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Assessment of Bojnurd airport from regions climatic situations and topography perspective

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ABSTRACT

In today world that speed of everyday life is increasing, solving the problems of fast and comfort transportation could be focus of attention by everybody thatrelates to this speed,now airports that have a basic role on all transportation dimensions; have also heavy duties to transmit merchandises and individuals to any related destination in the best way by airplane. Airports wrong location is one of the most important things that we have in some airportsBojnurd airport is one of Iran's airports that in spite of its effective role on the region, because of special location and particular topography and climatic situations has some problems in airplane's grounding and rising so that yearly a lot of number of flights for different reasons would be cancelled and causes to people's mistrust about airport as a trustful transportation navy.so in this investigation, in addition to pursuing and offering standard topography indices we would work on climatic situations in airport building and adaptation of that standards with formation place of Bojnurd airport. Resultant outcome of adapting airport place with region's topography situations is representative of weakness of needed standards in airplane's grounding and rising and observing the standard grounding angle(3/6degree), that will be removable with few changes in runway and adjacent altitudes. These changes would include height of Babamusa mount about 50m,and also increasing runway length about 1200m from opposite side of runway impending Babamusa that would cause to observing the grounding standard angle that is equal to 3/6 degree. From climatic situations view and flight runway adaptation, it is accommodate with dominant wind side and accomplished corrections on flight runway by temperature, its height toward sea level and admixture of these two factors is correct.

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INTRODUCTION

Flying growth and rapid evolution and aerial transportation have been presented some problems in airports location that need to programming and using aviation technologies and knowledge to be solved. However airports development with regard to a considerable space that it needs near a city, requires a particular programming and investment with respect to functions. So airports are main critical and important part of a country or a city, and indeed international airports are aerial borders of countries and aerial gate of the cities of that country.

Today with a view to the importance of airports and aviation industry and its major progressions in the world and also results of this technology and with regard to flights statistics and passengers relocation and growing space of aerial action field, airplane's type and number and increasing their speed, it's better that we use “ aerial ports”instead of airports. Before transportation being considers as an industry and technology for merchandise and passenger relocation, airports often have been developed in a remarkable distance from city and in places where have cheap earths with a few barriers that gets the most flexibility for actions in the airport. Because of the airplane structure in that days and lack of continuation and frequency in flights, noise contamination wasn't creating problem for society. It also was preventing from dangerous accidents for urban societies because of less aggregate of crowed in adjacent to airport and light aerial traffic. This is while today wonderful growth of aerial traffic would increase probability of society's negative reaction, but development and evolution of airplanes have been traced the deepest effects on relations between urban communities and airports. Increase in size and speed of airplanes, has been caused to increase in necessary equipment for their grounding changes infunctional composition and development of runways in the airport.

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problem expression:

Bojnurd with more than 387000 person is capital of khorasan – e – shomali province with 872711 person(census of 1390). This city has an airport that is the single airport of this province, its coordinates includes 37 29 35" northern, 57 18 30" eastern , and about its establishment we could say that this airport is located on west side of city and in fact in adjacent to the city or adhesive to the city. Runway length of the airport is 3200 meters and its width is 45 meters, and from airport class is D4 type, and its height of sea level is 1138 meters. There are two chains of mounts in the beginning and side of Bojnurd airport. In the northeast there exists Babamoussa mount with 1497 meters height from sea level along with 25 runway and in southwest of airport along with 07 runway Badranlu height exists in south there are Asedley chain – mounts that are continuance of salukchaines and in its west there exists " AkharDagh".

Distance of the end of 25 runways from Baba musa is 5700 meters that because most flight access plans for grounding are of 25- runway that is adjacent to Babamusa. Because of its low distance towards mount, standard flight angle(min 3/6 degree) don't being observed, so grounding and rising being done hardly(1-1 figure). Particular location of this airport had caused that in compact cloudy and rainy days, being cancelled so that in 1390, 32 flights and in 1391 , 87 flights and in 1392, 30 flights were cancelled. Census of Bojnurd airport, 1392)

