary airport: as defined by the FAA, a commercial service airport with more than 10,000 passenger boarding each year and secondary airport is an airport that is used as an alternative to a cities primary airport. Reduced fares are sometimes applicable from these alternate airports. As Therefore, it is absolutely required to establish a well circulation in order to have a logical passengers flow as, for secondary airport, the circulation should be in such a way that transit passenger access to their designated path without difficulties (figure 3 and 4).



Another categorization divides airports based in their primary and secondary roles:



Other sub-categorizations are as:

- Large/Main hubs
- Medium hubs
- Small hubs

Hubs are generally used as a transfer point to take passengers to their designated destinations. Hubs are parts of airports that travelers move and reach their flights. Some of airports may use a singles hub where as some other use multiple hubs.

Or

- Commercial
- Non commercial

Commercial airports have almost 2500 passengers in each year while none commercial ones have at least 2500 passengers and not more than 10000 individuals.

- Cargo are airports that, in addition to any other air transportation services that may be available, are served by aircraft providing air transportation of only cargo with a total annual landed weight of more than 100 million pounds. "Landed weight" means the weight of aircraft transporting only cargo in intrastate, interstate, and foreign air transportation. An airport may be both a commercial service and a cargo service airport.

- Military: An airbase (sometimes referred to as a military airfield, military airport, air force station or air force base) is an aerodrome used by a military force for the operation of military aircraft .

- Heliport: A heliport is a small airport suitable only for use by helicopters. Heliports typically contain one or more helipads and may have limited facilities such as fuel, lighting, a windsock, or even hangars. In larger towns and cities, customs facilities may be available at a heliport .

Four important schools of thoughts in airports

Type 1

The first school suggest that the airport as an island which can accommodate the planes as twice as much as classic airport. Cars can access to the airport through a subterranean path and parking can be located on roofs or under the building.

Type 2

The crucial suggestion is based on an absolute separation between planes and cars. Some experts believe that due to *unsimilarity* of function between planes and cars, it would be possible to separate them from each other in order to make the mechanical connection such as buses pr mobile corridors and resolve the correct issues.

Type 3

It recommends small airports and claims that the big building cannot integrate in the airport; therefore, it would be preferable if each company owns an independent airport.

Type 4

The followers of this school of thought share their opinion with second theory and believe that airports and depending buildings should moved out of cities and apparently these facilities will be establishing in neighborhoods of connection routes and other transport means such as railway, helicopter and mobile systems, Connected directly to planes. Of course, this theory is not economic and people just benefit from using public transport systems.

Designing airports

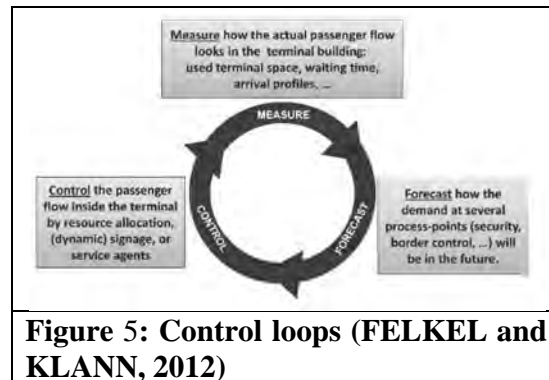
Although, it seems that airport is included some architectural spaces, set by standards, each individual can play a crucial role in forming the architectural spaces in the airport, thus circulation and the undetachable bonds between users and physical body of the airport are prior to formal view in designing the airport. Due to design the airport, the architect like any other architectural project, give the preference to varied factors. As a well-circulated space requires a logical relationship between user and space and the latter is directly connected to sit building, the exterior planning is essential to form a wise connection in circulation.

