PASSENGER TERMINAL FACILITY
FOR EVANSVILLE DRESS REGIONAL AIRPORT
AN ARCHITECTURAL THESIS BY STEVEN R. JUAREZ
SEPTEMBER 78 – MAY 79
ORGANIZATIONAL FORMAT

ABSTRACT

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PASSENGER TERMINAL FACILITY — EVANSVILLE DRESS REGIONAL AIRPORT

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SUMMARY
ABSTRACT

The objective of this architectural thesis book is to present the design process which evolved for the design on an airport passenger terminal facility. As this design process unfolds, various insights and explanations will be supplemented to provide a context as to the reasons for certain design decisions. Variances and additions to the facilities program will also be elucidated throughout the process. It is my aspiration that not only an understanding of the factors and decisions involved in designing a passenger terminal facility will be achieved, but also that my personal design methodology and creative insights will be comprehended and imparted.
INTRODUCTION

The essential goal of this architectural thesis was to evolve and design a new passenger terminal facility for the Evansville Dress Regional Airport. Its intention would be the fulfillment of the Evansville metropolitan area air transportation needs up to and beyond the year 1990. Not only would this terminal facility fulfill this functional need, but would also provide an "introductory statement" for the city of Evansville which would symbolize and convey it as a progressive and growing metropolis. With these and many other goals in mind, the process of evolving this passenger terminal began.

The reasons for this project were manifold. The initial decision for its selection was one stimulated by the existing need of a new passenger
terminal facility at the airport. Even though, from the outset, the likelihood of my final solution's realization was minute, it was my aspiration that this thesis project could be utilized as a supplemental impetus to the airport authority board in making their decisions to resolve their existing needs. It was also my intention that this solution could be applied as a comparative base from which they could analyze their submitted proposals. Because my design decisions were free from the usual economic constraints as well as normal political obstacles, it was my intent that, at a minimum, this project would illustrate what could potentially of ultimately be obtained in terms of a viable solution, and not what could be financially afforded. It was also my desire that this project would be enlightening as to the possibilities of a passenger terminal design. This enlightenment is in hopes of increasing their palette of knowledge for basing their decisions. With these goals in mind, the project took direction.

The direction of this project was one which not only would satisfy the functional needs of the program, but would also provide a testing ground to experiment and to expand old creative boundaries. The investigation of new ideas and the verification of untested architectural philosophies was of paramount importance in terms of my personal goals. Also, my desire was that this thesis would be utilized as a time-period of growth and evolution; a time to make mistakes, and most importantly, to learn and mature from them. Thus with the desire to extend oneself, and to culminate with the best obtainable solution, the odyssey of this thesis began.
PROJECT PROGRAM FOR THE NEW
PASSENGER TERMINAL FACILITY
EVANSVILLE DRESS REGIONAL AIRPORT
Passenger Terminal Facility

Evansville Dress Regional Airport

Evansville--Vanderburgh Airport

6001 Flight Line Road

Evansville, Indiana 47711

Programmer: Steven R. Juarez

Date: October 9, 1978
INTRODUCTION

BACKGROUND

Evansville Dress Regional Airport, located at latitude 38° 2' 13" north, by longitude 87° 31' 58" west, at 418 feet above sea level, lies five miles north of downtown Evansville at the intersection of U. S. Highway 41 and Indiana 57.

Chartered service is available through Delta, Eastern, and Allegheny Airlines with presently 17 inbound and 17 outbound flights daily, with direct or connecting service to major cities throughout the world. Space is also available for private planes.

The airport is publicly owned, with administration by the Evansville - Vanderburgh
County Airport Authority Board which is appointed by the mayor of Evansville, and Vanderburgh County Commission, and of which board members serve without compensation.

The rapid growth of aviation activities at Dress Regional Airport, Evansville, Indiana has caused many problems for the Airport and the community. This growth and the corresponding problems have been caused primarily by the economic revitalization of Evansville which started about 1962 and the introduction of almost total jet service to Evansville in 1967. The economic growth of Evansville with a corresponding increase in aviation activity at Evansville, and the improvement of airline service through the introduction of jet equipment has shown the present Airport to be inadequate for the needs of modern air service.

The major problem facing the airport at the present time is the inadequacy of the present terminal building. While in excellent material condition, was initially designed for the needs of DC-3 type aircraft which had about 21 to 26 seats. It was expanded and entirely remodeled in October, 1970, to facilitate the service needs of the DC-9, which ranges from 70 to 100 seats, and the Boeing 727, which ranges from 90 to over 120 seats. At that time, the increase was sufficient to meet its present and future needs up to "projected" time-period, (that could be financed), when a new terminal could be designed and built. Since about 1976, because of underestimated passenger volume growth, the expanded facilities are inadequate to comfortably satisfy the volumetric needs. With more expected growth, the situation will soon become intolerable. Thus, it
is imperative that a new passenger terminal be designed and constructed.

**SCOPE**

The scope of the new passenger terminal facility at Evansville Dress Regional Airport, will be of a programatic directive to facilitate the air transportation needs through the year 1990. Utilized as a programing resource was the Master Plan Study for Dress Memorial Airport, prepared by Ralph H. Burke, Inc., and commissioned by the Evansville--Vanderburgh Airport Authority District in 1970. At that time, the master plan study analyzed and proposed the overall airport and passenger terminal needs to the year 1990. Because of unforeseen developments during the ensuing years after the study was made, alterations and additions were regarded to produce this resultant terminal program.

