Transportation Engineering -11
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Lecture - 36
Aprons & Aircraft Parking

Dear students, today's lecture we are going to discuss about the various types of Aprons and Aircraft parking. So far what we have been discussing is about the runways and then we have discussed about the different types of taxiways, their design features, their utilities and the types which can be provided depending on the specific purpose or a specific location where they need to be provided. In continuation of that in the previous lectures what we have seen is that those taxiways provide access to the apron areas or the aircraft stands where the aircraft can be parked. So in that aspect we are going to look at the types of the aprons which can be provided in any of the airport and what maybe the different ways in which the aircraft can be parked. In that sense in today's lecture is being outlined in the form that today we will be discussing about holding aprons, the loading or terminal aprons, the gate positions and the numbers, and the aircraft parking.

So we will be starting with holding aprons and we will discuss what these holding aprons are and what are the different types which can be there. The holding aprons are generally the places which are adjacent to the ends of runways where the aircraft park briefly before taking off. So the area which is provided very adjacent to the end of the runways strip where the aircraft is stopping before it take its position on the runways strip so as take off then that particular area or that particular location is termed as holding aprons, because the word comes from the word hold that it is trying to stop, it is trying to just restrict the moment or keeping it at a hold before it finally goes for the operation.

Now there are different ways due to which the aircraft needs to be hold at this location where it is very near to the runways strip and these factors, these reasons maybe that aircraft is already busy with one of the operations like the landing or the take off being going on at that point of a time when the aircraft preaches the end of the runways strip and therefore it cannot come on the runway or there is engine run up or warming up condition where this is another condition which is related to the heavy type of the fuel which is used by the aircrafts so before it comes to the runways strip its tries to just switch off before that and runs the engine or makes the engine warm up. So that takes some seconds and before doing this one than after doing this one only this will

be coming
to the runways strip.

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Or there is certain checkup which needs to be done in the cockpit or the instruments on
the dashboard or being provided within the cockpit needs to be examined or checked up
before any take off has been taken up. So for that reason also the aircraft is stopped just
before the runway strip and that is why this is another reason of holding the aircraft. Now
there can be different shapes which can be provided for these holding aprons which we
look in this picture. Here we can see that this is rectangular shape being provided so we
are providing connectivity between this is the runways strip, this is a wider strip as
compared to this strip, this is taxiway strip. So these are the parallel taxiway and runways
being provided and the normal condition at the end of this runways strip a connectivity is
being provided between the taxiway and the runway like this, so that is the connectivity.

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Now at this location where the connectivity is being provided between these two there is
an extra area being shown here like this; this is the rectangular area being shown. Any
aircraft which is coming from this taxiway so as to use this runways strip for taking off so
it will be starting from this direction and will go from this direction and will take off like
this. So before doing this one this may be required, this aircraft maybe required to stop in
this area. If there is any emergency, if there is a checkup then this aircraft will be
stopping in this area whereas if it is in a queue for taking off than it maybe standing
someway here using the taxiway plane strip only. So this is how this one particular shape
is being provided whereas another shape being provided is a trapezoidal shape which is
shown like this here so the aircraft comes this way and takes turn this way.

Here it will be
standing in the apron straight portion with respect to the center line of the taxiway.
Sometimes there are also parked in the angle position and we will be looking at all these
different type of aspects as we continue with our discussion in this lecture on holding
aprons or the other type of aprons.

There is another specific sort of holding apron being provided here which is provided at
the transition phase where this is the taxiway and this is the runways strip and this is the
transition from the taxiway to runways strip. In this particular location widening area is
being provided and this widened area is known as holding apron. Here the aircraft will
again will be standing at this particular location and it will be clear of this center line so
that if there is another aircraft which is going to use this transition then that can be used
without any interference from the aircraft which is already standing in this bay area. So in
all these cases there cannot be any interference from those aircrafts which are standing on
these holding aprons. So therefore there are certain guiding principles by which we have
to design, or we have to locate, or we have to provide the space for these holding aprons.