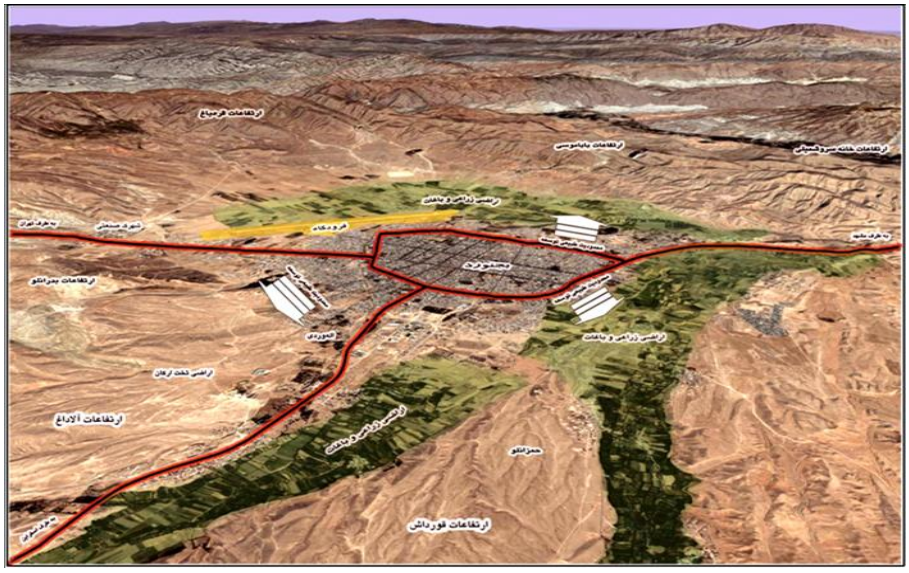

Fig. 1: Geographical situation Bojnurd
Source:Google Earth 2014

2-1General purpose:

Pathology of Bojnurd airport from region's climatic situations and topography perspective

3-1study question:

Whether it has been considered in establishment of Bojnurd airport the climatic and topography situations of region?

4-1study method:

Base of this study includes describing and analyzing method and scientific comparison method that would be obtained by gathering information from several library resources, field removals, conference with experts and available maps and documents, analyzing and comparing them with necessary standards for developing an airport. Execution process of this study has been accomplished in two basic steps:

Step1: Effect of region's topography on grounding and rising airplane at airport.

Step2: Effect of climatic variables on Bojnurd airport

5-1information gathering tool:

1-General maps of Bojnurd city

2-Satellite image of Bojnurd and the region

3-Topography maps of Bojnurd city.

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6-1Study range:

Range of this study includes Bojnurd city and its airport with coordination 37 29 35" northern, 57 18 30" eastern of Bojnurd and capital of khorasan – e – shomali .Bojnurd has been located on coordination of 56 degree and 19 minutes to 57 degree and 43 minutes geographic length, and coordination of 37 degree and 13 minutes to 38 degree and 17 minutes geographic width.

This city has been located with 6563 km^2 area in the center and its continuance along north and northwest and from northeast and northwest is conterminous with Turkmenistan, it is limited from west to Mane and Semelghan city, from southwest to Jajarm city, from south to Esfarayen cityand from southeast and east is limited to shirvan city. Bojnurd is capital ofkhorasan – e – shomali that has been located on 250 km northwest far from Mashhad city – the capital of khorasan – e –Razavi.(Sharaki,1388:17)

1-2Select a suitable site for the airport:

In general, selecting a suitable site for airport of a city depends on following factors:

1-maximum radius of airportsite to city center must be 30 km.

2-for small cities airport must be selected centrally. For example when one decided to develop an airport for three cities, it's better that select it in the center of triangle's middles incidence or near that site.

3-selected site must have following qualifications:

After characterizing runway location on runway direction from takeoff side with 2% gradient not have to be any barrier and in runway direction from approach side up to 3000 m. Radius with 2% gradient and after that, up to 3600m, With 2.5% gradient and after that, up to 8400m, With zero gradient not have to be any barrier.

Perpendicular to runway up to 315 m,of every side with 7 to 1 gradient and after that, up to 4000 m,with zero gradient and after that up to2000 m, With 5 gradient not have to any barrier. So height variation among runway bottom up to ultimate limit of sides would reach to 145m.

Runway direction must be coordinated with 95% of dominant wind and if the region's climatic situations wouldn't necessitates such relation, it must be selected two or more runway depending on rather dominant directions.

