

POSSIBILITY OF ESTABLISHING A TAXIWAY FOR A QUICK TURN AT THE AIRPORT

Jana Cibereová – Peter Koščák

This paper defines the possibilities of building a taxiway for a quick turn at the airport. Analyzes and describes taxiways for quick turn, methods for calculating the location and general requirements for building them. Suggests the optimal location of taxiway for a quick turn at a particular airport and for certain types of aircraft and points to the possibility of using them at the airport.

Key words: figures airport taxiway, location, distance

1 INTRODUCTION

Use of the runway depends on the aircraft to stay there, because the construction of the taxiway to quickly turn helps the aircraft stay on the runway shortened and thereby increase the capacity of its use. The present article deals with the general characteristics of taxiways for quick turn, the method of calculating the optimal location of taxiway to quickly turn and using this method at a particular airport and assessing the feasibility of the construction of the taxiway for quick turn at the airport to specific types of aircraft.

2 GENERAL CHARACTERISTICS TAXIWAYS AIRPORT

Taxiway airport should be constructed so as to secure the smooth and safe ground movement of aircraft. For each runway at an airport should be built enough taxiways at entrance and exit of aircraft to ensure smooth movement of aircraft on the runway and there. At airports where traffic volume is high, it is appropriate to consider the construction of the taxiway for a quick turn. Taxiways must be designed so as not to distance the outer wheel landing gear from the edge of the taxiway less than indicated in the table.

2.1 Taxiway to quickly turn

Taxiways for fast turn are connected to the runway at an acute angle and designed to allow landing aircraft turn and at higher speeds than other taxiways and thereby minimize aircraft stay on the runway. The decision for the design and construction of the taxiway for a quick turn is based on the analysis of existing and projected traffic at the airport. The main objective of these taxiways is to minimize the residence aircraft on the runway and thus increase the capacity of operating areas. If the density of traffic in peak hour, approximately less than 25 movements (takeoffs and landings), it is sufficient for constructing a right angle to the taxiway for a quick turn. Building a taxiway for a quick turn to the right angle is less expensive and the location along the runway can be achieved powerful traffic.

Creation of a single global standard for the design taxiways for quick turn has many obvious

advantages. Pilots familiar with the configuration of the taxiway for a quick turn can expect the same result as in any other airport with this device. Since the introduction of taxiways for quick turn to the operation carried out further study and test the operation of the taxiway to determine the appropriate location and design of taxiways to shorten the time stay aircraft on the runway. Evaluation of the results of these studies led to the development taxiways for quick turn and their design criteria specified speed moving aircraft.

Disagreement arises in determining the rate at which pilots must scroll through the taxiway for a quick turn. Of those studies, the specified frame rate to use for the taxiway rapid exit, typically are used at a rate no greater than 40 km / h and also in some cases a lower speed and braking conditions are poor or when strong side winds, studies have also shown that at some airports can use these taxiways and at speeds above 90 km / h in accordance with the dry surface and good braking. For safety reasons, the speed of 90 km/h recognized as appropriate only for taxiways for rapid exit code number is 3 or 4 Calculation of the optimal position for the entrance taxiway along runway, even if the scheduler uses a lower speed. In any case, the use of taxiway for a quick turn requires a pilot cooperation. Regulation for the design and use of taxiways for quick turn creates to increase their use.

3 PROPOSALS FOR QUICK TAXIWAY TURNS IN THE KOŠICE AIRPORT

The taxiway is used for quick turn landing aircraft to turn the runway at higher speeds. These taxiways are connected to a runway at an acute angle. Construction of such taxiways is carried out to reduce the residence aircraft runway and thus actually increase the capacity of this pathway. When designing the taxiway for a quick turn is necessary to evaluate existing and planned traffic at the airport. Since EXIT different types of aircraft, varying size and threshold speed, braking ability and operating speed for turn these factors are essential yardstick for determining a suitable location taxiway for a quick turn. You need to consider what the aircraft will be operated at the airport before we start with the actual proposal. The decision to build a taxiway for a quick turn at the airport Košice was established based on the

assumption of cooperation with AirberlinTechnik, which plans to repair Boeing 737100-500 and the Airbus A 320 200 just for that airport.