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So we look at the design criteria of those holding aprons and what we observe is that then
adequate space is needs to be provided for aircraft so that they can maneuver easily into

the runway strip irrespective of position of adjacent aircraft on the apron. So that is what
I was just trying to tell you in the previous diagram that if there are standing in this
location, or this location, or this location then they should not create an interference for
the another aircraft which is moving like this or which is coming from the runway strip is
slowing towards the taxiway. So that interference cannot be there.

Another thing is that they should be sufficient room for an aircraft to bypass parked
aircraft on the apron. So it means we need to provide the clearance sort in between the
two aircrafts which are just moving by bypassing each other or just passing from the

other aircraft. So we try to look at the working of this holding apron through this diagram; here we are providing this exit taxiway and this is the runways strip. So this runway strip is going in this direction and the aircraft is suppose to come from this exit taxiway takes a turn like this and then come to this runways strip and once a takes its position along the center line here then it will start the engines in such a way that there is a thrust and the aircraft will start moving, running in this direction. So therefore we have the design of this exit taxiway condition as we have discussed in the previous lecture.

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Now in this case there is another aircraft which has been placed on the side because of certain reasons as we have seen previously maybe like there is checkup in the cop rate or there is some problem in the aircraft so that due to that reason its needs to be taken away from the movement and away from the operations for some period of time maybe movement period maybe some small time period. So in that case this aircraft is to be part in certain fashion. Now whatever is the way by which the aircraft has been part they needs to be sufficient distance between these 2 aircrafts so that this wing which is taking a turn like this or this wing which is having a curve like this when it moves from this direction and comes this way then there remains adequate distance between these 2 and this is something like 12 meter clearance being provided between these 2 aircrafts.

Similarly, in this case when we are looking at this movement of this aircraft from this side towards the runways strip than the inner side of the main gear that should remain at a distance of 6 meters from the edge of the payment strip, that is, this is the edge if the payment is strip and this is the way this inner side of the inner main gear is taking a turn so that distance is 6 meters and the same is the condition in the case of this part of aircraft for which again the distance between the main gear on the outer side and distance between this edge of the payment strip should be 6 meters, so that the distance being provided here also. Apart from that there is some marking being shown here, this is the marking being provided for the holding apron and with this marking we will be discussing, will take up the visual aids or control of movements on the airport and there we will be looking at writings and the marking.

Then in this diagram the another important thing which is being shown is the distance here that defines the size of this holding apron and this is around 95 meters to 100 meters

and that depends on the type of the aircraft which is going to use it. In case it is being used by 747 fourth hundred than this is hundred meters where if it is 747400 D then it is 95 meters. So depends on the type of the aircraft which will be going to utilize or use this runways or the airport on the basis of that we have to find out the dimensions of these holding base or aprons. So this diagram is quite clearly defines how we can provide the holding apron and what should be the size of that holding apron, how it operates.

This is another diagram which is trying to depict the similar sort of condition where there is a holding position of this aircraft which is being hold at this location or there is another position where the aircraft can be hold at this location. It depends means if it is being hold at this location and then the aircraft will be taking a turn like this and will be going towards the runway strip in this form. So specified clearance we have seen in previously 12 meters like similarly in this particular diagram is being shown as 15 meters as the separation between the movement or the turning of this aircraft with respect to this aircraft and similarly the size of the taxiway is being shown here as 23 meters in 45 meters for the runways strip and the taxiway holding condition is being defined in terms of the distances which can be there like here it is 90 meters being define for this particular holding apron or the type of the aircraft which will be using is this one.

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This is another diagram which tries to show the operation of different types of the holding aprons. We have seen the shapes of the holding aprons that trapezoid sort of holding aprons, or rectangular holding aprons which is being provided at the end of the taxiway and runway strip.

