# Airport Layout Plan for Efficient Airport Design

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***Abstract:*** **- Airport Engineering incorporates the design, planning, and construction of runways, terminals, and navigation assistance to provide an entrenched service for passengers and freight service. Airport engineers design and construct airports. They majorly consider the influences and demands of aircraft in their design of airport facilities. These engineers must use the investigation of largest wind direction to design runway orientation, safety areas and to determine the size of the runway border, different wing tip to wing clearances for all gates and must designate the clear zones in the entire port. In this literature a detailed view of airport layout planning is studied and also a simple designed airport layout for ports near water bodies is presented**.

## I. INTRODUCTION

The main objective that was taken for the development of a Domestic Airport resulted in favor substitute. The favored substitute must be put into the layout plan of an airport of Domestic Airport drawing plans, which is shown in this literature. The procedure set, which is mentioned in summative of the "ALP" is primed accordingly under the rules of the FAA. The changes in indicates prevailing conditions, needed changes in services on airfield, ownership, land use, and removal of obstructions. The airport plan drawing provides a detailed information for present and future construction. The future improvements in the plan layout are made up with the airport layout plan drawing updated 20- year capital improvement program. The ALP layout will be submitted along with the draft of the master plan report for review and approval to Federal Aviation Administration (FAA). The drawings will be reviewed by the FAA Airports District Office (ADO) with additional review coordinated with other FAA offices (Flight Procedures, Flight Standards, etc.). Once it is done, the final ALP plan layout will be signed and the FAA Airports District Off the ice (ADO). As individual projects are completed, minor updates to the ALP drawing may be completed (with FAA coordination) without updating the airport master layout plan. A complete update of the full ALP drawing set will be conducted as part of the next la, you update. The airport layout plan drawings are prepared using AutoCAD® computer-aided drafting software, which allows for easier updating and revision. The drawing files may also be imported into local geographic information systems (GIS) to support land use planning, removal of the obstruction., etc.

A brief summary of the individual drawings is provided below:

## II. AIRPORT DATA SHEET DRAWING

The Airport layout drawings are generated by the rules established by Design and AC 150/5300-18 General Guidance and Specifications for Submission of Aeronautical Surveys to NGS: Field Data Collection and Geographic Information System (GIS) Standard and the FAA Advisory Circular (AC) 150/5300-13 Airport. The discrete sheets of the airport layout plan were resolute using the layout guidelines fan and in those requirements contained in the FAA Region ALP checklist and AC 150/5070-6b Airport Master Plans Appendix F Airport Layout Plan Drawing Set.

| AIRPORT DATA | EXISTING | FUTURE |
|---|---|---|
| AIRPORT ELEVATION (NAVD 88) | 160' | SAME |
| AIRPORT REFERENCE POINT (ARP) | N 44° 34' 49.3" W 124° 03' 28.5" | SAME |
| MEAN DAILY MAXIMUM TEMPERATURE | 65.1°F | SAME |
| AIRPORT REFERENCE CODE | B-II | B-III |
| NPIAS ROLE | GA | SAME |
| NAVIGATIONAL AIDS | ILS;VORTAC;MALSR | SAME |
| WEATHER SYSTEM | AWOS-III | SAME |
| TAXIWAY LIGHTING | NONE | MIRL |
| TAXIWAY MARKINGS | CENTERLINE | SAME |

Fig.1. Airport data of Newport municipal airport, Oregon.

## III. AIRPORT LAYOUT PLAN DRAWING

The presents and the prevailing ultimate airport layout is explained in detail in Airport Layout Drawing. The main components of the Airport plan drawing contain wind data formulation, Place of airfield services, the physical features of the airport and prevailing general aviation growth. Airport Layout drawings also present the runway protection locations, airport boundary property, and income funding zones. The descriptive plan designed for computers provides a detailed information on the future and prevailing features about several structures of understanding that allows the user to analyze and study any section in the airport zone clearly. The .plan can be used for the primary information and understand the design of the airport and it can also update easily in the future in accordance to the new growth of the airport and more elaborated conditions of prevailing airport conditions that are made by airport design surveys.