It has to mention that even land nature and the history of area can help design the airport facilities. More importantly, the internal circulation is tightly interlocked by exterior space and as whole; this system is connected to city by roads. Such as other architectural projects, climate can impact on building orientations. As different passengers for different purposes travel by plane and different services, presented in the airport a spatial configuration is required in order not to avoid interfering functions. And finally, it goes without saying that insufficient budget can stop the project regardless the level of progress. -

Different passengers

In terms of purpose of travelling, passengers fall in two main categories: firstly, people who travel for their profession and second group have recreational purposes. The professional passengers mainly use the given services in comparison with tourists. There is another group who has less information about the considerable services. For instance, in small or fairly big airports, services are given for traversing to recreational or religious centers.

Aforementioned airports benefit from different facilities, compared to airports with large numbers of travelers. Also, in airports with numerous visitors, sufficient spaces should be predicted in order not to block the passengers flow (figure 5).



Regarding the type of travel as domestic or international, the passenger would be transiting, entering and existing ones- (Kazda.A, Cavesairport.R, 2007).

A domestic passenger is for a group travelling inside the border area and exempt from checking in custom, passport control and quarantine, this includes the free land zones, which authorities consider some advantages for passengers.

International passengers are those who travel different countries and are under legal controls such as custom, passport and quarantine.

Exiting passengers are those who depart an airport for a specific destination by airplanes.

Entering passengers are groups of passengers who enter the airport and stop travelling.

Transit passengers are numbers of passengers who enter the airport and after a while they leave for other destinations, during the transit, they may stay in plane or in terminal. Meanwhile, the plane is given necessary services such as fuel, cleaning; it would be possible that transit passengers are asked for border controls.

It happens when past of the route is domestic and rest is international. Some passengers may come from an airport, lacks border control, in this case, they have to pass a quick control, and therefore, the designing facilities for transit passengers are required.

The transit passengers are a group of travelers who entered the airport through air and may continue their trips. Designing facilities for passengers is prior to other requirements as these passengers mat spend more time in the airport and would like to benefit from available services. Some times their expecting time for next flight may exceed hours.

Random users in the airport

Although, passengers are the main users in terminal but there are other group who commute

- among different spots in the airport
- Airport staff (agencies employees, restaurants and official department)
- Visitors and people who attend in the airport to see off
- Random people
- Security department

The circulation in the airport

The circulation in the airport includes the following factors:

- An easy access to airport by different public transport means
- Predicting stop points in suitable places or acceptable destination
- Routes should be short, direct and clear and avoid interfering with long distance passengers, baggage claims and other vehicles

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- Not creating level difference in walking sides
- Improving the landscape by adding architectural works
- Installing beautiful signs and helping passengers enjoy the scenes

Exiting passengers check in in the nearest possible spots and help them access to airport cart. Designing one way paths and when it is needed. Consider two ways direction.

With respect to creating psychological comfort for passengers, a free flow in different path should be considered and minimize the gaps as much as possible.

Potentially, every check point causes delay and it may make the passengers nervous. Illiteracy and language obstacles can increase this time, therefore, reducing check points and centralization can be a great help

Passengers should not pass one type of check points twice and it would be proper to design the interior circulation in such as way passengers to pass these points (Blow.B, 2000).

Security checks are the last phase of passing the check points, it is suggested to design far enough from the exit door in order to restrict unauthorized passengers to access the exit door.

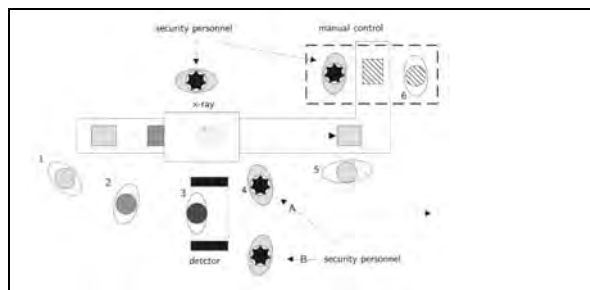


Figure 6: Details of security points (Schultz and Fricke, 2012)

The circulation should be designed sequential and continual. In order to respect security purposes, passengers' flows should be divided as below:

- The domestic and international flows should be separated (IATA, 1995).
- The entrance of exiting passengers should be set after security points of entering passengers.
- The speed of passengers flow and the capacity of routes should be accordance with checking baggage and turnarounds (figure 6).
- The passengers flow should be in harmony and stability with other parts in the airport otherwise even the fastest passengers flow with best capacity can cause confusion.
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Figure 7: Pier-finger

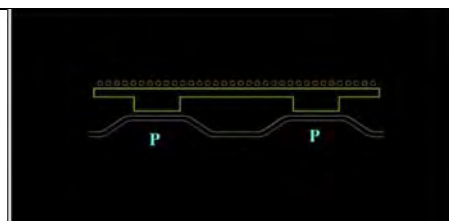


Figure 9: Linear

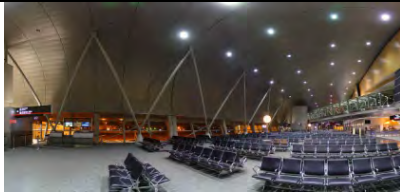


Figure 8: Miami International Airport



Figure 10: Denver International Airport

Pier-finger Concept

In pier-finger concept, all recourses are centralized. It helps the management handle the airport easier and also it can improve the passengers' management. In terms of architecture it the process of building is economical and land is uses efficiently (Horonjeff, McKelvey, & Sproule, 2010). This method has some disadvantages such as long walking distances that make passengers have to spend more time and energy to reach at destination and with respect to their ages and health condition, it could be inconvenient for some (Schultz, & Fricke, 2008). The shape does dictate the level of maneuverability for planes (figure 7,8) and it does not allow more circulation. And finally it would be very difficult to expand the site in the future.

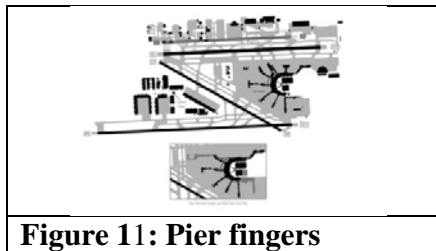
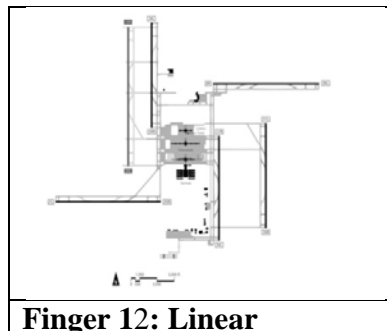