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So in these cases like here it is being shown that this is the runway strip and this is the taxiway there is connectivity between this runway strip and taxiway which is at 90 degrees here. Here this aircraft is coming to the extreme locations so that it can start taking off from this location and this direction. So here there are another 2 aircraft which

has come to this location and they are waiting for their turn or there is a problem with
these aircraft so that there being taken away from the central position which remains
along the central line of the part being provided so they are being parked in this form so
that once they are ready we can directly start moving towards the runways strip, so that
the angle at which they have been here.

Similarly when we are looking at this trapezoidal form then these aircraft which are
coming from this taxiway and they are coming to this holding apron and they are taking a
turn and will be parked like this. The reason again remains the same that they should be
the minimum type which is being taken from this location for this aircraft to come to the
end point of the runway strip so as to take off So that is the way the aircraft is to
be fault or they utilize the holding apron location. Here the aircrafts are waiting for the
time to come so that one by one they will be moving ahead and the other aircrafts will
keep coming into the queue like this. So that may be a condition for very busy airport
where there maybe a number of aircrafts which are queuing and aircrafts are taking there
takes off at time distance of some seconds only.

This is another diagram which tries to show that there are still the movements on the all
the sides of the aircraft which has been stopped in the holding area and they are still
waiting for time to come whereas there are other aircraft which are moving towards the
runway strip or there is a condition that the aircraft has there is a smaller aircraft has been
shown here has come over its location and its moving towards the x end of the exit
taxiway, that is, taxiway this sided coming to the exit taxiway for the runway strip. So
there is already one bigger aircraft moving towards the end of the runways strip and will
be taking a take off and at the same time there is another smaller aircraft which is just
warming up at this location and trying and starting to come towards the end of the
taxiway.

At the same time there are other aircraft which are still in waiting but there is another
aircraft which is coming from this direction and it is moving towards the end of the
taxiway and towards the runways strip and probably is being given priority with respect
to the other aircraft. So in such conditions where this is normal condition which may
happen then this type of a configuration of a holding apron can be provided. So that is
another way another type of operation which can be there with respect to any holding
apron so we have seen various types of operational condition which can be there

with
respect to any holding apron and it depends on which particular type of aircraft is being
designed with what capacity which can handle or what number of aircraft can be handled
by that airport and what is the size and what are the number of runway strip being
provided depending on that this design features has to be taken into consideration.

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Now we look at the configuration so what is needed is that the area should be sufficient
to accommodate 3 to 4 aircrafts of the largest size expected to be handled by the airport.
So that is one of the important things that whatever is the size is being defined size of
defined by the largest aircraft which is coming on the airport and within that also we take
the overall sizes equivalent to 3 to 4 aircrafts. Then the entry to the runway strip, this is
provided on the basis of the departing aircraft. We should enter the runway at an angle
less than 90 degree and if it is being done in the case of less than 90 degree then it will
permit rapid turn off from the taxiway, so that will be more efficient unless time
consuming. So that is another design feature or specific feature with respect to the
connectivity being provided between the holding apron and runway. Then there should be
a facility of bypassing as we have seen in the diagrams they are all chances that some of
the aircrafts has to be part and there will be other aircraft which will be bypassing then
will be moving towards the runway strip.

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Therefore, these type of facility needs to be provided. It means the size of the aprons
should be large enough so that if any aircraft is unable to take off then another aircraft
ready to take off can bypass it and can move towards the runways strip. So in this case
another thing which needs to be provided at some of the condition is termed as holding b
and this holding b is small area which is located conveniently to hold aircrafts during the
busy period until a gate becomes available. So that is a condition when the aircraft has
already landed and it is moving towards the terminal operand that is where the terminal
building is provided where there is a gate position up to which the aircraft can go so the
passengers can come out and can move away so that is the gate position. So in the in the
case of the busy airports it is the condition arise that the gate position is not empty and
therefore no further aircraft can be taken to that locations. So in that condition holding
base are provided. Holding base is similar to the holding aprons and they are the small
areas where temporarily the aircraft which has landed will be stopped and as soon as the
gate is available it will move towards that location.