2-2Airport site division:

Airports primarily are divided in two parts: earthy aerial

a)Earthy part:total buildings, institutions and equipment's that are blocked with physical border or security control stations that would be separated from levels depends to airplane usage. This complex is responsible of serving clients from city and airplanes fromparking's.

Individuals for traffic to some parts of this complex should have particular licenses'.(197 Journal of Planning and Budget)

b)Aerialpart: total lands, limitations and institutions and equipment that have direct physical relation with grounding and rising services, stop and move of airport and would be separated from earthy complex with blocked border and with security control stations.(The same source)

3-2important factors in planning flight runways:

1-Runway length 2-The number of runways 3-sight length in runways

4-2-calculation of flight runway length:

Necessary length for airport would be calculated by three methods including: ICAO, A.A.F(American Aviation Federal) and live factory catalogues. Runway length is dependent to following factors:

1-airplanes type 2- Region's height from sea level.

3-Temperature unto the warmest day's temperature of the warmest month that is received from the nearest aerology center

4-wind,s effective gradient

5-2Array of airport runways:

Basic modes of airport runways include:

1-5-2 single flight runway:

Is the most simple example that is placed on using sites that in the most time of airflow is in one particular direction term ally have a given dominant wind) and aerial traffic don't exceed of that

2-5-2 parallel flight runways:

Capacity of this designing model depends on following factors:

1-lateral distance of two parallel runways

2-Atmospheric conditions

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3-Aviation aids

3-5-2 cross (convergent) flight runways:

This type of flight runways are usually built in sites that at the time of puffing in a particular direction it couldn't provide necessary coverage. In this kind of designing feasibility of using both kinds of runways concurrently depends on wind's lateral components of each runway.

4-5-2Non – cross(divergent) flight runways:

Capacity of this runway depends on wind conditions and its visibility.

3-Effect of region's conditions on Bojnurd airport:

1-3-Effect of wind on airport designing:

In airports designing and developing, with regard to region's dominant winds, it will be considered one or more specified run for airport's grounding and rising , Selected runs in an airport will be favorable when its usage coefficient always being higher than its least acceptable class(Behni,142,1372)

Having a coefficient equal to 100% isn't compulsory for airports and it's clear that achieving to such a situation practically is impossible,Sowe can accept unprofitability of the airport under particular atmospheric conditions(severe wind) and we can use of secondary airport for grounding and rising of airports. Minimal usage coefficient according to French classification for airports is: for class A up to 95% forclass B up to 90%, class C up to 80% and class D up to 70% , and in ICAO classification, usage coefficient is 95% for all classes.(The same source)

To calculate the use coefficient of one landing and rising protraction, it's presenting wind's statistical information such as frequency, direction and speed like " prevailing wind" , after drawing " prevailing winds" and analyzing them, dominant winds being determined and its utilization amount for landing and rising protraction would be obtained from calculating region's dominant wind and fair weather.

If dominant wind's coverage from one side don't be enough, second class dominant wind will be determined, because necessary coverage for landing and rising protraction being attained from total dominant wind and second class wind and fair weather. So if maximum wind blows from a certain direction, aerial traffic doesn't exceed the capacity of a runway, so it used to a runway, But if wind blows from various directions. It's necessary to attain the minimum acceptable French classification or ICAO classification, being used of two or more runways(parallel, cross or non- cross).(The same source)

To determine use coefficient of one or more landing and rising protraction, lateral winds condition should also be considered. Lateral wind is vertical component that is perpendicular to runway axis. It's meaning that airplane orientation towards central line of runway depends on the power of lateral wind blow to runway axis, when it approaches to runway. Direction course along the central line of the runway is expressed as flight course and that direction.

According to 30 years aerology statics of synoptic station of Bojnurd, most wind blowing direction is from west to east and it is considered as dominant wind direction.Graph(1-1) and chart(1-1)

Chart 1-1: fair weather and dominant direction and wind – blow speed in synoptic station of Bojnurd – statistical period 55-84

moth Description	April	May	Jun	July	AUGUST	September	October	November	December	January	January	March	Annual absolute
Fair weather percentage	62	57	49	44	49	59	74	74	79	75	68	60	57-6
Dominant direction	West	West	West	West	West	Northwest	West	West	West	West	West	West	West
Second classdominant	Northwest	Northwest	Northwest	Northwest	Northwest	West	Northwest	Northwest	Northwest	-	-	Northwest	Northwest
Speed m/s	9.7	11.2	8.7	7.6	7.7	7.6	13	7.5	7.6	8.6	9	11.5	9.1