This facility program will entail the projected requiremental needs of curbing, parking (both public and employee), as well as rent-a-car spaces. Definitions of airline spacial requirements for functions such as ticket counters, holding areas, operations, baggage area and baggage claim area, maintenance and storage, etc., will be elucidated. Passenger areas such as ticket lobby, waiting area, restaurant, toilet facilities and other atmenities will be specified. Airport management and its related factions spacial needs will be defined. Fire and security operations requirements, which are an addition to the Burke's master plan proposal, will be quantified.

Because of the time constraint of this architectural thesis endeavor, this facility program is of a constitution to produce a terminal
building which will satisfy functional organization requirements and culminate in a viable "solution" to the problem. The depth of the viability of this "solution" will be restricted to spacial organization, and will not delve into the resolution of specific equipment needs and arrangements, such as kitchen equipment and layout requirements for the airport restaurant as an example. Equipment and furniture needs will have to be considered and utilized as spacial parameters during the schematic and design development states to obtain functional layouts. As more information is amassed concerning these "specifics," they will be amended and incorporated into this initial program product.

PARTICIPANTS

The following people were the contributors to the assemblage of this program:

Steven R. Juarez--Project Programmer, architectural student, College of Architecture and Planning, Ball State University, Muncie, Indiana.

Robert A. Fisher--Project Critic, Professor of Architecture, College of Architecture and Planning, Ball State University, Muncie, Indiana.

Marvin Rosenman--Project Critic, Professor of Architecture, College of Architecture and Planning, Ball State University, Muncie, Indiana.

James B. Stapleton--Client Representative, Airport Manager and Treasurer, Evansville Dress Regional Airport, Evansville, Indiana.

James S. Hansford--Client Representative, Assistant Airport Manager, Evansville Dress Regional Airport, Evansville, Indiana.


Charles A. Saletta--Project Consultant, Airport Architect/Engineer, Charles A. Saletta, Architect, Evansville, Indiana.


GOALS:

Conceptually, a passenger terminal is a conglomerate of different and unique entities, each functioning with the framework of the same facility. The result being interdependencies among the various factions. Thus, the goals of this project must be a reflection of each enterprise's viewpoint. Therefore, separate major interest groups are presented herein.

PASSENGER GOALS:

1. Minimal distance and time from curbing or parking area to the building, and eventually the aircraft.
2. Ease in conveyance of their baggage
3. Least amount of queing and waiting
4. Minimal complications through security
5. Clearly defined routes to various points within the terminal.
6. Minimum time in baggage retrieval
AIRLINE GOALS:

1. Minimum time and confusion during the enplaning and deplaning procedures of the aircraft.
2. Short travel distances for their baggage returning systems.
3. Avoidance of ticket counter queuing build-up.

AIRPORT MANAGEMENT GOALS:

1. To obtain a building of low operation costs.
2. One of minimal maintenance
3. Easy to repair
4. Smooth flowing passenger security system and procedure.
5. Ease in overall security surveillance

AMENITIES GOALS:

1. Individuality yet congruency with surrounding factions.
2. Harmony of constituents

COMMUNITY GOALS:

1. To obtain a passenger terminal facility which will satisfy their air transportation needs.
2. To obtain a quality transportation service which will stimulate commerce and attract new business, industry, and services.
3. To obtain a new "introductory statement" for the city of Evansville, which will convey a progressive and growing metropolis.

Along with the various terminal building user goals, there must be a definition of designer goals and philosophies in relation to the project.

PERSONAL PROJECT GOALS:

1. To grow from the learning experience in dealing and organizing the multiple of variables that this project size and complexity provides.
2. To derive an innovative organizational concept for passenger terminals, which will be a contribution to airport planning and design.
PROJECT DESIGN PHILOSOPHIES:

1. An aim toward a simplistic and straightforward solution; to eliminate complexity.

2. A strong statement; pronounced

3. A balance between aesthetics and function.

4. Spaces and building in relation to human scale.

5. A spacial and building form which is an honest expression of needs.

6. A distinction of parts yet a consistency as a whole.

7. Strive for an equilibrium between man-made elements and natural elements.

8. The variety of contrast.
   a. volumetric variety
   b. light quality variety
ORGANIZATIONAL DATA:

CRITICAL ISSUES

In the organization of a passenger terminal facility, there are a number of critical issues that must be considered and analyzed in order to obtain a viable design solution. These critical issues can be broken down into the following three main categories: distance, time, and clarity.

Distance. The nature of an air terminal is that of a series of transitions from various station points within the facility. Thus, as a passenger transfers from Point A to Point B, and from Point B to Point C, the distance between each point is very critical. The optimum situation is
to have minimal distances between these various points.

To place this in a realistic context, analysis of the transition route of an enplaning passenger will illustrate the critical importance of the distance issue. Arriving at the airport entrance, he or she would progress to the terminal curbing area to unload their baggage. Hopefully they can find someone to watch over their baggage, to avoid carrying their bags from the parking space they will obtain in the long-term parking area. From their car, they will travel back to the curbing area, and then to their specific airline ticket counter to check-in their baggage. From there they can either journey to the waiting area, or go directly to the security check point. Afterwards they will terminate their excursion at the ticket check point of the late holding lounge and from there ascend into their aircraft.