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Now location of these holding apron or base is defined by the aircraft and the aircraft
should be permitted to enter the runway as close to the end of the runway as possible that
is the thing which we have seen in all of the figures that the holding base of the holding
aprons are provided at the end of the taxiway and similarly near the end of the runway
strip. The reason is that all those aircrafts which as standing in that location

they should
reach as early as possible the runway strip so that they can a start their operation that is
they can a start taking off or similarly if the aircraft which has landed is to be hold on
than it will be taken away from the runway strip at the end and then can be hold in that
location that is very near to the end of the runway strip.

Then holding aircraft should be placed outside the bypass route so that blast do not affect
the bypassing aircraft and this is one thing which we have seen in the figures where the
different positions of the aircrafts were shown in all those positions the one thing which
remain as that the location should be such in the field that the blast which is coming out
of the aircraft should not create any problem to the another aircraft which is bypassing
that holding aircraft. So the blast should be away from the route through which another
aircraft will be moving. This is what is also been shown here is that the blast will be
coming from this location that is and of the this aircraft and these 2 aircraft needs to be
placed in the same holding area than they should be located in such a way that the blast
which is coming out of this aircraft is not in towards this aircraft otherwise it will create a
problem for this one or may make this aircraft un functional.

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So that is how the direction or the angles with which these aircraft have been parked in
this area needs to be varied and here it is also trying to defined that what should be the
size of this B that is in terms of this distance E as well as what should be the clearance
between these 2 aircrafts which is being shown by value B here. At the same time it is
trying to show the design features in the same that this particular slope being given here
is 30 degrees whether respect to the horizontal which can be provided here and the
distance which is being provided from this point to this location that is this one this is 30
meters minimum. Similarly, the other design features which are related to the runways
strips for the radius phase of this is a compound radius being shown here along with the
minimum distance which needs to be provided between these 2 points as 22.5 meters has
been shown. So they are all the design features of any holding apron and or used
whenever we design them.

Now in this case where we are taking about all these holding aprons and they are design
details we have to look at what is the number of aircraft which are going to utilize those

holding aprons and this is obviously going to be governed by the volume of the aircrafts which will be coming to any of the airport and therefore we have to look at the peak demand and this peak demand will be during the peak periods where the traffic volume will be exceeding the holding capacity of the aircrafts. So that is what I was talking before is that if there is a busy aircraft and there all chances that there is a big queue of the aircrafts and there are take offs at some distance or some seconds. So that is a condition which is happening if the volume is heavy then the connect is exceeding the holding capacity then it will be resulting in queuing. So therefore we required to provide a space where this queue formation can be accommodated.

Now the clearance between the wing tips of the parked aircraft should not be less than 7.5 meters and that is the distance which needs to be there between the wing tips of the 2 parked aircrafts on the side by side which we have seen that the desirable in the certain

condition it should be something like 12 meters to 15 meters but the minimum value remains as 7.5 meters. As for as possible the entry into the runway should be made with an angle of 30 degrees that is the optimum angle of turning from the exit taxiway.

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So far what we have discussed is regarding the holding aprons and the holding base and specific features related to the holding aprons or holding base as for as the design is concerned. Now we will be looking at another type of aprons which is known as loading apron and we will look at the various specific features again in the similar form regarding these loading aprons. Now the loading aprons are basically paved areas which are provided adjacent or in front of the terminal building so therefore they also termed as the terminal aprons. What one specific name which is given is the loading aprons because this is the area where the aircraft will be parked near to the terminal building before it is being loaded and the passengers will be coming out of the terminal building and

this
particular location and will be boarding the aircraft at the same time if there is a flight or
a cargo then that also will be loaded in the aircraft at this location, so that is why the
name is being given as a loading apron. Generally it is used for loading, unloading,
fueling or minor servicing or checkup of aircraft. So these are the different operations or
fiinctions which can be performed with respect to aircraft in this area or in this location.
The airplanes are berth on the aprons before they are loaded and unloaded and hence it is
also known as parking apron.