As eminent in the Circular 150/5070-6B recommended by FAA and Airport Master Plans, the ALP has five prime purposes:

- To create a design for the airport development by portraying planned facility growth.
- The instruction by the ALP through which the airport promoter can ensure that growth upholds safety requirements and airport design standards, and is fully reliable with airport and community land use plans.
- It acts as a manuscript for public use that aids as aeronautical record necessities and as a place of community reference discussions on budget resource planning and land use proposals.
- It serves to enable the airport sponsor and the FAA to plan for ability developments at the airport. It also allows the FAA to forestall financial and technical needs. It also allows the FAA to prevent the airspace needed for approach procedure improvements or facility.
- It acts as an efficient tool for the airport supporter, particularly its maintenance staff and growth.
- It acts as a major requirement for the airport sponsor to get financial support from the FAA

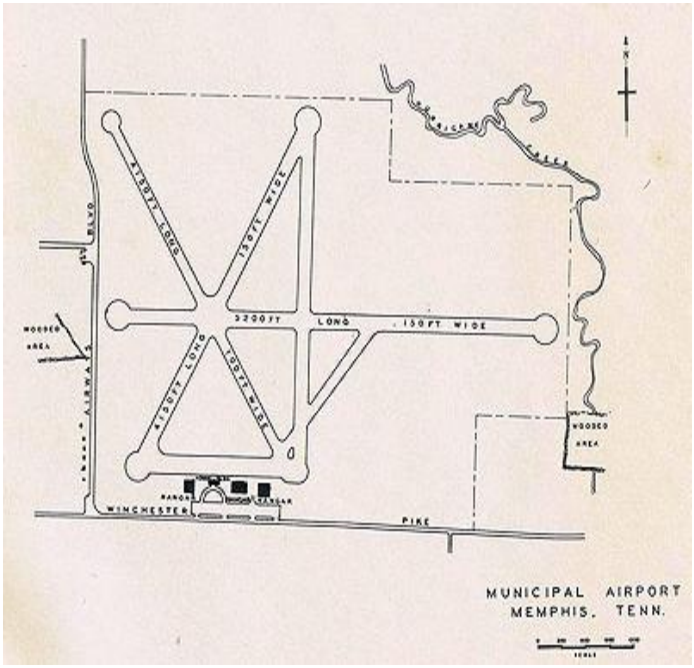


Fig.2. Airport layout of Memphis municipal airport, Memphis.