Within that narrative, there were 5 transitions; parking to curb, curb to ticket counter, counter to security check point, check point to holding lounge, and finally holding lounge to aircraft. The distances between those points must be kept to a minimum. There is nothing more dreadful than an endless trek across a terminal building. Distances?—Minimize!

Time: The time issue is involved not only in the distance traveling times, but the amount of time spent at each stopping point. Waiting in a queuing line can be very frustrating, especially if you are late for your flight. This check point must be designed as to minimize queuing lines and to accelerate the processing procedure.

Clarity: Fatigued from the expansive walking distances, frustrated by the never ending baggage and security check-in, the breaking point can be
not being able to locate where their specific gate holding lounge is. Circulation routes must be direct and clear. Of course, signage systems can aid the passenger in locating their destination, but if he or she has to meander through a maze, nothing can abet them.

These three critical issues apply to all factions within the terminal facility since all are concerned with: (1) the distances they must travel to provide their service; (2) the time it takes to furnish it; and; (3) the clarity of their operation paths and procedures to accomplish it.
PRESENT AIRPORT MANAGEMENT ORGANIZATION
PASSENGER-HANDLING SYSTEMS

The passenger-handling system is the major connection between airport access and the aircraft. The purpose of the passenger-handling system is to (1) interface with the passenger's mode of airport access, (2) process the passenger for starting or ending an air trip, and (3) convey the passenger to and from the aircraft.

Components of the system are:

1. **Access Interface**: Here the passenger transfers from the access mode of travel to the passenger-processing component. Circulation, parking, and curbside loading and unloading of passengers are the activities that take place in this mode.

2. **Processing**: Here the passenger is processed in preparation for starting or ending an air trip. The primary activities that take place here are ticketing, baggage check-in, baggage claim, and control.

3. **Flight Interface**: Here the passenger transfers from the processing component to the aircraft. The activities that occur here include assembly, conveyance to and from the aircraft, and aircraft loading and unloading.
PASSENGER-HANDLING CONCEPTS

There are a number of ways in which the facilities of the passenger-handling system are physically arranged and in which the various passenger-handling activities are performed.

"Centralized passenger processing" means all the facilities of the system are housed in one building and used for processing all passengers using the building. "Decentralized processing," on the other hand, means the passenger-handling facilities are arranged in smaller modular units and repeated in one or more buildings. Each unit is arranged around one or more adjacent gate positions and serves the passengers using those gate positions. There are five passenger-processing concepts, each of which can be used with varying degrees of centralization. These concepts are:

1. **Gate Arrival.** This is a decentralized processing concept that is aimed at bringing the automobile as close as possible to the aircraft. (See Fig. 1) The building is arranged in a one-dimensional manner such that curbside facilities are close to aircraft gate positions, thus reducing the walking distances for the passengers.

2. **Pier Finger.** This is a centralized processing concept. (See Fig. 2) The processing occurs in a centralized building to which is attached a long corridor, called a finger, that conveys passengers to and from aircraft parked outside. With centralized passenger processing, the facilities are housed in one building that may not have sufficient perimeter to accommodate the corresponding number of aircraft gate positions. Therefore, a finger is added onto the building to increase the perimeter without increasing the total floor area, a substantial amount. The major characteristic of this concept is that it is capable of providing larger passenger-processing capacity without excessive land requirements.

3. **Pier Satellite.** This is a modification of the basic pier finger concept; aircraft are parked around a circular rotunda at the end rather than along the sides of the finger. (See Fig. 3) The advantage of this arrangement is that more space may
FIG. 1 GATE ARRIVAL

FIG. 2 PIER FINGER
FIG. 3 PIER SATELLITE

FIG. 4 REMOTE SATELLITE
FIG. 5 MOBILE CONVEYANCE
GATE ARRIVAL CONFIGURATION
PIER FINGER CIRCULATION FLOW DIAGRAM
Runway Centerline
Mittellinie der Start- und Landebahn

600' 180m

Outer Taxiway Centerline
Mittellinie des äußeren Rollweges

300' 90m

Inner Taxiway Centerline
Mittellinie des inneren Rollweges

150' 45m

Maneuvering Taxiway Lanes
Rollwege für Flugzeugmanöver

250' 75m

2400' +x 720m +x

45 m

Maneuvering Taxiway Lanes
Rollwege für Flugzeugmanöver

150' 45m

x

Average Walking Distance  Mittlerer Fußweg

150' 45 m  250' 75 m  100' 30 m  100' 15 m  100' 30 m  250' 75 m  150' 45 m

1050' / 315 m
become available to permit easy assembly of passengers as well as ticketing activities by the aircraft gate.

4. Remote Satellite. In this system, aircraft are parked around units called "satellites" that are separate from the main terminal building. Some processing activities (ticketing, passenger assembly, and aircraft loading and unloading) are performed at these units, and the rest of the activities (baggage check-in, baggage claim, etc.) are performed at the main terminal building. (See Fig. 4) This system allows partial decentralization of the processing activities. It also permits a flexible aircraft circulation pattern around the satellites. Conveyance of passengers between the main terminal building and the satellites occurs via corridors usually located below apron level. Mobile conveyance using busses is sometimes used.

5. Mobile Conveyance. In this system aircraft are parked in groups remote from the passenger terminal buildings. A mobile conveyance system, such as buses or mobile lounges, is used to take passengers to and from the aircraft. (See Fig. 5) The main feature of this system is the independence between aircraft operations and passenger terminal building operations. This has the advantage of flexibility in adjusting to changes in aircraft characteristics such as size and maneuvering requirements.