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So that is the another name which is given to these aprons because whatever airplanes are
coming for loading or whatever airplanes are coming for unloading they will be placed on
these aprons before they reach those locations where they can be loaded or unloaded so
therefore once they are been parked in that area so they are also termed as parking
aprons. Now we look at how we are going to decide about size of any loading aprons and
the size of loading aprons is going to be governed by certain factors like the number of
gate positions, the size of the gates and the arrangement of gates positions around the
terminal building before we take another thing we can just look at what these gate
positions are?

These gate positions are the locations through which the passengers can reach the aircraft
or those persons or those passengers who are unloading the aircraft then they can come
out of the aircraft and use this gate position to reach the terminal building. So that is the
connectivity which is provided between the terminal building and the aircraft so we have
to look at how many gate position have been provided and depending on the number of
gate positions being provided and if there is a simultaneous use of those gate positions
then the type of the aircrafts which can use those gate positions at any point of a time is
going to define what should be the size of that loading aprons.

Now when we talk about this the size of the gate becomes the governing factor and the size of the gate obviously is going to be defined by the size of the aircraft which will be parked that location for loading or unloading so we have the look at the size of the aircraft, we have to look at the way that aircraft has been parked and we have to look at the clearances which needs to be provided between the 2 aircraft being located simultaneously adjacent to each other on the 2 gate locations which are adjacent again to each other and another thing is that how the gate positions have been arranged around the terminal building that is another aspect and this also will define that how efficiently the gate positions can be operated and another thing is that if there is sprawling arrangement

which is being used then it will be increasing the size of the loading apron so that all those gate positions can be adjusted.

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Then another factor which is having its effect is the aircraft parking because as adjust park is that when you are talking about the size of the gate then obviously it is going to be the size of the aircraft where at the same time the way the aircraft is being parked is also going to create its effect. Therefore not only the type of the parking what the system in which the aircraft or parked allow with respect to the arrangement of the gate position has been provided on periphery of the terminal building that is the combination which also creates the effect which also governs the overall size of any loading apron.

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So we start with the number of gates which creates in effect and how we can find out the number of gates. The gate position is defined as an area which is earmarked for loading of and parking of each type of aircraft and the number of gate positions to be provided or controlled by peak hour aircraft movements and the gate occupancy time. So we have to look at these 2 factors the peak hour aircraft movements and then what is the occupancy time for each gate the estimated peak hour volume can be is to be computed and this is defined as the number of aircrafts which are can be handed during the design hour. So on the basis of the total number of aircrafts which can be handled we are going to get the number of gate position which needs to be provided. In the case of balanced airport design this volume should not exceed the runway capacity and that is what we

have seen
when we have discussed about the acceptance rate and arrival rate of the aircrafts the
balance position needs to be achieved.

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preparation of Flight

The design volume that is the aircrafts per hour has to be weighted depending upon the
ratio of number of arrivals and departures, that is another aspects of design. We have to
look at what is the ratio of arrivals and departures. If it’s a balanced condition then the
arrivals and departures assumed to be equal and in this case the weighted factor will be
0.5 but if there is a difference that there are more of arrivals and less of departures then
on the basis of that it maybe 0.6 or if it is a reverse condition then it maybe 0.4 so that is
how it is defined and it has it again effect it terms of that how many gate positions will
become vacant at any point of a time based on the number of departures with respect to
the arrivals and then what are the requirements, how many gate positions will be required
other than the positions which are already under use.