Source: Headquarters of bojnurd aerology 1392

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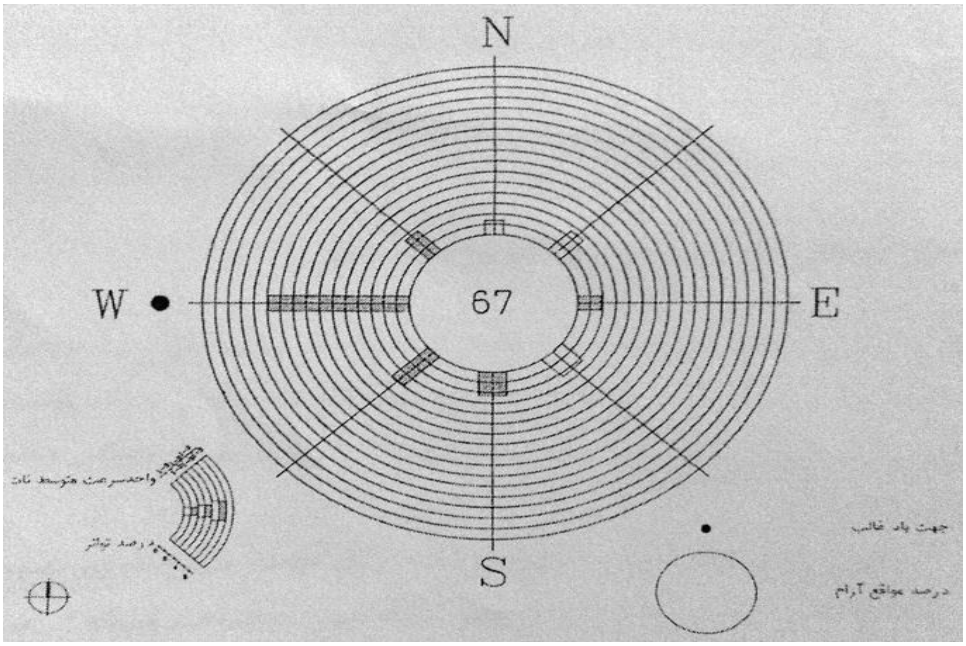
With"prevailing wind" adaptation by runway direction do imply to alignment and nearly coaxial of runway direction with dominant wind direction and we will see deviation of a few degreesfigure (2-1)



Graph 1-1: prevailing wind of Bojnurd city (1355-1385)
Source: Headquarters of bojnurd aerology 1392

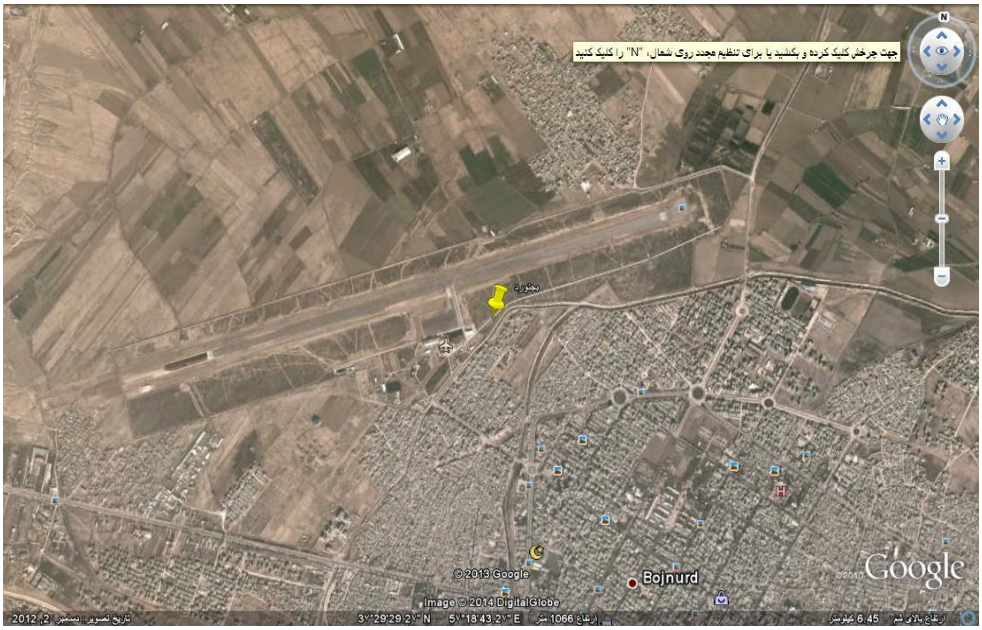


Fig. 2: 1Runway direction and its adaptation with dominant wind direction
Source: Google Earth 2014