## IV. TERMINAL AREA DRAWINGS PLAN

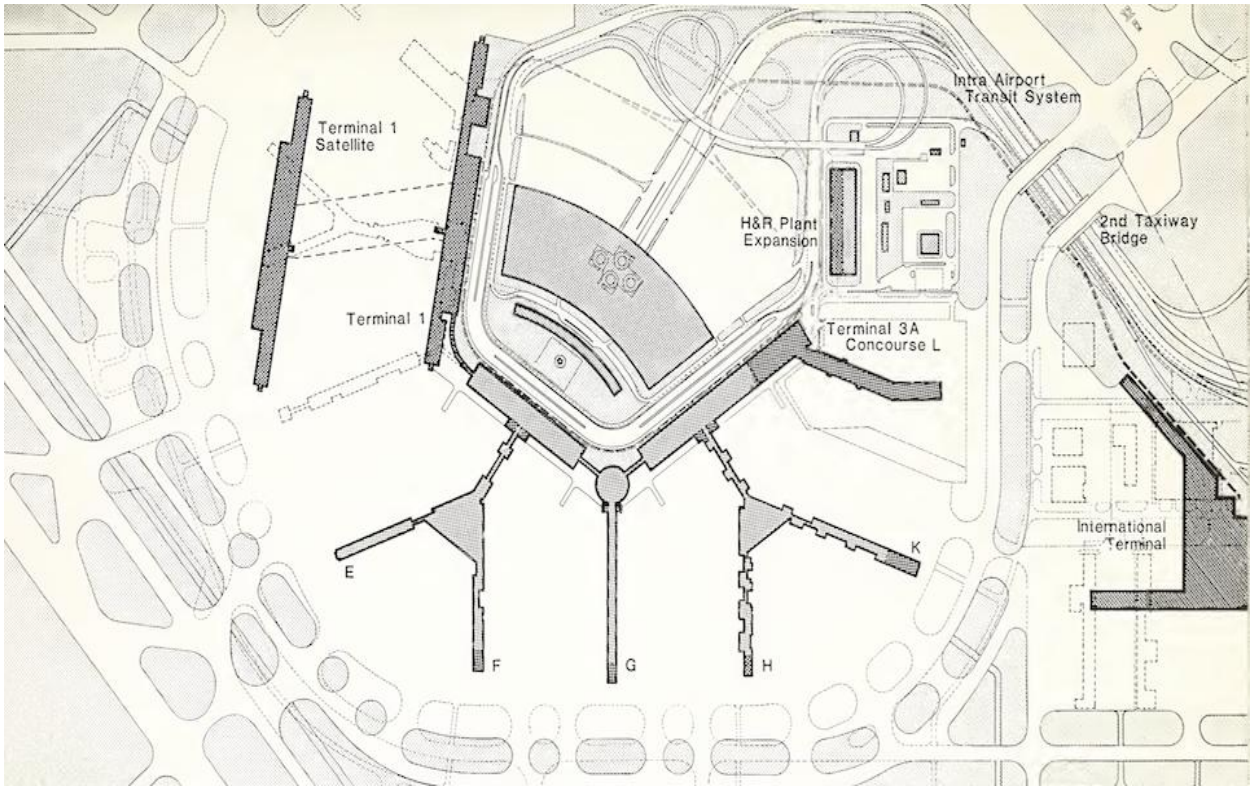


Fig.3. Terminal area plan of Chicago-O'Hare International Airport

The plan of the larger scale outlook drawing of prevailing and buildings, hangars, parking lots, planned aprons, and other landside facilities engrossed in the development of area under airport terminal.

## V. FAR PART 77 AIRSPACE DRAWINGS

The FAR Part 77 Airspace drawings are the protected airfield defined for Runway in Federal Air Regulation (FAR) and for all the significantly affecting objects of Navigable Airspace. The airspace plan depicts the five "imaginary surfaces" that are stated in FAR Part 77.25 including the primary, transitional, approach, horizontal and conical surfaces, previously described later. Part 77 surfaces should be free to build or terrain obstructions to a great extent possible.

