International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 09 | Sep 2021 www.irjet.net p-ISSN: 2395-0072

DESIGN REPORT OF AIRPORT RUNWAY FOR VELLORE

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Abstract: *This Project clearly illustrates the Design of the Runway. We have chosen VELLORE city for our area of study. This city is near Chittoor, quite near the border of Andhra Pradesh. We have chosen this area specifically because of the trend of rising population and travel demand to Vellore city. Due to the mentioned factors, we have figured that there is a need for an airport and decided upon this place. So that it will act as a good mode of transport for investors from various states of India and various countries. This airport will also generate huge revenue for the city and it will also create a lot of employment for primary, secondary, and tertiary sectors.*

Key words: Design, Runway, population, travel demand, transport, employment.

1. Introduction:

The Population of the World is skyrocketing continuously and all the people are adapting to the modern era and getting advanced in terms of technology and Transportation. Things have changed enormously over the Centuries. The field of transportation saw spectacular developments over the period. Transportation has evolved a lot, from bullock carts to airplanes. Nowadays, everyone has acclimatized to the current advances. Whilst the vast majority of people always wanted to travel faster and ensure safety irrespective of the costs. The Convenient and easy way of transportation is Airways. So their demand is proliferating at a great number. Airports consist of so many things like Air Traffic Controller, Taxiways, Terminal Building, Terminal Gates, etc. Over the period, Airports witnessed dramatic changes. Airports have been developed and advanced a lot over the years in terms of maintenance and the number of buildings an Airport has. Nowadays, due to the consistent increase in the demand for transportation, the air traffic has also outraced.

Over the years, Civil engineers have found a better method for alignment of the runway which is based on the Wind rose diagram. There are two types in the windrose diagrams, one is Type 1 and the other is type 2. Type I only gives the direction of the runway whereas, Type II not only tells the direction of the runway but also gives the output of the crosswind component. The airport is designed precisely at PEDDISETTY PALLE that comes under the VELLORE district, which is considered as a hub for students aspiring for their career in medical sciences and engineering. The presence of two reputed colleges i.e. Vellore Institute of Technology (VIT) and Christian medical college (CMC) enhance the importance of this place. This site is 13.130688 N,79.06232 E. The average elevation of the runway path is 100ft.