Then the gate occupancy time is the amount of time in aircraft occupies a gate and this is
also termed as the ramp time and it needs to be computed and this gate occupancy time
basically includes the following things depending on the type of operations which will be
going on at that location where the aircraft is parked for either the loading or unloading of

the aircraft. So depending on the type of the function for which the aircraft is being
parked we can have different things like how much time it has taken for the parking of
the aircraft that is one thing, then how much time it is going to take for loading and
unloading of the passengers then what is the time which is required to be taken for
aircraft servicing which means some emergency checks, the checks for the engines, the
checks for the cockpits etcetera needs to be done so how much time it is going to be taken
by the mechanically stopper, by the electronic stop switch to check the things

that is the
another respect and then there is a preparation of flight means before the loading of the
passengers or the taking off the flights needs to be prepared and in that sense the AC’s
are made own so that it becomes cool by the time passenger’s are coming inside before at
the same time the various services which needs to be provided to the passengers are
loaded in the respective areas, that is another sort of preparation of the flight.

Then the flow takes its position at different locations in the aircraft, the pilots takes their
position in the cockpit and they also check all the electronic machines because that is to
be checked by them only so that is another part of the preparation of the flight. So there
are so many aspects which will take time and therefore before any loading of the
passengers is being done rest of the things needs to be completed so before the loading of
the passenger is being done that is time is being given for this one there are the 3 other
operations are already over that is the parking time, the aircraft servicing time and the
preparation of flight and once the loading is being done then it takes a very less times to
come out and make the gate vacant. This gate occupancy time in that sense its going to be
defended fiirther on the type of the aircraft because it is going to be governed by the size
and the characteristics that is whether the turning is possible or what is the load of the
aircraft by which it is to be stored away from the parking area or away from the gate
position so that is another aspect in this case. So this is one of the aspects if the size is
very big it will take some more times so as to clear the gate the number of enplaning and
enplaning passengers that is another thing so going out or coming in passengers that
needs to be checked in they are not enplaning and enplaning.

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'--me of operation - through or turn around fligiht

So that numbers needs to be also seen so how many passengers are going out and then
how many passengers are coming in. At the place where it is a terminal condition then all
of the persons will be coming in or all the persons will be going out so how much time it
takes is going to be governing the gate position time then the amount of baggage's of the
cargo or the freight which is being loaded and which is to be cleared and its to be taken to
terminal building or otherwise from the terminal building how much baggage of cargo is
to be loaded in the aircraft and how much time it takes to load them that is another aspect.
The magnitude and nature of other services required the cabin cleaning and refueling
time or some other such features needs to be considered or finding the gate of refueling
time.

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I Number of Gates

Gate G|~i::cuparii:1_,- Time

I In case of through tight no ser'i-iI:ing is inirohied
and hence it rri.a'i- take EU to 3-D minutes
whereas a tumaround flight resulting 5-E.'F"iI'I'.!l|'l§l
and mauhtenan-ce rna1_.' talte -tt'.'i to El} 1'|'1l.|'1t.lIE'5

Mostiir 3 to 5 gates oer mrllion annual
passengers are prom-Izled

Then efficiency of apron personnel that is the manual behaviorally factor, the type of
operation whether it is a through or turn around flight, that is another condition. If it is a
through flight then it is going to take lesser time or it is a turnaround flight then it means
it will the flight has come then the passengers will come out of this one then certain
cleaning is to be done, then certain checks up have to be done and then again the
passengers will be allowed to come in and the flight will be going back so it will be
taking more time as compared to a through type of an operation.

The another aspect is related which is related to gate occupancy time is that in the case of
through flight there is no servicing involved and hence it will be taking something like 20
to 30 minutes whereas in the case of the turnaround time because the servicing and the
maintenance is also involved therefore it takes more time it ranges from 40 to 60 minutes
and the number of gates which are generally provided or of estimate is there where in the
3 to 5 gates per million annual passengers are provided means for every million annual

passengers 3 to 5 gates locations should be there from where the boarding and boarding
of passengers can be carried out. Now this value of the number of gate positions can be
computed by using this multiplicative equation which is being given here that is aircraft

design volume multiplied with the weighted factor as we have found out which is computed on the basis of arrive and departures multiplied with the average occupancy
time. So using these values then we can see that how many number of gate positions
needs to be provided so this is aircrafts per hour then this is the weighted factor and this
average occupancy time will be in hours so therefore we are left with aircrafts so this
number of aircrafts is equivalent to the number of gate positions.