*Objects that are FAR Part 77*

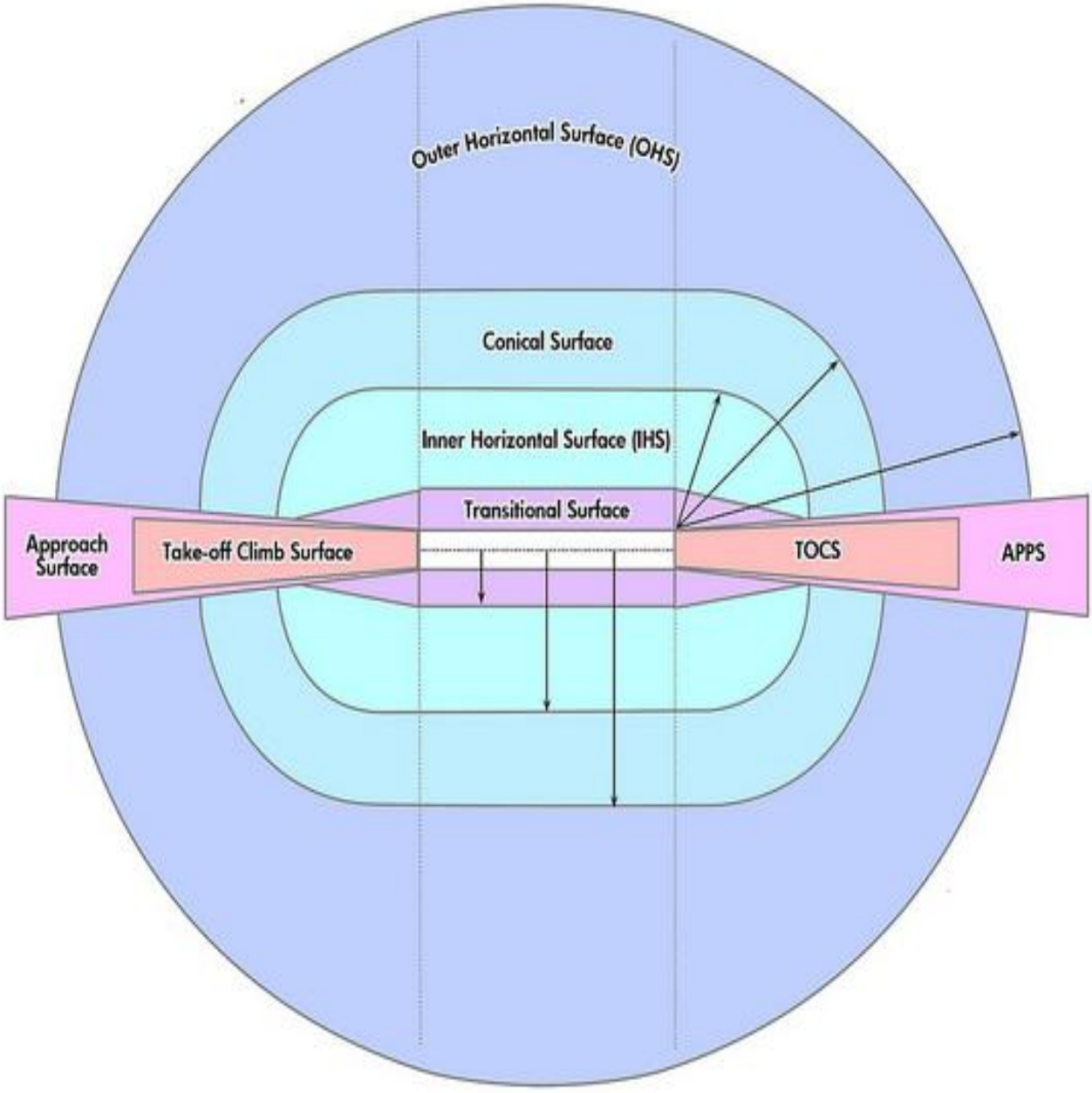


Fig.4. Schematic view of Aerodromes

Surfaces may require an action of mark or removal depends on their severity, location and the feasibility of the action. The characteristics of surfaces define the size of aircraft using the runway and the capabilities to land on the runway. Runway commonly accommodates large aircraft (over 5670 kg) with precision instrument approaches capabilities on Runway and non-precision instrument approach capabilities on Runway.

*Runway Profile Drawing*

The Runway is provided a depiction of the now and then Runway elevations. The plan presents the longitudinal grades for Runway. The Airport Airspace Drawing – The Airport Airfield Drawing is depicted using the rules in Part 77 of Federal Aviation Regulations which include governing criterion and objects that are affecting Navigable Airspace. The main objective of Airport Airspace Drawing is to help the local specialists in finding whether the planned growth of the airport is hazardous to the airport and will it block the path of the airplane in a runway. It is really important to coordinate the plan with the local land users.

*Runway Approach Surface Profile Drawing*

The main use of this drawing is that it shows both the design plan and the whole profile of the runway approach surface based on the FAR part 77. It also gives a clear view of the extended ground lines that are constructed using composite. An appropriate amount of the Impediments and clearances using railroads are also shown.

*Inner Portion of the Approach Surface Drawings*

Majority of the inside portions of Approach Surface Drawings contains scaled down depictions of the runway safety area (RSA), obstacle-free zone (OFZ), object free area (OFA) and runway protection zone (RPZ) for every proposed runway. The total design plan and the planned profile view of every distinct runway protection zone are shown to identify any obstacles and obstructions that might present on the safety. For the necessity of identification and disposal of obstructions, a clear and detailed facility data info is also shown.