The implementation of this cooperation will increase its operational capacity at the airport, especially during the summer months, when that airport highest peak, because in addition to the regular lines are operated at the airport Košice well as charter flights to various destinations. It will therefore be necessary to shorten the length of stay of aircraft on the runway for its efficient use, thus allowing for the shortest time spare runway for aircraft ready for take-off or landing. Draft Taxiway location for a quick turn on the Košice airport is considered by combining the apron number 1 and LRT intersection with taxiway C. However, C is from the threshold of runway 01 just over 2,000 m, it is necessary to assess if this is the appropriate location if we take into account that the aircraft of various sizes have different braking speed.

Assess whether it would be appropriate to place this taxiway closer to the threshold of runway 01, and whether that location will be important, and what will be the impact of this location for its usability.

3.1 Calculate the optimal location of taxiway to quickly turn the Košice airport

Calculate the optimal location of the taxiway for a quick turn, we conducted based on the method of three segments, where each segment were calculated separately. Calculation was used for the Boeing 737-500, Airbus 320, the operation of which is assumed in connection with cooperation of AirBerline and Košice airport. For the calculation we need to know the landing speed of these aircraft types. Landing speeds are given in the operating manual for each aircraft type. For example - calculation for aircraft Boeing 737-500.

Boeing 737-500

Exit taxiway for a quick turn , we assumed located at a distance of approximately 2000 m from the threshold of runway 01 , which has a length of 3100 m . Before we started with the calculation method of the three segments of this type of aircraft, it was necessary to determine the landing speed of the aircraft and the slope of the runway.

Being an aircraft landing speed from 737 to 500 is 128 knots (237 km / h) in landing weight of the aircraft 50 000 kg and an angle of inclination of 40 ° flaps . When calculating method of the first segment of three segments, which we determined the required distance from the runway threshold and the first contact of the main landing gear of the aircraft, we need to know the slope of the taxiway at the airport 01 Košice

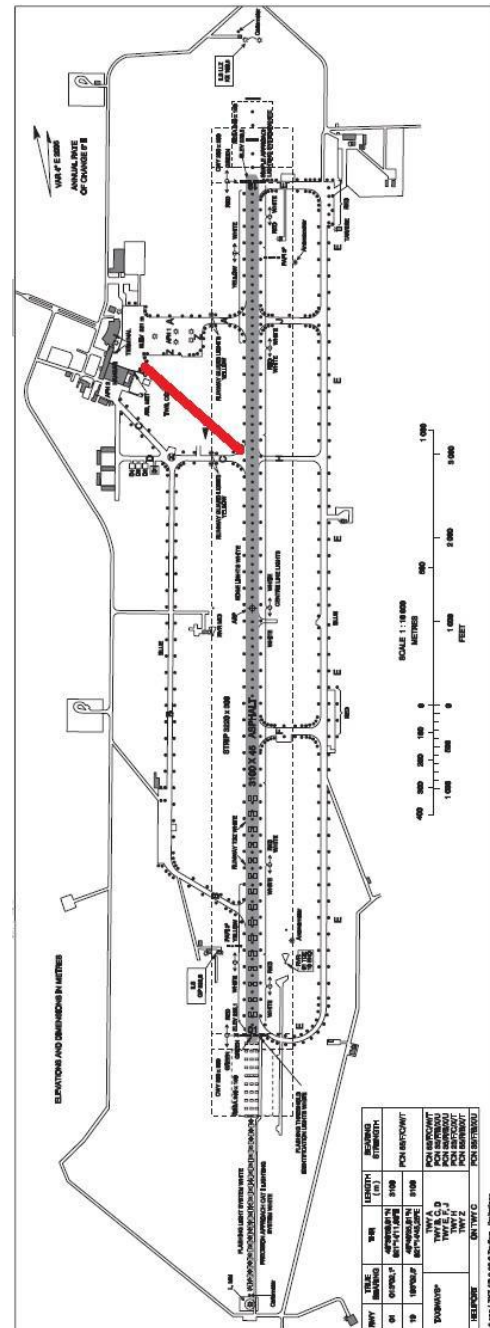


Fig. 1 Prior representation of the location of the taxiway for a quick turn at the airport Košice