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I Number of Gates
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Aircrafl design iirotuniie 1 weighted
factor it Ive-rage occupancy time

Now there are various models which can be used to find out the number of gate positions
and some of them are being listed here; there is a Horonjeff model which is used in US,
then there is a Piper modal in being used in Germany, there is Snow and Partners model
being used in UK, then there is Loughborough model which is again used in UK and
there is a Hart model which is being used in US.

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So number of persons given their own models on the basis of generally the factors which
we have already discussed which constitute as the design factors of finding out the
values. There is another model which is being given by Stafford and the Stafford has
developed this expression for future number of gates not for the gates which needs to be
provided today on the basis of their arrivals and departure rates. What it says is that we
can find out this value by n dash minus 2 which is multiplied with the future passenger
demand divided by the present passenger demand and then this value is added with 2.
Now here this n dash as this is existing number of gate position.

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So whatever existing number of gate positions are there the subtracted reduced by 2 even
multiply it with factor which is factor is the ratio of the passenger demand for fiiture and

present and then we add 2 to that one which defines these are the number of gates needs
to be provided in any feature date. The size of the gate position now we discuss this then
its depends upon the size and minimum turning radius of the aircraft to be solved and
type of the aircraft parking in the gate so these are the two things which will be basically
governing the size of the aircraft. The turning radius is defined here is utilized here
because the aircraft which is taken as a certain position now as it goes away from the gate
position it will be taking at turn so that it can go to the taxiway, so therefore whatever is
the minimum turning radius the separation needs to be there between this turning radius
and the turning radius of the another aircraft which is located on the adjacent gate
position. So that is why this will govern at overall size of the gate position. The size of
the aircraft generally defines or determines the space which is required for parking as
well as maneuvering and the extent and the size of the servicing equipments which will
be needed for that aircraft.

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I Size of Gate Position
Depends upon the following

I Site and minimum turning radius of ai-r-:ra1'I1i:- he
served

I Type cit a.iri:.raI‘t parking in the pale
tr
The size ot aircraft detennines

- The space re-iziuired for parking as -I-EH as
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I The extent and size of tier.-iizing equipment needed

Now we look at one of the loading aprons where the painted guidelines are gate position
have been shown; this is the building line being shown here and this is the parking angle
with which this aircraft is taking at turn and here this aircraft is being placed like this, this
is plain parking position and this is the path of the wing tip because this is the tip of the
wing so this is how when it is taking a turn so this is the path with which will be
governed and the clearance between this path and building has to be there so that this
much clearance needs to be provided.

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Similarly there is a path of the nose wheel in nose wheel that is how this nose wheel is going to take at a turn so this is being shown here all these markings will be there on the ground so this is a diagram which will be there on the ground and this defines that the aircraft has to come in this way and then it has to take a position like this for this particular parking area. So this will be done in the different colors like this is going to be a yellow strip so this is yellow strip condition and then there will be other this is 2 color condition which will be provided again on the ground that is on the payment. Now we come to the aircraft parking because this aircraft parking or the type of the aircraft parking is going to created an effect because of the size of the gate position so we have different types of aircraft parking we have nose in parking we have angled noise in parking then the noise out parking and the angled nose out parking and parallel parking.
So these are the different types of the parking which can be utilized for any aircraft.

We start with the first type of parking that is noise in parking. In the case of noise in parking the aircraft maneuvers into the parking space under its own power and is towed out of position. So as to go back it is not possible for the aircraft because there is no reverse gear condition so it will be towed out of the position by a 2. The lower noise level is there because there is no use of the power in turning of the aircrafts so in the noise is less. There is a front passenger loading because the nose is nearer to the terminal building as compared to the tail so the front door is used for loading of the passengers. In this case smallest gate area is required because it is coming with the nose in condition there is no jet blast which is towards the terminal building so therefore there is no deterioration of the terminal building but there is a problem that we cannot use a rear door it means it will take more time for the loading of the passengers and large power is required so that in this loaded aircraft can be towed back towards the taxiway. Then there is a angle nose is parking in this case the aircraft maneuvers into and out of the parking space under its own power, so that is the similar sort of condition as we have discussed in the nose in parking

but in this case there is a higher noise level because of angle so there is

turning associated
with it.