On-Airport Land Use Drawing – It mainly depicts the land use recommendations graphically. When it is time for the land use of the proposed design it should take place according to the land use area described in this plan.

Property Map - It gives information about the acquisition and helps in identifying all the land regions that are under the airport control. All the future and already prevailing properties that come under airport authority can be identified in Property Map.

- Runway Transitional Surface: The runway transitional surfaces are the ones that extend outward and upward from the outer edges of the crucial surface. The transitional surfaces have a slope of 7:1 and extend to an elevation 46 m above airfield elevation and connect to the runway horizontal surface. This surface is required for precision instrument approach surfaces.
- Horizontal Surface: The horizontal surface is drawn from 3048 m radii that extend from both ends of the primary surface to form an oval. The horizontal surface is designed as a flat plane of airspace with an elevation 46 m above the airport elevation. The majority of obstructions identified in the horizontal surface are trees located off airport property.
- Conical Surface: From the outer horizontal edge surfaces at a slope of 20:1 for 1219 m extends the conical surface. An area of terrain penetration is identified in the northwest section of the conical surface.

## VI. RUNWAY APPROACH SURFACE PLAN AND PROFILE DRAWINGS

The Approach Surface drawings depict plan and profile views of the runway approach surfaces depicted in FAR Part 77 airspace plan. The drawings provide additional detail in identify obstructions, terrain and other physical features within the approach surfaces. The drawings include obstruction data tables for items depicted on the drawing, using the same numbering identifiers from the overall Airspace Plan. The drawing for Runway also depicts the threshold sitting surface (TSS) that is used to mitigate obstructions to the approach surface. The appropriate applications, dimensions, and slope are defined in FAA Advisory Circular (AC) 150/5300-13A (paragraph 303, section b.).

## VII. RUNWAY RPZ & INNER APPROACH SURFACE DRAWINGS

The runway protection zone (RPZ) and inner approach surface drawings depict detailed plan views of these areas and a profile view of the approach surface and threshold sitting surface (when used). The drawings include obstruction data tables for items depicted on the drawing, using the same numbering identifiers from the overall Airspace Plan layout, Profile drawings, and Approach runway Surface.

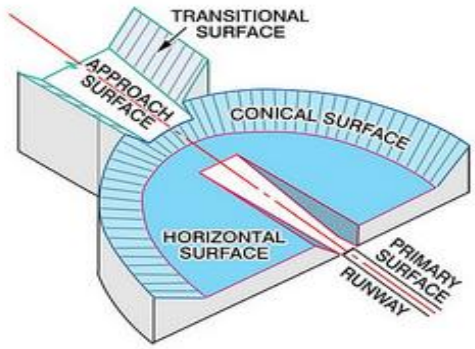


Fig.5. Schematic view of Runway profile drawings.

## VIII. ON-AIRPORT LAND PLAN

The On-Airport Land Plan shows the existing land use within the airport property and to the airport facilities in the Airport and surface access in the airport and within the land plan. The land uses plans on the airfield includes a variety of aviation setup and non-aviation use. The existing facilities located on the airport closed runway will be relocated if there is any commotion. Land use within the industrial park is exclusively non-aviation due to terrain and the inability to provide aeronautical access to the airfield. Updated 20-year noise contours are depicted based on the FAA-approved master plan aviation activity forecasts (2032). All aviation and non-aviation uses (industrial, commercial) at the airport are compatible with current and long-term noise exposure levels.

## IX. OFF-AIRPORT LAND USE PLAN

The Off-Airport Land Use Plan is to assist the existing layout plans land uses and efforts zoning of the airport. The FAA, local immediate vicinity. The state aviation agencies expend a significant fund. The majority of which will be within the City limits. Land use and zoning compatibility plans throughout the state.

## X. AIRPORT PROPERTY PLAN

The Airport Property Plans provides depicts every property owned by the airport and industrial park. The plan drawings note the ownership and control of fee simple, navigation, and the FAA guidelines date of acquisition.

