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Dynamic Runway in Airport Projects

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Abstract

Airports are considered one of the main projects in the development of any country; but some of these countries can dispense such a project or the extension of it because of a lack in surface areas or a lack in money for investing it in constructing an airport. A great amount of money from this investment is spent on the construction of a runway. This paper discusses an innovation in the construction or the extension of a runway. The proposed system of the runway is designed with best quality and with materials that are sustainable to the environment to decrease any harm that could occur.

Keywords: Airport Runway, Dynamic Runway, Landing Takeoff, Aircraft Small land area

1. Introduction

As it is known that a runway is the main spine of an airport. Runway length, width, and surface type are determined through different factors as airport location, weather conditions and aircraft types that the airport receives. Most airports have from one to three runways with lengths ranging from 2000-4500 meters and widths ranging from 60-120 meters. As times flows, the need of a larger airport becomes a desire of countries development in which engineers starts to design new airports or reconstruct extensions for an existing terminals and runways for increasing the airport capacity and efficiency to receive more and larger aircrafts. These extensions will need large investment in addition to wide land area that may not be available in many cases. The following study shows a new technique in constructing such a project to reduce the runway length.

2. Dynamic Runway

My project is a challenge of how to design an international airport in a very small land area with best functions and good qualities that receives aircraft for both passengers and cargo. To design an airport under these conditions it is impossible to use traditional standard specially in runway construction as in all routine airports Landing Distance Available (LDA) should be greater than Landing Distance Required (LDR) as shown in Figure 1 this require a long space which is not available in the city zone.

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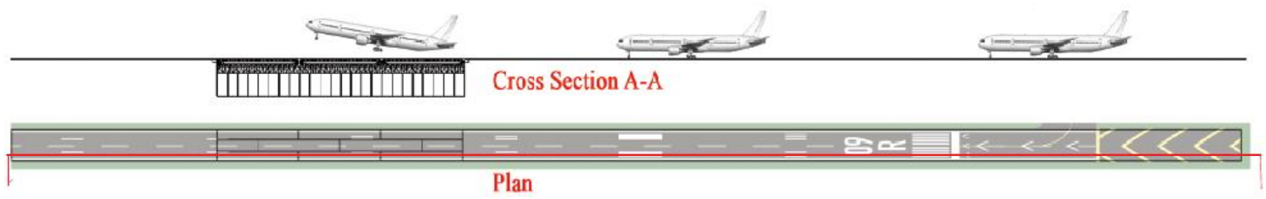
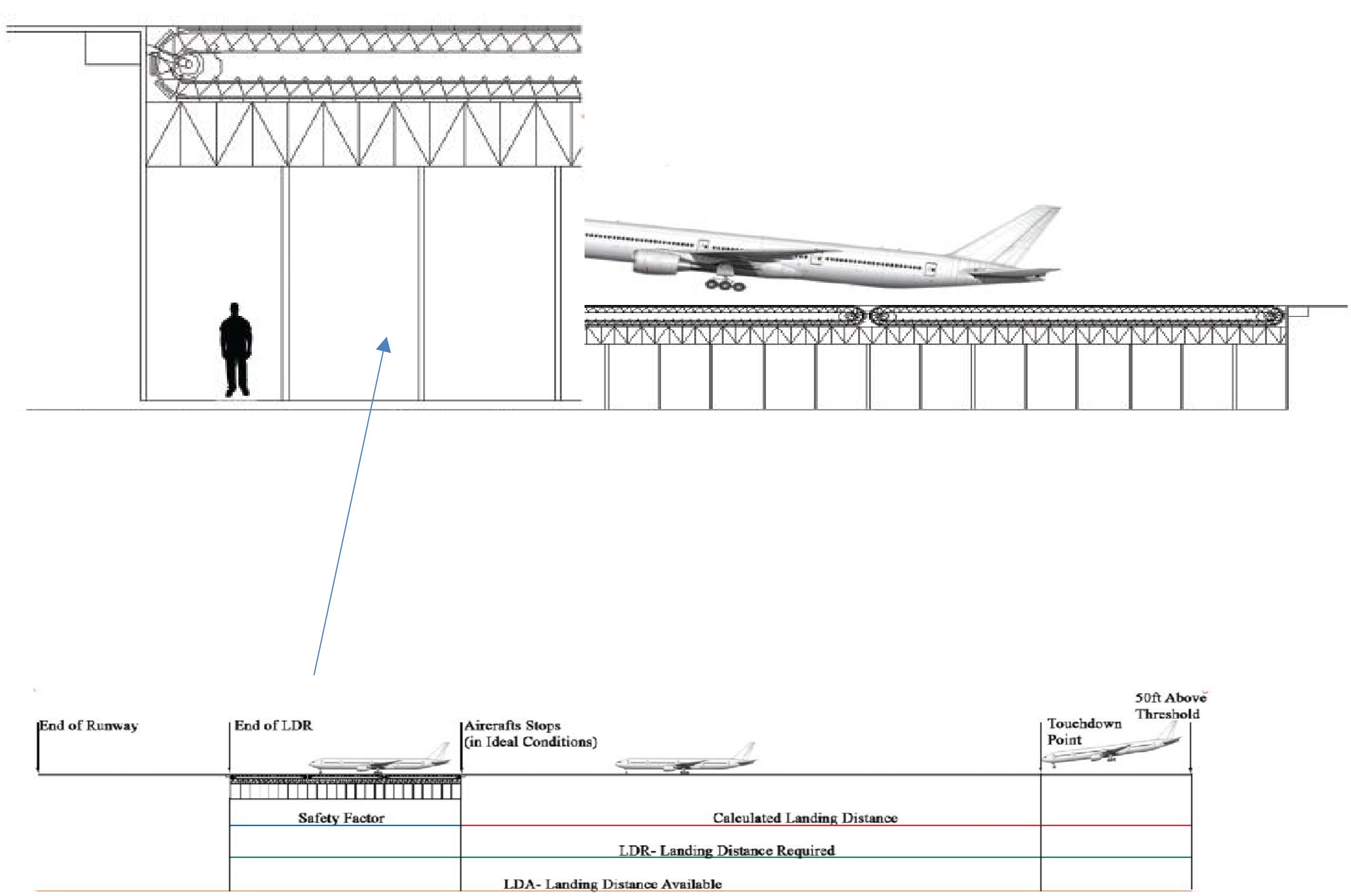
Figure 1. The Dynamic Runway system