2-3the effect of temperature on the Bojnurd airport:

One important thing in airport design to determine runway length.so airport type is determined with one of the two airports classification methods that has been provided by ICAO organization based on geometric standards of runway length. In this classification that airports are characterized with Ato E letters, A type airport has the longest and Etype airport has the shortest runway. The summary of geometric specifications of runway length have been presented in chart (2-3) based on ICAO recommendation for any type of airport. To determine runway's real length, the length of runway base should be corrected relative to difference in altitude, airport temperature difference relative to the standard to the standard temperature(15 ◦c) and longitudinal slope.

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Chart 2-1: geometrical specifications of flight base length

classification	Basic length of runway		Pavement wind	Maximum slop
airport	Max(m)	Min(m)	runway	Length%
A	-	2100	45	1.5%
B	2100	1500	45	1.5%
C	149	900	30	1.5%
D	899	750	22.5	2%
E	749	600	18	2%

Source:ICAO Annex

for every airport calculate the reference temperature and modify the basic runway length is necessary, Reference temperature of every airport in Celsius scale is calculated from average monthly temperature and mean daily maximum temperatures of the warmest month, that is obtained by an annual average rate:

The reference airport temperature T0= $Ta+\frac{Tm-Ta}{3}$

In the above relation

Ta = average daily temperature for the warmest month.

Tm= maximum daily temperature for the same month.

Chart 3-1 Average monthly temperature in bojnurd synoptic station(1355-1384)

Annual absolute	March	February	January	December	November	October	September	August	July	June	May	April	month / Description
Ta	6.7	2.2	-.2	0	9.2	29.2	20.3	23.9	25.1	22.8	18.6	13.4	Daily average
Tm	12.5	7.4	6.3	8.7	14.3	21.2	28.2	31.8	32.4	29.6	24.3	19.9	Daily minimum
Source:synoptic stationbojnurd													

Chart 3-3 shows that July with average temperature equal to 25.1 ◦c was the warmest month of year and its average maximum daily is 32.4 ◦c , so airport average reference temperature is:

Tm and Ta calculated values of Bojnurd:

Reference temperature of Bojnurd airport $\rightarrow 1+\frac{32.4-25.1}{3}=27.5\ .c$

Correcting runway length:

Basic runway length is determined for the latitude by standard atmospheric condition. Therefore necessary reformations should be done about any changes in height, temperature and slope for real site of the airport as following:

The impact of airport reference temperature rise relative to the standard temperature is the same as the impact of height rise. The correction of temperature change based on ICAO recommendations is according to following procedures:

A) Standard atmospheric temperature is determined equal to 15◦c

B) The airport reference temperature is calculated

C) Airport reference temperature rise is determined relative to standard temperature.

D) For every one degree increase in temperature of 1% is added to the adjusted base of runway and in more stringent state, height rise is considered in the standard temperature amount. So for every one meter latitude equal to 0.0056◦c is decreased from standard atmospheric temperature(15◦c)or 5.6◦c for 1000meters.

Temperature rise → **7.5-15=12.5◦c**

Correction for class A airport → $\frac{2658}{100}*12.5=$**=332m**

3-**3The impact of region altitude on Bojnurd airport:**

Air density decreases with increasing altitude. this phenomenon in turn causes to life power reduction of airport wings, so the airport will need to more speed for rising that, as a result to achieve greater speed it will be needed to longer runway.ICAO recommends that for every 300 meters altitude, 7% add to base runway length.

Correction for class A airport → $\frac{7}{100}*\frac{1138}{300}$ ***2100=558m**

Length corrected for altitude → **2100+558=2658m**

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4-3total control of height correction and temperature of Bojnurd airport:

According to ICAO recommendation, if the total; height correction and temperature exceeds from 35% the length of runway base, these corrections should be controlled with doing particular studies in place and by sample tests.