## XI. AIRPORT LAYOUT PLAN FOR THE DESIGNED AIRPORT

*General*

The airport layout plan is a comprehensive illustration of the scaled version of prevailing and planned airport features. It indicates the position of the port and relevant authorization and geometric info that is needed to show compliance with pertinent principles. The Airport Layout Plan portrays the suggested place of the capacities which are estimated to provide accommodations for the 30-year requirement. The airport layout plan shows growth of needed capacities in stages, constant with estimate request. Summary of the plan aids as a guide to the methodical and balanced developments of the airport that is done progressively.

*Major Role of the airport*

The Airport that is designed in this literature is chosen to be general aviation airport that is used only for general purposes like transportation of cargos, military operations, corporate use, emergency purposes, and for medical and agricultural uses, etc. As suggested, the forthcoming part played by an airport is to endure this general purpose until the municipal decides to follow commercial roles. Using existing Federal aviation authority guidelines, the Airport suggested can be listed in the Wasatch Front Regional Council's apprise to the Metropolitan Airports System Plan (MASP) and National Plan of Integrated Airport Systems (NPIAS) as a general aviation facility, accepting group C aircraft.

*Runways described in the Layout*

The suggested Airport will be maintaining two major runways. For time sake the runways can be named as Runway AB-12 and Runway CD-34. Runway AB-12 will be asphalt composed and will be of dimensions, 2620m long (rounded) and 46m wide. It will be attached to a medium intensity runway lighting arrangement (MRL), with a marked precision instrument which is intended to serve runways like ILS. Conferring to the Federal aviation authority Form 5010-1 of 1999, the total strength of the runway estimated to be around 63503 kg dual tandem gear (DTG), 38556 kg dual wheel gear (DWG), 29484 kg single wheel gear (SWG), and the type of landing flyers have a PAPI-4 type on Runway-AB and Runway-12 will be having VASI-2 type. The runway will be maintained in excellent condition, though, monotonous coats will be finished to protect the reliability of the pavement. The lighting assistances will be reserved and maintained properly.

Runway CD-34 will be asphalt composed and its measurements are 2012m long and a width of 46m. The runway strength will be estimated around at 49895 kg DTG, 31751 kg DWG and 22680 kg SWG based on the form 5010-1 of 1999 FAA regulation. For the consideration of visual approach operations marking, Runway CD-34 will be containing a medium intensity runway lighting system (MIRL), and a 2-box visual approach slope indicator (VASI-2) will be present at each runway ends. There will be a sufficient runway length, but there should be lighting maintenance and routine pavement.

The Future Runway EF-56, which will be constructed afterward will be of 1341m long by 23m wide. It will have a

proposed strength of 56700kg SWG. It will also have a medium intensity runway lighting system and marked for visual operations and there will be a 2-box precision approach with path indicator.

*Taxiways described in the Layout*

In this airport design, parallel taxiways are considered since it is an important item for development and it is mainly considered to efficiency enhancement and reduce the delay but the only problem is they will be high cost. The designed airport will maintain a system of 16m width, a part will be parallel and it will be of connecting taxiways types which easily gives access to both apron and building areas.

Runway AB-12 will be having a partial parallel taxiway. The taxiway will be 16m wide, with asphalt paved surface. The phase I of the construction will be containing the complete extension of the full parallel taxiway schedule.

The Future Runway EF-56 is also planned to have a parallel taxiway of full-length as shown on Airport Layout Plan. The taxiway will be built in stages to match with runway maintenance works and will be of 11m wide, with a composition of asphalt.

*Development of Commercial Aviation*

The crucial terminal building will be positioned on the Runway AB-12 southeast side. This location is chosen because to provide reasonable access to airside and landside.

In front of the new terminal building, there will be a place where all commercial aircraft should be located. The apron will be initially designed with an accommodation capacity for aircraft like Boeing 737 with expansion capability. Till the end of the year 2018, there is no requirement of more than eight aircraft parking positions, although the airport layout plan is estimated for up to 20 gate positions and five air cargo positions for parking.