I designed a system named "Dynamic Runway". The Dynamic Runway system was influenced from the design of a horizontal walkway escalator that are generally found in long buildings such as hospitals, airports, malls, etc.. "Dynamic Runway" use a system of mechanical, electrical and electronic equipment for operating the system, which allow aircraft performance as "Landing Distance Available- LDA" is less than the"Landing Distance Require - "LDR" but the dynamic part could cover and solve this problem.

Figure 2. The plan and cross section sketches of this system.



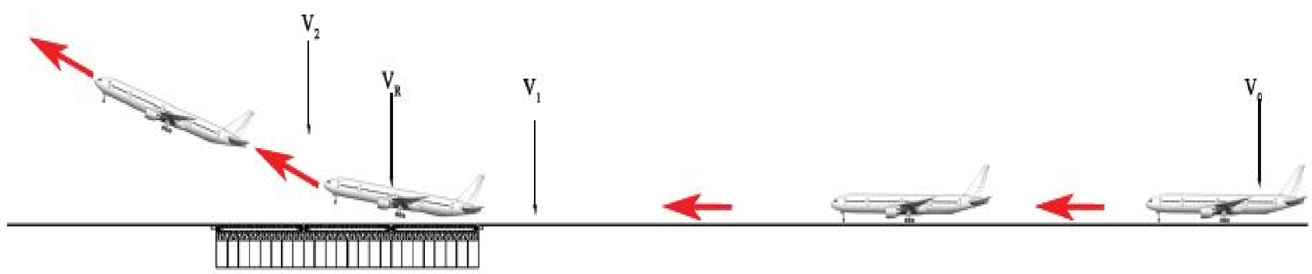
The proposed design shows that the runway is divided to three parts:

i The first part of the runway may be constructed by using concrete, asphalt, composite of concrete and asphalt surface or any other standard materials depending on the location of the project.

ii The second part of the runway is a dynamic system in which it acts as a continuous part of the runway which work to enhance the aircraft landing and taking- off process The third part of the runway is similar to the first part.

As shown in Figure 3, the dynamic system is carried by a truss system to bear the weight and force of the aircraft. Below the truss system is a floor that permit the accessibility of persons for maintenance and storage purposes.

Figure 3. The cross section sketches in dynamic runway part



Takeoff Operationsin Dynamic Runway

The take-off of any aircraft in directly into the wind if weather conditions and runway orientations permit it. Figure 4 illustrates the safety factors of designing this system in that way. In taking off, the dynamic runway acts in theopposite direction of the aircraft by motion sensors indicating the presence of the movement on the first part of the runway. The procedure for take-off will be that the vehicle will accelerate until it reaches a safe initial flying speed, the pilot can then rotate the vehicle to an attitude to produce climb lift and it will ascend from the ground. The determination of this safe flying speed or rotation speed, VR, is a critical factor in determining take-off performance. Following points define the speed of the aircraft in each phase as shown in Figure 4:

• V0 = the speed is zero in this part of the runway

• V1= Abort decision speed. Below this speed, the take-off can be safely aborted. After this, there will not be sufficient runway length to allow the aircraft to decelerate to a stop.

• V2 = Safe climb speed. Below this speed, aircraft cannot attain sufficient climb rate. Aircraft must climb at a minimum gradient to avoid obstacles at the end of the runway. With engine failure on multi-engine aircraft, this speed should still be achievable.

4) Landing Operations in Dynamic Runway

The landing of any aircraft in directly into the wind if weather conditions and runway orientations permit it. Figure 1 illustrates the safety factors of designing this system in that way. During landing operations the sensors present in the system indicates the acceleration of the air when the aircraft is near to the runway making the system works in the opposite direction of the aircrafts movement. This system decreases the acceleration of the aircraft while the landing of the aircraft.