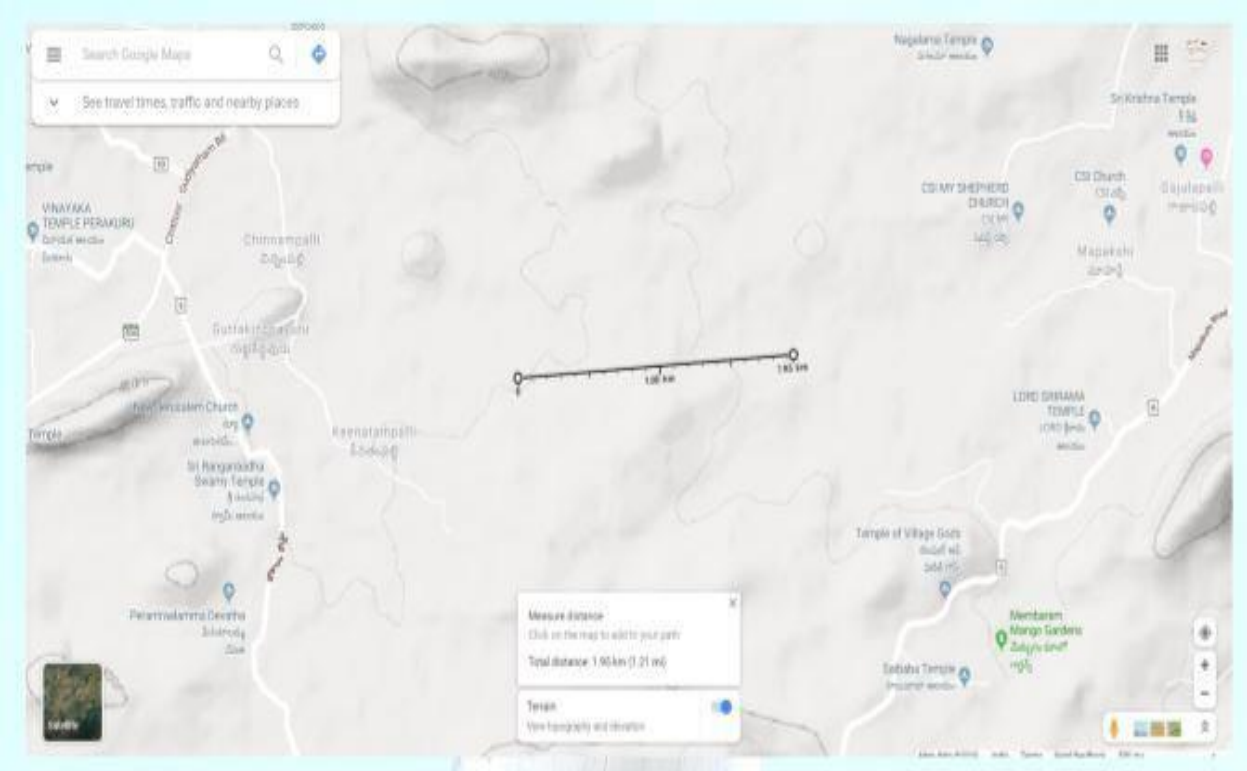

Figure 1: Selected study area

2. Methodology:

We have collected the Information about "Place of the Site, Elevation of Site, Distance of Site From the Nearby Cities, Highways, River and Area of the Site'' by **Google Earth** for Windrose Diagram to our selected study area.

We have drawn the Airport Layout and Collected the Information about the Specifications such as Length, Width of Runway, Takeoff Distance and Specifications such as "Threshold Markings, Aiming Point Markings, Touchdown Zone Markings, Centre Line Markings, Runway strip Markings", the direction of the Runway, etc. and We have Calculated the Runway Takeoff Length as per the specifications.

Estimation of runway direction:

For this project, a type II of windrose diagram has been used, which gives the suitable wind direction and the crosswind component.

Table-1: Grouped data of wind components in percentage(%)

Direction	<0.5	0.5-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	>5.0	Total
N	0.00	0.38	1.51	0.89	0.10	0.14	0.14	3.16
NNE	0.00	0.17	1.75	1.78	0.48	0.24	0.58	5.00
WE	0.03	0.31	1.27	2.81	1.93	0.72	0.45	7.54
ENE	0.14	0.34	2.032	4.59	3.39	1.61	0.34	12.43
E	0.07	0.27	1.02	3.53	1.81	1.03	0.10	7.84

ESE	0.07	0.27	1.57	2.26	1.23	0.82	0.07	6.29
SE	0.14	0.21	1.75	2.09	1.47	0.41	0.00	6.07
SSE	0.10	0.10	1.88	2.67	0.68	0.14	0.00	5.57
S	0.03	0.07	2.02	1.88	0.21	0.00	0.00	4.21
SSW	0.00	0.07	2.05	1.10	0.31	0.00	0.00	3.53
SW	0.03	0.38	1.40	0.75	0.24	0.00	0.00	2.80
WSW	0.03	0.31	1.61	1.03	0.62	0.75	0.92	5.27
W	0.10	0.51	1.96	1.27	1.61	3.05	10.07	17.77
WNW	0.07	0.34	0.79	0.89	1.13	1.27	4.79	9.28
NW	0.10	0.41	0.48	0.14	0.07	0.00	0.14	1.34
NNW	0.10	0.21	1.16	0.34	0.03	0.00	0.07	1.91
TOTAL	1.01	4.35	23.45	28.06	15.33	10.18	17.67	100

Figure-2: Windrose diagram for the selected area using the wind components.

From the data obtained, the wind rose diagram has been plotted and the suitable direction that we have got from the reckoning is EAST to WEST. Therefore, the runway can be aligned in the EAST-WEST direction

3. RUNWAY LENGTH:

Runway, being the prime aspect of an airport. To design the runway, a reference airplane should be considered and maximum capacity has to be adapted. As Vellore is not a big city, we are taking the A320 as our reference airplane. Generally, runway length is categorized as

1. Basic runway length

2. Actual runway length

3.1 Basic runway length:

it is the length estimated under some standard conditions

The conditions are as follows:

a) The altitude of an airport is assumed to be at sea level

b) Airport temperature assumed to be standard

c) Assumed that no wind exists on the runway

d) The runway has to be leveled in the longitudinal direction

e) Enroute temperature is assumed to be standard

f) It is Assumed that there is no wind blowing en route to the destination.

For the A320 aircraft, the basic runway length is 2100 meters (specified in the specification booklet)

3.2 Actual runway length:

It is the length that we would get after correcting the temperature, elevation, and slope by applying corrections. It should be adequate enough to satisfy all the aircraft's operational requirements. It is not supposed to be less than the longest length obtained after correcting by using the corrections of local conditions for operations and performance. Local Neighborhood conditions that must be reckoned are temperature, rise, slant and dampness, and runway surface qualities.