**VERTICAL DISTRIBUTION CONCEPTS**

The basis for distributing the primary processing activities in a passenger terminal among several levels is mainly to separate the flow of arriving and departing passengers. The decision of how many levels a terminal facility should have depends primarily on the volume of passengers.

With a one-level system all processing of passengers and baggage occurs at the level of the apron. Separation between arriving and departing passenger flows is achieved horizontally. Amenities and administrative functions may occur at a second level. With this system stairs are normally used to load passengers onto aircraft. This system is quite economical and is suitable with low passenger volumes not exceeding 1 or 2 million annually. (See Fig. 6)
ENPLANING PASSENGER FLOW
DEPLANING PASSENGER FLOW

FIG. 6  ONE-LEVEL PROCESSING

CURB  TERMINAL  APRON

FIG. 7  TWO-LEVEL PROCESSING: SIMPLE

CURB  TERMINAL  APRON

FIG. 8  TWO-LEVEL PROCESSING: W/SEPARATION
(a) The baggage is transported from the aircraft to the claiming device by a cart and is then off-loaded manually by an attendant.

(b) **DIVERTER** In this system the baggage is placed on a conveyor at one end. A diverter moves back and forth along the conveyor and disperses the baggage onto the claiming device.

(c) **CAROUSEL** A conveyor, from underneath or from above, delivers the baggage to a rotating carousel.

(d) **RACE TRACK** A conveyor from underneath or from above, delivers the baggage to a continuously circulating conveyor, the length of which will depend upon the terminal layout.

(e) **POD** The baggage pod is removed from the aircraft and delivered to the claim area. The passengers remove their baggage from the pod.
(f) **AMOEBA** This system is an extension of the race track system. The only difference being that the baggage is manually loaded directly onto the conveyor by an attendant behind a wall and out of view from the passengers.

(g) **AUTOMATED** This system consists of carts that are operated by a computer system. The passenger inserts his claim ticket into a call box at a desired location, the cart then delivers the baggage at that location.

**BAGGAGE CLAIM SYSTEMS**
Two-level passenger terminal systems may be designed in a number of different ways. In one type, (See Fig. 7), the two levels are used to separate the passenger-processing area and the baggage handling area. Thus, processing activities including baggage claim occur on the upper level, while airlines operations and baggage-handling activities occur at the lower apron level. The advantage of raising the passenger-handling level is that it becomes compatible with aircraft doorsill heights, allowing convenient interface with the aircraft. Vehicular access occurs on the upper level to facilitate the interface with the processing system.

Another articulation of the two-level system separates the arriving and departing passenger streams. In this case departing passenger-processing activities occur on the upper level, and arriving-passenger-processing including baggage claim occurs at the apron level. Airline operations and baggage handling also occur at the lower level. Vehicular access and parking occurs at both levels, one for arrivals and one for departures, and parking can be surface or structured. (See Fig. 8)

**AIRCRAFT PARKING TYPE**

Aircraft parking type refers to the manner in which the aircraft is positioned with respect to the terminal building and to the manner in which aircraft maneuver in and out of parking positions. It is an important factor affecting the size of the parking positions and consequently the apron-gate area. Aircraft can be positioned at various angles with respect to the terminal building line and can maneuver in and out of parking positions either under their
own power or with the aid of towing equipment.

With aircraft towing it is possible to reduce the size of parking positions.

The four parking types are nose-in, angled nose-in, angled nose-out, and parallel.

1. **Nose-In Parking.** In this configuration (See Fig. 9) the aircraft is parked perpendicular to the building line with the nose as close to the building as permissible. The aircraft maneuvers into the parking position under its own power. In order to leave the gate the aircraft has to be towed out a sufficient distance to allow it to proceed on its own power. The advantages of this configuration are:
   a. It requires the smallest gate area for a given aircraft.
   b. It causes lower noise levels, as there is no turning movement.
   c. No jet blast toward the building is caused by the parking maneuver.
   d. The noise is close to the building, which facilitates passenger loading and unloading via short bridges.

The disadvantages of this configuration are:
   a. It requires the use of towing equipment.
   b. The rear aircraft doors are two far from the building and cannot be used effectively for passenger loading and unloading.

c. The towing-out maneuver may take up to 2 min., during which access to the gate position for other aircraft may be inhibited.

2. **Angled Nose-In.** This configuration is similar to the nose-in configuration except that the aircraft is not parked perpendicular to the building. (See Fig. 9) The configuration has the advantage of allowing the aircraft to maneuver in and out of the gate under its own power. However, it requires a larger gate area than the nose-in configuration and causes a higher noise level.

3. **Angled Nose-Out.** In this configuration the aircraft is parked with its nose pointing away from the terminal building. (See Fig. 9) Like the angled nose-in configuration, it has the advantage of allowing aircraft to maneuver in and out of gate positions without a need for towing. It does require a larger gate area than the nose-in position, but less than the angled nose-in. A disadvantage of this configuration is that breakaway jet blast and noise are pointed toward the building when the aircraft starts its taxiing-out maneuver.