Again there will be only front passenger loading because still the I will remain at the
distance, it will be requiring medium gate area. There is no problem of jet blast because it
is not towards external building it is away from it but then again the similar sort of
problem is there that is the rear door cannot be used for loading. Another aspect is nose
out parking in the case of nose out parking the aircraft maneuvers out of the parking is
space under its own power so it is going out under its own power but it is to be stored in
this particular location by a door.

Then there is a higher noise level because the blast will be in this direction as well as the
engine noise will be coming in this direction and passengers are loaded through the rear
door, the front door will not be used in this case. Again the gate area required will be
smaller as compare to the angle conditions and the jet blast will be towards terminal
building therefore the jet fancies of the blast fancies needs to be provided on the face of
the building so that jets space is not deteriorating the terminal building as been told that
we cannot use the front door because if the nose is away and there is a less power
required while maneuvering the loaded aircraft out of gate position because it also use its
own power so as to come out of the parking space. In the case when it is being door in
this parking area then it is not loaded and therefore in that case also the power required
for the door is also lesser.

So we start with another type of this is angled nose out parking. In this case the aircraft
maneuvers into and out of the parking space under its own power as the similar to the
previous case. Then higher noise level there is a rear load passenger loading the medium
gate area is required and the jet blast again remains towards terminal building there is a
problem of using the front door. Another one is the parallel parking in which case the
aircraft maneuvers into and out of the parking space under its own power that is the
advantages condition in this case. There will be medium noise level because the direction
of noise will be at 90 degrees, the front and rear door both can be used for loading of the
passengers but then it requires largest gate area and there is a problem of jet blast because
it will become towards other aircrafts so jet fences needs to be provided between the 2
locations or gate positions of aircrafts and it requires long loading bridges because they
will be little fiirther away and we require to use 2 doors.

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I Types of Itircraft Pa-rti.ini'_:i

Here we are going to just look at the different types of the parking which we have just discuss; this is the terminal building and this is nose in parking because nose is towards the terminal building so we can use the connectivity will be provided like this or like this so we can use the front door and the loading will be through the front door and this is this as come in this location by toe and will be also toed back like this and then it will go to the taxiway. This is angle condition, this is angle out condition and this is a parallel condition where we can use both the doors but then the blast is going towards this aircraft so that is the position in this case. Now we look at some of the aircraft parking systems there are some systems which we are used they affect the grouping of aircraft and the simultaneous use of gates and basically this defines the traffic handing capacity of the overall system. There are different systems like frontal or linear systems which are also termed as close in which has the close in parking. There is an easy access in this case and there is a short walking distance and what it involves higher cost because the area will become more as we go in a linear form for the parking of the aircrafts.

Then there is a open apron or transporter system where the longer walking distances are required and it is a hazardous condition but it is low cost and is a flexibility of operations and movements. Then another systems which are there are the pier or the finger system. This is an economical system where the expansion is easy but then again it requires longer walking distances and the another system is termed as satellite system which is where the common facilities are provided but then there is a high cost because there is a discomfort associated to the movement of passengers and its lacks flexibility. So these are the various systems of aircraft parking and we will be looking these in combination with the design of the terminal buildings in a later stage in another lecture. So we stop at this point and what we have discussed in this particular lecture is regarding the various gate positions, the how we can find out the number of gate positions, the size of the gate positions, what are the factors which affect them, the aircraft parking systems etcetera. So under the different type of the aprons which can be there at the holding aprons or the

loading aprons. We will be continuing our discussion on airport engineering in the

coming lectures till then good bye and thank you to all of you.