As the aircraft Being 737-500 belongs to a category C is a fixed distance from the point of contact designated 450 m, this distance is not corrected rope climbing. Rope climbing for runway 01 at the airport Košice we can determine from the Aeronautical Information Publication (AIP), which lists the physical characteristics of the runway of the airport.

Landing speed V_{th} : 128 knots;
Gradient VPD 01: +0,2 % (0 m – 1100 m).

As the correction for slopes VPD is -0.25% + 50 m, at an inclination of +0.2% path we have set correction -40 m, we calculated classical rule of three. Minus value were determined by the slope, which is on an upward track 01, this value we then deducted from the value set by the desired distance from touchdown.

$$\begin{aligned} S_1 &= 450 \text{ m} \\ S_1 &= 450 \text{ m} - 40 \text{ m} \\ S_1 &= 410 \text{ m} \end{aligned}$$

The second segment method three segments, which we determined transition distances intended for the estimated transit time, were calculated according to the formula. Reason for selecting formula for calculating our landing speed was determined in knots.

Landing speed V_{th} : 128 knots;

$$\begin{aligned} S_2 &= 5x (V_{th} - 10) \\ S_2 &= 5 \times (128 - 10) \\ S_2 &= 590 \text{ m} \end{aligned}$$

The third segment method three segments, provides distance required for braking aircraft. When calculating this segment, we used the formula, where it was necessary for us to determine the landing speed turnout rate according to the operating manual of the aircraft and the degree of braking, which is defined in the Aerodrome Design Manual Part 2 to this formula, we have also decided, because we used speed given in knots.

Landing speed V_{th} : 128 knots;
Turnout speeds: V_{ex} : 24 knots (44 km/h)
Degree of braking: 1,5 m/s².

$$S_3 = \frac{(V_{th} - 15)^2 - V_{ex}^2}{8a}$$

$$S_3 = \frac{(V_{th} - 15)^2 - V_{ex}^2}{8a}$$

$$S_3 = \frac{(V_{th} - 15)^2 - V_{ex}^2}{8a}$$

$$S_3 = 1016 \text{ m}$$

The final calculation method of the three segments is counting the three segments and based on the resulting value we determine the optimal location of taxiway for a quick turn to the Košice airport, aircraft type Boeing 737 – 500.

$$S_1 + S_2 + S_3$$

$$410 \text{ m} + 590 \text{ m} + 1016 \text{ m} = 2016 \text{ m}$$

Method three segments, we therefore calculate the optimal location of taxiway for a quick turn for the Boeing 737-500 is 2016 m from the threshold of runway 01. These calculations are carried out without assuming wind resistance, so it was necessary to carry out calculations in the case of headwinds blowing at 15 knots (28 km / h), 20 knots (37 km / h) and 25 knots (46 km / h).

Correction for wind speed $V_{wind} = 15$ knots:

$$V_{th,ground} = V_{th} - V_{wind}$$

$$V_{th,ground} = 128 - 15$$

$$V_{th,ground} = 113 \text{ uzlov}$$

$$S_2 = 5x (V_{th,ground} - 10)$$

$$S_2 = 5 \times (113 - 10)$$

$$S_2 = 515 \text{ m}$$

$$S_3 = \frac{(V_{th,ground} - 15)^2 - V_{ex}^2}{8a}$$

$$S_3 = \frac{(113 - 15)^2 - 24^2}{8 \times 1,5}$$

$$S_3 = \frac{9604 - 576}{12}$$

$$S_3 = 752 \text{ m}$$

$$S_1 + S_2 + S_3$$

$$410 \text{ m} + 515 \text{ m} + 752 \text{ m} = 1677 \text{ m}$$

Calculation $V_{th,ground}$ we determined the landing speed of the aircraft in the event of headwinds blowing at a speed of 15 knots. Subsequently, we performed calculations of the second and third segments and three segments are counted. The resulting sum of the distance was determined, which is suitable for rapid exit in case of blowing wind speed of 15 knots. For calculations of wind correction is not necessary for them to recalculate the value of the first segment, whereas the calculation of this segment is not used in the landing speed of the aircraft. These calculations are also performed for the correction of headwinds speed of 20 knots and 25 knots.

Based on these calculations, we have obtained more suitable location distance to the taxiway rapid exit

from the threshold of runway 01 at the airport Kosice. It is not possible to build all four taxiways for quick turn, so we have the following distances calculated average value which is considered optimal location taxiway for a quick turn for this aircraft type. Optimal distance for the location taxiway we therefore determined as 1670 m from the threshold.

4 DISCUSSION OF THE DRAFT TAXIWAY TO QUICKLY TURN RUNWAY 01 AT THE AIRPORT KOSICE

Based on the calculations, we can say that the optimal location of taxiway to quickly turn in our case would be appropriate at a distance of approximately 1,700 meters. Boeing 737 and Airbus 320 Patiris in category C, so that the new taxiway to quickly turn should have a width of 18 meters to be satisfactory for these aircraft types, rotation angle taxiway should be not more than 45° , in our case we set the angle 30° arc with a radius of 160 meters, which we identified based on the aircraft's turn rate which is 24 knots.

Location taxiway at a distance of 1,700 meters, it is appropriate for the Boeing 737 and Airbus 320, but it is not suitable for the current state of movement areas at the airport Košice. If we taxiway to quickly turn built at a distance of 1,700 meters would be the path to join the taxiway C, the taxiway is its width 18 meters satisfactory for these two types of aircraft but leads ramp No. 2, which is used for general aviation and its size is not suitable for use by these two types of aircraft. If the Košice airport decided to build a taxiway for a quick turn at a distance of 1,700 meters would have to reckon with the construction of another taxiway, which would lead to the apron number 1 suitable for these aircraft. This solution is not suitable for the Košice airport in economic terms, since the construction of the taxiway for a quick turn and then build another taxiway leading to a ramp 1 would be more costly than building solely to the taxiway for a quick turn. It would also have an impact on reducing traffic at that airport over time.

5 CONCLUSION

Taxiways to quickly turn are used to reduce the aircraft stay on the runway and thus increase the capacity utilization of the runway. Their location, be pointed out because, due to the size and performance of aircraft is variable it is not possible to set a single distance, which will be satisfactory for all categories. Despite all the calculations necessary to assess whether we specify the location taxiway for a quick turn at all suitable for the airport, as it affects the operation of the airport or the taxiway for a rapid turn for the airport is in fact necessary.

BIBLIOGRAPHY

- [1] Annex 14 to the Convention on International Civil Aviation, Aerodrome Design and Operations, Volume I, International Standards and Recommended Practices, sixth edition, 2013
- [2] AERODROME DESIGN MANUAL, Part 2 Taxiways, Aprons and Holding Bays ICAO 2005. 155p., Doc 9157-AN/901
- [3] OPERATIONS MANUAL, Being 737 – 300/400/500 The Boeing Company 2002. 946s.,
- [4] OPERATIONS MANUAL, Aircraft characteristics airport and maintenance planning, Airbus 320 – 200 Airbus S.A.S 2012. 607s.

AUTHORS ADDRESSES

Cibereová Jana, Ing.
Moskovská 22, Michalovce
janka.cibere@gmail.com

Koščák Peter, Ing., PhD.
Rampová 7, Košice
peter.koscak@tuke.sk