4. **Parallel Parking.** This configuration is the easiest to achieve from the aircraft maneuvering standpoint. In this case noise and jet blast are minimized, as there are no sharp turning maneuvers required. It does require, however, a
FIG. 10 AIRCRAFT PARKING SYSTEMS:
(A) FRONTAL; (B) OPEN APRON; (C) FINGER; (D) SATELLITE
larger gate position area, particularly along the terminal building frontage. Another advantage of this configuration is that both forward and aft aircraft doors can be used for loading and unloading passengers, although relatively long loading bridges may be required.

**APRON LAYOUT**

The apron layout refers to the manner in which the apron is arranged around the terminal building. The apron layout depends directly on the way the aircraft gate positions are grouped around the buildings and on the circulation and taxiing patterns dictated by the relative locations of the terminal buildings and the airfield system.

Aircraft are grouped adjacent to the terminal building in a variety of ways depending on the processing system used. These groupings are referred to as parking systems and are classified as following:

1. **Frontal System.** In this system aircraft are parked on the apron immediately adjacent to the terminal building line. (See Fig.10) This is a simple system used where the terminal building will be small in size and the number of gate positions are low. It is also used when the gate-arrival passenger-processing concept is used, such as in linear terminals.

2. **Open-Apron System.** Here the aircraft are parked freely on the apron near the terminal but not directly adjacent to it. (See Fig.10) This system requires the conveyance of passengers from the terminal building to the aircraft and is used in conjunction with the mobile conveyance processing concept. It is also often used at low-volume airports where the number of parking positions is small and where passengers walk on the apron between the terminal building and the aircraft.

3. **Finger System.** This system is used in conjunction with the pier finger processing concept. (See Fig.10) It allows for the expansion of the number of gate positions without additions to the size of the processing system itself. It also permits the use of passenger-loading facilities onto aircraft, such as nose bridges.

4. **Satellite System.** As with the satellite processing concept, aircraft are parked in groups around smaller terminal building
units referred to as satellites. When aircraft parking is allowed freely all around the satellite building, simple maneuvering and taxiing patterns can be achieved. This system does require a larger apron than the other three.

**Passenger Conveyance to Aircraft**

There are three basic methods of conveyance that can be used between the terminal building and the aircraft. They are (1) walking on the apron, (2) walking through aircraft-building connectors such as bridges, and (3) by mobile conveyance using any of a variety of apron vehicles.

The first method can be employed with all processing and parking systems. However, as the number of parking positions and the apron size increases, it becomes impractical to use walking for the conveyance of passengers. The economic appeal of this method is overcome by the need to protect the passengers from the elements and from the hazards of walking on the apron.

The second method can be employed for all systems other than where open-apron parking is used. Of the aircraft-building connectors, the most common is the nose bridge, which is a short connector suitable for use when the aircraft door comes close to the building such as with nose-in parking. Another common system is the connecting jetway. (See Fig. 11A) Jetways have the flexibility of extending from the building to reach the aircraft door and of swinging to accommodate different types of aircraft.

The third system is suitable when open-apron parking is used. Here conveyance can be accomplished either with busses or with mobile lounges. With buses, passengers have to walk upstairs to aircraft doors. With the mobile
(a) From a single level terminal building the passengers walk across the apron to the aircraft. This method is presently being employed by many airports in use today.

(b) From a two level terminal building the passengers walk down a flight of stairs and then across the apron to the aircraft. This is an intermediate phase in use, where the future development would employ the use of jetways.

(c) This method shows a jetway which rotates into position and has the capability of telescoping to accommodate the interface between aircraft of different sill height. This diagram demonstrates a power-in, push-out gate position.

(d) This is the same as method (c) above, however, it differs only in that this diagram demonstrates a power-in, power-out gate position.
This diagram demonstrates a fixed jetway of short length and with a small amount of telescoping capability. This jetway also has the capability of making plane adjustments in still height. The gate position can only be a power-in, push-out condition.

This method, which is used in some present day airports, consists of a train of carts designed to carry passengers or it may consist of the use of buses to deliver the passengers to a remote aircraft parking position. The terminal building can be either a one level or two level structure.

This method is known as the Mobil-lounge and consists of an elaborately furnished room with a scissor lift and a telescoping front to achieve the interface between both the aircraft and the terminal building. The aircraft is parked at a remote position from the terminal building.

This method is used for the wide bodied aircraft and will accept the B-747, the DC-10 and the L-1011. The two main corridors are fixed in their location, however, the four short jetways have telescoping capability in order to achieve the interface with the aircraft. The gate position requires a power-in, push-out condition.

This method is also used for the wide bodied aircraft and will accept all three aircraft as listed above. It is based upon the concept of a fixed corridor for access to the front two passenger doors and a cantilevered jet way over the wing to reach the rear door. Here again, the gate position requires a power-in, push-out condition.
lounges this need is eliminated, as the lounge is capable of direct interface with aircraft doors through vertical movement. (See Fig. 11) The mobile lounge thus provides for complete passenger protection. There is, of course, a considerable cost difference between the mobile lounge and the conventional bus.

A graphical analysis of the various conveyance types are illustrated in Fig.

**APRON UTILITY REQUIREMENTS**

Aircraft need to be serviced at their respective gates. Thus certain fixed installations may be required on the apron. Of these installation or service needs, there are three general functions that must be facilitated. They are aircraft fueling, electrical power, and aircraft grounding facilities.