*General Aviation Development*

There is a steady increase of aviation operations based on general aviation aircraft. The predictions by the aviation industry antedate that this leaning will be continuing throughout the study period. Hence, there should be a development in airport facilities that will meet the projected demand.

The service of general aviation is designed to first serve by the east of Runway CD-34. It is expected that growth of general aviation development will be continuing in this area. The plan also includes an expansion of the general aviation apron on the north. This expansion is expected to be sufficient in the upcoming years.

Individual corporate hangars have been designed based on the aircraft storage in T-hangars. Hangar locations are designed to be constant with the current airport land use and current hangar facilities. The location and size are only for planning purposes and some of the distinct plans will be estimated on a case-by-case basis for the conformance to the Airport Layout Plan.

## XII. PLAN OF TERMINAL AREA

*General*

The prevailing and planned layout of the terminal zones containing features like buildings, aprons, parking are graphically depicted in terminal area plan (TAP). The drawing represents the location and position of the general aviation facilities and commercial area and their allied growth.

*Terminal Area For commercial purpose*

The doorway to the municipal community is generally measured by the terminal building. The terminal building is one of the crucial building that imitates the appeal of the citizens as well as the community. It is highly recommended to use a broadminded structural design and style, using local flavors. It is highly important to have a proper layout plan and size of the terminal building for a well-organized airport mission. In the airport layout plan, it is been projected that the upcoming terminal building eventually is about 8715-meter square and situated east of Runway AB-12. It is predicted that the fresh terminal will help current and future demand through 2018.

Airside admission to the terminal would be through a planned taxiway and apron. Firstlythe apron will be accommodating nine Boeing 737 aircraft type at least with 18 parking positions expansion capability.

Parking for automobiles is proposed to give sufficient placed for prevailing and forecasted demand. Every proposed public parking will be accessibly situated in front of the terminal. Parking for rental vehicles will also be taken into account.

**Hangars described in the layout.**

The type and number of hangars that are built mainly depend on the necessity and space of an airport. It should be predictable that each building size and type will be carefully estimated before the beginning of the construction process. The sizes shown are distinctive, however, the actual sizes of the hangars may vary provisional to the planned use. The important aspect is to preserve the complete development scheme defined in the plan.

Many new T-hangar is shown on the ALP. These units will be housing forecast and existing need in 2018. The hangars will be established by necessity and will be built by the private interests or by a city. The hangars have been planned for all

phases and are predicted to meet future demand. Each hangar will be provided with good landside and airside access. It is suggested that the airport tenancy these zones for building by individual operators as demand authorizations.