The corrected length of runway for class A airport2658+332=2990m:

From above findings it is concluded that even if Bojnurd airport was of class A airport, runway length with regard to airport latitude and temperature was enough.

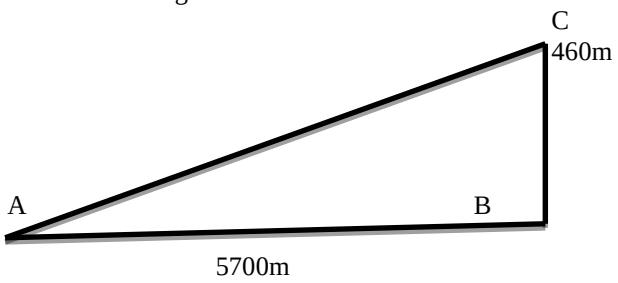
5-3The effect of topography at Bojnurd airport:

Bojnurd runway latitude is 1138m and height of BaBamusaMountain is 1497m. Therunway gap of the mountain is 5700m. Map 2-4 according to aviation regulations for plane passing, Bojnurd airport plan would have at least 300 feet or 100meters more height than any obstacles. So considering that the airplane should reduce the difference of mountain 359 meters plus distance of 100meters safe distance with obstacles that is a total of 459 meters, in 5700 meters that this will be contrary to the standard descent angle meaning that geometric relationships will be established.

AB=short distance to the runway beginning

BC= mountain height difference plus safe distance of flight

Tag @ = BC/AB (2-4)



Obtained number is larger than the maximum descent angle $(3.6)^0$So safe flight angle will not be made. For correcting the descent angle there are tree solutions.

1) Reducing BC length, means that reducing the height of the mountain

2)Increase AB length, meansthat increasing distance from the landing point to the mountain

3) Concurrently reducing and increasing the mountain length and distance from the landing point to the mountain.

Reducing mountain height of 50 meters and increasing runway length of 1200 meters, from the runway in opposite side of the mountain causes that a standard descent angle being achieved.

Height difference between mountain runways after 50 meters, Height reduction of the mountain:**460-50 = 410 m**

Increase over 1200 meters runway in the opposite side of runway the mountain side BabaMoussa:**5700+1200 = 6900**m

3.6^0: right angle landing: **Tag 3.6*6900= 434m> 410m**

07 runway increase length equal to 1200 meters, Although makes the total runway length equal to 4400 meters and the airplanes for creates a safe distance from the mountain and makes a right landing angle, will lose 1200meters of the 25 runway length and the landing distance is 6900 meters, this distance is provided for making a 3.6^0angle that is at last standard landingangle, and the remaining runway of 3200meters will have a standard distance for deceleration and stopping the plain even in bad weather conditions.

Results:

Evaluation of climate information and meteorology information is representative of deviation of a few degrees of Bojnurd ,s prevailing wind relative to airport runway which is acceptable in terms of civil aviation organization.According to the Bojnurd airport reference temperature, the corrected amount for runway length rise will be 332 meters and also according to the airport latitude of Bojnurd, corrected amount of runway length will be 558 meters. Simultaneous impact of height and temperature on Bojnurd airport runway length is 2990 meters that is less than current runway length (current runway length is 3200 meters) and this reflects that climatic conditions is considered in the length of Bojnurd airport. Obtained results from analysis of the region topography show that because of a latitude equal to 1138 meters in Bojnurd airport runway, and a height equal to 1497 meters in Baba musa mountain and end distance of runway from mountain is 5700 meters, and according to aviation regulations about passing Bojnurd,s airport project from any obstacle it should have a height at least 300 feet or 100 meters more than it. This will be contrary to standard landing angle. A 50 meters

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reduce in mountain height and an 1200 meters rise in 07 runway length, although cause that the total runway length become 4400 meters , and airplane for making safe distance and a right landing angle. It will lose 1200 meters of 25 runway and it lands in a 6900 meters for from Baba musa mountain, this distance for making an angle equal to 3.6^0 that is minimum standard angle of descent , is provided and the remaining runway equal to 3200 meters will have a standard distance for deceleration and plain stopping even in bad climatic conditions.

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