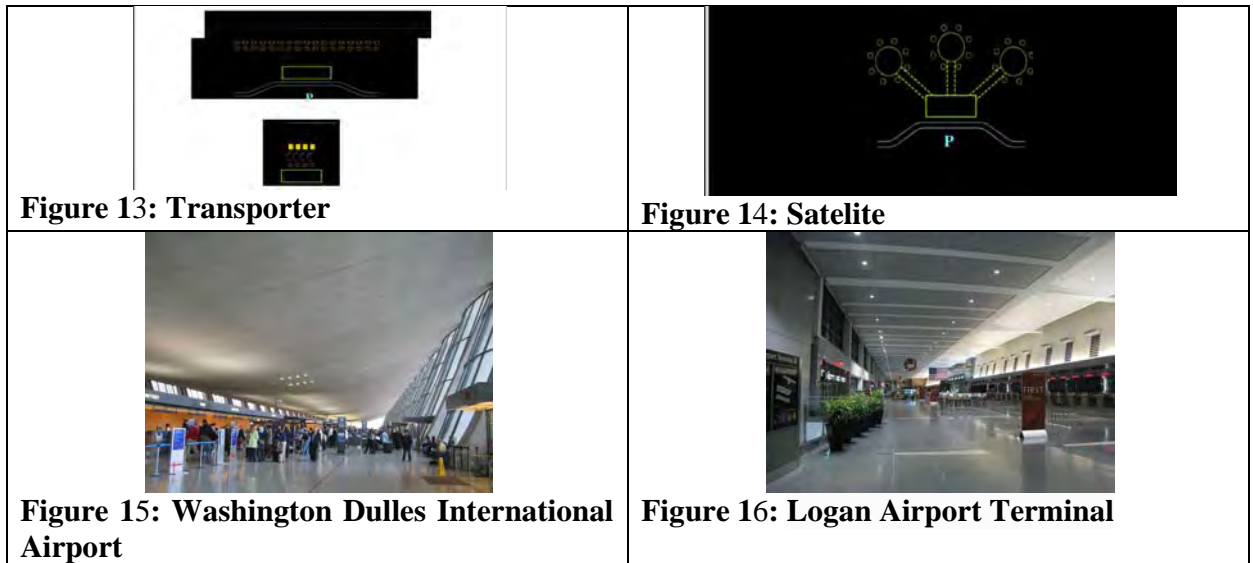
Figure 11: Pier fingers

Linear Concept

The linear concept has many advantages, first of all the walking distances are fairly short and it helps passengers reach different parts of the airport. The airport benefits from clear orientation as well. The time for termination any activity would be shorter and the baggage system cost lower. All together this system is decentralized (Airports Council International, 2000). This method has some disadvantages as well such as longer minimum connecting time and of course longer walking distances for transfer passengers (figure 9, 10). In order to carry the baggage, special logistics are needed. More importantly, in the future, the expansion of the site (figure 12), due to some formal restriction, may occur hardly (Transportation Research Board, 1987).

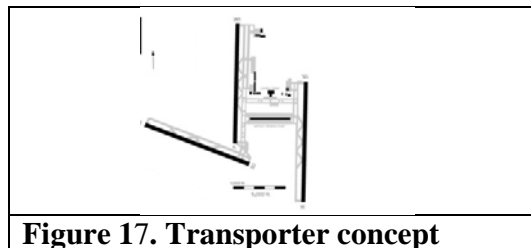


Finger 12: Linear

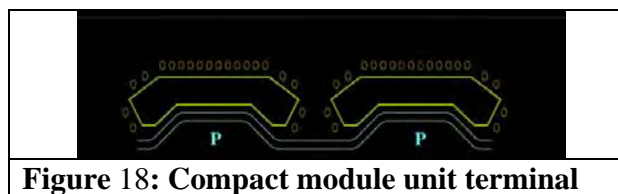


Transporter Concept

The main advantage of this concept is compatibility of terminal to be developed in the future. Additionally, it can accelerate the maneuverability of planes (figure 13, 14). This terminal is smaller and simpler and smaller (Felkel, & Klann, 2012). A huge investment for this concept is not needed whereas passengers’ will have more delays in this airport and it sometimes does not use the land efficiently (figure 15, 16). The expenses for maintenance and operation in this airport are fairly high (figure 17).



There are some other concepts such as Compact module unit terminal that advantages and disadvantages are listed below (figure 18):



<p>Advantages</p> <ul style="list-style-type: none"> Short walking distances Late closed-out times Longer kerb length than conventional central terminal 	<p>Disadvantages</p> <ul style="list-style-type: none"> Multi-compact module units require bag transfer systems between terminals Duplication of facilities,
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Capital investment is commensurate with demand Simple baggage transportation/sorting systems within each module Low baggage mishandling Potential	higher operating costs
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Conclusion

Architectural form of airport and its circulation is very important for creating smooth circulations for passengers. It can help passengers put themselves in such a calm atmosphere and prepare for a trip. There are many complaints, arose by passengers who feel confused in the airports. Therefore the main aim for designing an airport should be based on items below:

- An efficient passengers flow
- Helping passengers experience comfort and relaxation before their flights
- Avoiding unnecessary circulations and movements
- Creating clear spaces and preventing complicated ones
- Eliminating the multiple paths and helping passenger find direction easily

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