**Aircraft Fueling.** Aircraft are fueled at the apron by (1) fuel trucks, (2) fueling pits, and (3) hydrant systems. The principal advantage of fuel trucks is their flexibility. Aircraft can be fueled anywhere on the apron; the units can be added or taken away according to the need. There are disadvantages associated with the use of fuel trucks. Large jet transports require a considerable amount of fuel. Two refueling units are normally required, one under each wing. For the large jets, standby units are sometimes required if the fuel requirements are in excess of two units. This means that there are a large number of vehicles on the apron during peak periods, creating a potential hazard of collision with personnel, other vehicles, and aircraft. Since each truck carries a considerable quantity of fuel, it also constitutes a potential fire hazard.
when moving around on an apron when a number of other activities are taking place. When a truck is empty, it must return to the storage area for refueling before it can be used again. Thus extra trucks must be provided for use during the time when other trucks are being reloaded. When refueling trucks are not in use, parking spaces must be provided for these vehicles.

Another method of fueling is to install pipelines from a central fuel storage area located adjacent to the landing area to pits located at the gate positions on the apron. Each pit contains a meter, air separator, hose reel, and filter. Fuel is transferred to the pits by pumps located at the storage tanks. The pits must be located relatively near the fuel intakes in the wings of the aircraft.

Pits are considered satisfactory when the rates of fuel required are small (such as for a DC-3 or F-27), but for the high rates required by large turbojet aircraft, the equipment (size of hose, filter, meter, etc.) is much more bulky; consequently a much larger pit with a very husky metal cover is required. For this reason, pits are not normally used for fueling large aircraft.

The hydrant system accomplishes the same objectives as the pits but is simpler insofar as installation is concerned. Essentially, the hydrant system consists of the same elements as in the fuels pits, except that the pit is replaced by a special valve mounted in a box in the pavement and flush with the surface. The hose reel, meter, filter, and air eliminator are contained in a mobile self-propelled or towed hydrant dispenser. One end of the hose has a specially designed valve which is coupled to the valve installed in the
pavement. This hose feeds into the meter, filter, and air eliminator, from which another hose (usually on a reel) is led to the fuel intakes of the aircraft.

The principal advantages of the hydrant system are that a continuous supply of fuel is available at all times and it is safely carried underground. Additional advantages are eliminating the need for duplicating the hose reel, meter, and filter which are required in each pit; eliminating the need for maintaining pits; and providing a little more flexibility insofar as positioning of aircraft is concerned. The principal disadvantage is that vehicles are not entirely removed from the apron. However, because of their small size hydrant dispensers reduce possible collision damage to a minimum.

The location of the hydrant valves at an individual gate will depend upon the location of the fueling connections in the wings of the aircraft occupying the gates. It is desirable that the hose line from the hydrant dispenser or pit to the intakes in the wings not exceed 20 to 30 ft. The number of hydrants required per gate position depends not only on the type of aircraft but also on the number of grades of fuel required. Each grade of fuel requires a separate hydrant.
ENPLANING CARGO

MAIL CARGO
ENPLANING BAGGAGE FLOW

FROM AIRCRAFT

CENTRAL SORTING AREA

TO BAGGAGE CLAIM AREA

TRANSFER TO OTHER FLIGHTS

TO PASSENGER DEPLANING

DEPLANING BAGGAGE FLOW
DEPLANING PASSENGER → BAGGAGE CLAIM → RENT-A-CAR COUNTER → PICK-UP AT CURB → USER OBJECTIVE

DISPATCHMENT

CAR FROM "READY" LOT TO CURB PICK-UP POINT

RENT-A-CAR CUSTOMER USAGE FLOW

PARKED AT DROP-OFF POINT → PAYMENT PROCESS → PASSENGER'S DESTINATION

CLEANING AND MAINTENANCE PROCESS → "STORAGE" LOT PLACEMENT → TO "READY" LOT WHEN CALLED

RENT-A-CAR RETURN PROCESS
SPACE REQUIREMENTS

LANDSIDE

A. Curbing -- 1350 L. F.
   1. To facilitate enplaning and deplaning passengers, but possible need for two separate curbing areas.
   2. Should provide weather protection
   3. Strong proximity relation to parking area.
   4. Should have a surge space for bus loading and unloading.

B. Parking -- 2170 spaces
   1. Includes long and short term parking, employee, and rent-a-car areas.
   2. Should have weather protection access to terminal building.
   3. Should have one control or entry point, and from there, cars can be channeled to their various destinations.
   4. If control gates (automatic) are used, they should be close to a personnel or maintenance observation point so if a malfunction occurs, it can be detected and repaired in minimal time.
   5. Possibly a manually operated traffic light control should be placed in the attendance shelter to elevate traffic...
congestion and queing during peak loads when needed.
6. Employee parking possibly should be separated and should have close proximity to building.
7. Rent-a-car spaces should have proximity to exit points as well as to respective maintenance and cleaning areas.

TERMINAL INTERFACE

AIRLINE SPACES

A. Ticket Counters--2,600 S. F.
1. Should be layed out to produce minimum queing line distances
2. Counters should have direct proximity to baggage make-up conveyance system.
3. Should provide seating for 80 waiting passengers or visitors.
4. Should have direct relation to concourse
5. Transactions consist of checking of baggage, selling of tickets, and settling of re-issues.
6. Should be an aesthetical environment to compensate for the distractions and activity at counters. A "soothing" spacial experience with vegetation and natural light. Good views if possible for waiting passengers.