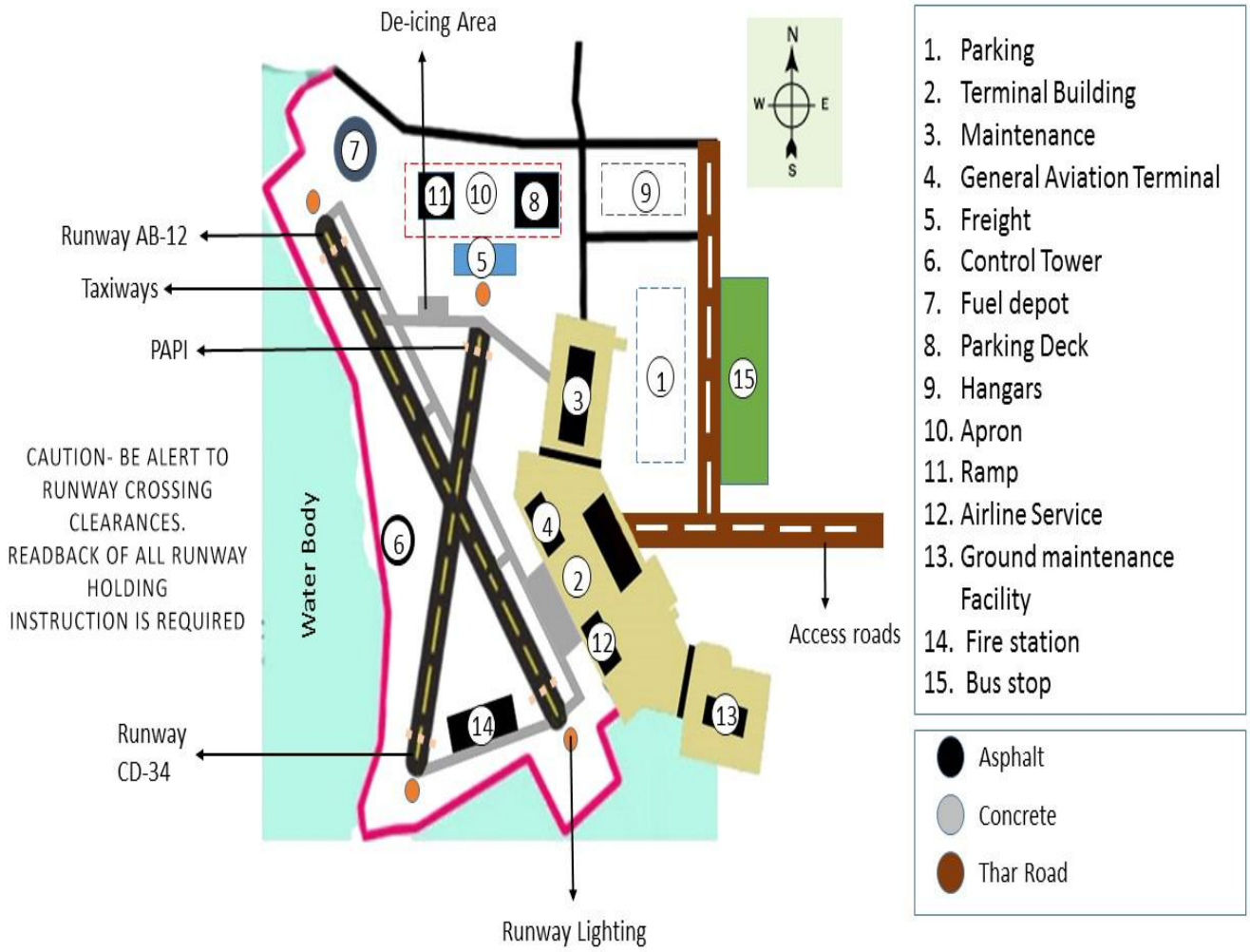


Fig.6. Airport Layout plan for the designed Airport.

## XIII. CONCLUSION

Airway transport system is one of the growing and efficient means of transport System. More than a million people around the globe travel through airlines each and every day. So it is highly recommended to design and plan the airport infrastructure to accommodate and serve the people with ease. In this literature a brief study about airport design and layout is performed. An efficient airport layout design is also developed and presented using the analysis of proficient airports around the globe. This work will be useful in designing an airport near any water bodies. One of the pros in constructing an airport near any water body is, we can develop hydroelectricity in order to power the whole airport without any external power generators.

In this model additionally we can also add noise abatement zones and control zones restricting airspace control. One of the important criteria in designing an airport is that the user should be able to maneuver the aircraft in taxiways and stimulate landing and takeoff to the necessary adjacent locations in line with the terminal building. If the runway or taxiway is occupied by more than one aircraft, there should be a further improvement of the dimensions of runways and

taxiways. When the aircraft is in docking position, support vehicles of the aircraft should be running parallel to the aircraft for subsidiary services. For this a convenient space should be added in the design. There should be a minimum separation distance for the aircraft after landing and taxing information should be provided as soon as possible after the aircraft is landed. Huge aircrafts like Boeing 737-300and an Airbus A380 requires an extra facilities and staffs in order for smooth baggage handling. Additional and larger docking bays is also required for such aircrafts. After unloading all the baggage and couriers, there should be enough space around the aircrafts for the movement of refueling vehicles, etc.

Each and every aircraft that takes offhas a different size and weight, so there should be distinct aircraft procedures for taxing and takeoff. And based on the departure time the aircrafts should be queued in corresponding order, so there must be a sufficient space in aircraft parking area. These are some of the elements that should be considered before designing an airport.

## EXTERNAL LINKS

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