Length calculation steps are as follows,

a) The runway's basic length should be increased at a rate of 7% per 300-meter increase. The runway should be enlarged by 0.05 meters due to the elevation of our site, which is 22 meters. Since 0.05metres is a small number, it can be neglected

b) The length of the runway in stone ought to be further incremented at the pace of 1% for each 1°C in the aerodrome; reference temperature surpasses the standard environment for the aerodrome. Assuming in any case, the complete adjustment for rising and temperature surpasses 35%, then the necessary rectification ought to be gotten through explicit investigation.

Generally, the standard temperature is assumed to be 15 C, but the temperature of the chosen study area is 27.4 C.

Therefore, the difference is 12.4 C; as mentioned, for every 1 C rise in standard temperature, there should be 1% increase in the runway length.

So, we are supposed to increase 260.4metres length.

c) When the runway length is higher than 900m, the runway length is extended at a rate of 10% for every 1% of the runway slope.

Considering this, for the 22-meter elevation, we are supposed to provide a 0.8% slope.

For a 0.8% slope, the runway length would be increased further by 18.883 meters.

Summing up all, the total length = (basic runway length + a + b + c)

Therefore, the total actual length of the runway will be 2379.283 meters.

4. PAVEMENT DESIGN:

Runway pavements are planned and developed to offer satisfactory help for the loads imposed by planes and to deliver a firm; steady, smooth, slip safe, all-year, all-climate surface liberated from trash or different particles that can be exploded or picked by propeller wash or stream impact. To satisfy these prerequisites, the quality and thickness of the asphalt should not come up short under the forced burdens. The asphalt should likewise have adequate innate soundness to withstand, without harm, the rough activity of traffic, unfavorable climate conditions, and other

breaking down impacts. This requires coordination of many plan variables, development, and assessment to guarantee the best blend of accessible materials and quality.

The thicknesses of the pavement section and the materials used are designed in software called the "FAARFIELD" which has been designed by "Federal Aviation Administration" (FAA) The results obtained from the studies are as follows Dense bituminous concrete = 100mm Dense bituminous macadam= 125mm Water bound macadam = 150mm Granular sub base= 200mm

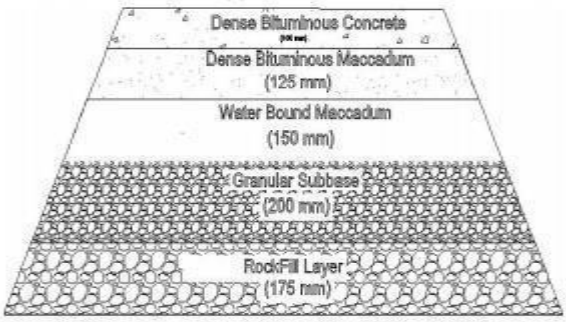

Figure-3: Sectional view of the pavement

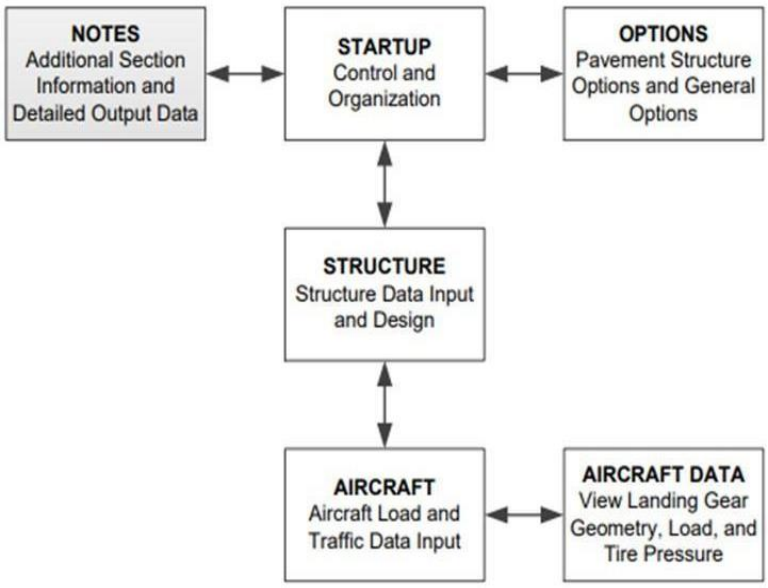

Chart-1: Steps of FAARFIELD program

5. CONCLUSION:

Summing up all, fathoming the travel demand in Vellore, we came to know that implementing an airport is a way to tackle the colossal amount of traffic demand. This paper illustrates every morsel of runway design for Vellore if the airport is to be constructed. This paper clearly delineates the process of runway design, obtaining wind direction through resources and finding the apt direction for the runway, and other miscellaneous factors.

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