B. Holding Areas--11,160 S. F.
1. Should have control access point for checking of tickets.
2. Direct proximity to gates
3. Each area should provide seating for 60.
   a. Possibly areas are combined to facilitate a number of gates since a number of aircraft will usually not be enplaned or deplaned simultaneously.
4. Possibly a gate baggage check for late enplaning passengers
5. Should have visual access to both apron area and concourse.
6. Must be a stimulating space to compensate for the boredom of waiting.
7. Considerations must be made for dramatic situations such as people departing who will never see their "farewells" again. Security check-point must be placed such that both passengers and "farewells" are "sterile" in a security sense, thus enabling physical contact up to departure time.

C. Baggage Area--3,000 S. F.
1. Primary function is the unloading of baggage from incoming carts to claim devices.
2. Must facilitate a number of tractor/carts from various unloading aircraft.
3. Transition area between apron and baggage claim area.
4. Should have interface with two baggage conveyance systems.
5. Substantial environmental considerations should be made since area is in constant indoor/outdoor transition.
6. No aesthetical considerations required.

D. Baggage Claim Area--3,000 S. F.
1. Must have ample queing and circulation space around the baggage conveyance system.
2. Must have seating for waiting passengers and guests.
3. Direct access from aircraft, and to exit points, curbing, and parking areas.
4. Should be separated from enplaning functions and circulation.
5. Potential for graphical communication about Evansville since passengers have just arrived and spend some time in waiting. Should be a stimulating space to compensate for boredom during waiting cycle.
6. Plants and natural light advisable.

E. Maintenance Area--4,900 S. F.
1. Light maintenance area for mechanics to carry out minor changes on aircraft ranging from wheel changes to altimeter adjustments
2. Should provide lockers, work counters, equipment areas, and tool and parts storage.

3. Should be in direct proximity to apron.
4. No aesthetical considerations required.

F. Storage Space--2,000 S. F.
1. Should be sub-divided for unclaimed baggage storage as well as general storage for office equipment, paper supplies, etc.
2. Should also provide interim waste disposal storage.

PASSenger AREAS

A. Ticket Lobby--4,000 S. F.
1. Should provide adequate area for queing lines, as well as circulation lanes.
2. Direct proximity to main entrance.
3. Should provide seating for 80 to facilitate waiting passengers and guests.
4. Should have direct access waiting and holding areas as well as amenities.
5. Should be an aesthetical environment to compensate for the distractions and activity at counters. A "soothing" spacial experience with vegetation and natural light. Good views if possible for waiting passengers.

B. Waiting Area--7,500 S. F.
1. Should provide seating for 540.
This includes waiting passengers and guests.

2. Should include a definite observation area with direct visual proximity to the apron.

3. Should have access to amenities.

4. Access should be controlled by the security check point, thus all occupants are "sterile."

5. Paramount need to provide a stimulating space to counterbalance boredom of waiting. Vegetation and natural light introduction essential. Possible introduction of moving water into the space to provide visual aesthetics as well as sonic "white" noise to screen conversation and activity noise.

6. Potential for introduction of an entertainment activity in either "live" or audio-visual form.

7. Possible access to an exterior observation deck area to view apron activities.

C. Amenities--17,200 S.F.

1. Includes concessions such as: T.V. lounge, restaurant, cocktail bar, snack bar, magazine shop, gift and sweets shop, insurance counter, post office, first aid, information desk, and public toilets.

2. Should be in access to waiting area as well as the concourse.

3. Locations should not impede passenger flow, but should occupy positions of prominence with regard to the main circulation flow.

4. The information kiosk's location should be one in which it has optimum proximity to all passenger related functions.

5. Restaurant and post office will require loading dock service of van type truck potential.

6. Considerations must be made since amenity personnel will utilize public toilets, unless separate facilities can be feasibly provided.

7. First aid room should have direct access to either service road or major ingress/egress points.

8. Spaces should provide physical and psychological relief from other areas of the terminal. Should provide both relaxing and stimulating experiences.


10. Consideration of elevated views of other terminal functions. To present them as a stage to the amenities area, which will be positioned as a "balcony." This should include views into apron operations and surrounding landscape.

D. Rent-A-Car Space--1600 S.F.

1. Location should have prominence with regard to the main deplaning circulation flow, with relative proximity.
2. Should have sufficient queing build-up space in front of ticket counters, and should not impede passenger flow.

E. Concourse--23,000 S. F.
1. Should have appropriate spaces configurations to absorb deplaning "surge" loads.
2. Much consideration should be given in regard to signage and information posts.
3. Should have direct access to public toilets, amenities, observation deck area, etc.
4. Considerations should be made concerning scale transition between airside and terminal spaces.
5. Concourse should be a pronounced visual and volumetrical transition space. Transition between land bounded environment and a totally mechanical environment. A step into a "machine" environment.

AIRPORT MANAGEMENT

A. Airport Administration--2000 S. F.
1. Purpose to facilitate general administrative direction, to plan, organize and administer the operation, maintenance and improvement of the airport as a whole and to do related work as required.
2. Should have separation from airline

and passenger related functions.

3. Visual access to apron area and airfield is desired.

4. Access points to offices should have relative proximity to terminal ingress/egress points to simplify airport business functions.

5. Should have direct relation to private toilet facility.

6. Should be a pleasant working environment. Addition of natural light, such as skylights or clerestory windows desired.

B. Custodian Locker and Breakroom--300 S. F.
1. Custodian's purpose are to carry out the cleaning and minor repair requirements of the terminal building.
2. To facilitate staff of 20
3. Location accessible to concourse and passenger areas, yet proximity relation to mech/waste disposal areas.
4. Breakroom area should be visually and psychologically refreshing. Introduction of natural light. Luxury items will be minimal.

C. Storage and Equipment Room--200 S. F.
1. To store cleaning equipment and related materials.
2. Separation into component rooms desired to provide S/Eq. rooms at
various locations within the terminal building.
  a. Concourse
  b. Waiting area
  c. Ticket lobby
  d. Public toilets
  e. Airport administration area

D. Maintenance Technicians Offices and Breakroom--300 S. F.
  1. Technicians responsibilities are to repair and maintain general building equipment, such as lights, windows, doors, as well as the operational needs of the HVAC equipment.
  2. To facilitate a staff of seven
  3. Location: accessibility to concourse and passenger area yet direct proximity to mechanical equipment area.
  4. Consideration should be made as to the combination of tech./custodian locker and breakroom areas.

E. Repairshop and Storage--620 S. F.
  1. To be utilized by the maintenance technicians in carrying out their duties.
  2. Requires loading dock service of van type truck potential.
  3. Direct proximity with mechanical and waste disposal areas.
  4. Access opening(s) should be of a size to facilitate the passage of large equipment and materials.
  5. Introduction of skylight or clerestory light desired, but not required.

F. Service Docks and Waste Disposal--1500 S. F.
  1. Direct proximity to service road
  2. Areas surrounding waste disposal area should be of sufficient size to allow vehicular maneuverability: turning radi, backing maneuvers, container emptying process.
  3. Service docks should be of a size to facilitate large van type trucks.
  4. Functions requiring service docks are:
     a. Mechanical equipment area
     b. Maintenance technicians repair shop
     c. Post office
     d. Restaurant
     e. Fire/security garage area
  5. There should be a service road access to the apron area as well as the first aid room.

G. Fire/Security Chief Office--100 S. F.
  1. Should have proximity relation to passenger areas as well as fire prevention vehicle garage area.
  2. Direct access link to control/observation room
  3. Should be a pleasant space with good views to S. E. of site.

H. Control and Observation Room--300 S. F.
  1. Should have visual access to both airside and landside operations.
  2. Direct proximity to fire prevention vehicles as well as operation areas.
3. Should be a stimulating environment to keep officer(s) alert during lull time-periods, yet soothing to offset the intensity of emergency procedure operations.

I. Kitchen/Lounge--450 S. F.
1. To allow for the preparation of meals, which permits the retention of all security officers during emergency procedures.
2. Should have access to both passenger areas as well as fire prevention vehicle garage and apron.
3. Configuration should be such to allow conversion into sleeping area in time of prolonged emergency operations.
4. Should be a refreshing space with addition of vegetation and natural light. Should be oriented to provide good views.

J. Classroom--360 S. F.
1. Sufficient space for 20 seats.
2. To be utilized for daily briefings and emergency procedure reviews.
3. Should have proximity with control and observation room and vehicle garage area.
4. Should have conversion flexibility in times of emergency activities.
5. Should be a stimulating environment. Introduction of natural light desirable.

K. Toilet/Shower Area--300 S. F.
1. To facilitate shower and clothing change needs which primarily proceed fire prevention operations.
2. Access from garage area as well as kitchen/lounge area.
3. Proximity to garage area.
4. To facilitate needs of 10 fire/security personal
5. Inclusion of skylights to create interesting environment.

L. Crash/Fire Vehicle Garage--4,400 S. F.
1. To shelter crash/fire and security vehicles, and provide maintenance area for vehicle repair.
2. Critical to have direct proximity with apron area and must have direct access to runways.
3. Fire Dept. must be able to respond in 3 min. maximum from the vehicle garage area to the farthest point of the runways.
4. Must be easily accessible for fire/security offices from any point within the terminal complex.
5. Apron area in front of garage egress must be clear at all times. If obstruction is unavoidable, as in some type of circulation route, it must be minimal both in size and duration.
6. Should have service road access, as well as proximity to waste disposal area.
6. Vehicles to be contained are
   a. One 1500 gallon Oshkosh MB-1500 AFFF
   b. One 1000 gallon Oshkosh MB-1000 AFFF
   c. One 400 gallon Ward LaFrance 530B-AFFF
   d. One 1/2 ton Ford, 1000 pounds of dry chemical
   e. One 2000 gallon water tanker
   f. 2 additional spaces for future vehicle purchases.
   g. 2 - 4 wheel drive land rover vehicles
   h. 1 - all terrain rescue vehicle

*For specifications of vehicles, see appendix.

7. Introduction of skylights or clerestory windows desirable.

M. Maintenance Area—1000 S. F.
   1. An area to carry out repairs, tune-ups, lubrication and any other.
   2. Will facilitate repairs of all vehicles, including ground maintenance vehicles, etc.
   3. Direct proximity to garage, parts/equipment storage area, and waste disposal area.
   4. Required service road access.
   5. Addition of natural light desirable.

N. Parts and Equipment Storage—800 S. F.
   1. To facilitate the storage of automotive replacement parts, lubricants, and related items. Also to

provide storage for tools and related equipment required in the maintenance of various vehicles.

2. Proximity to maintenance area.
3. Should have direct access to loading dock or service road entrance for the addition/removal of parts, equipment, etc.

AIRSIDE OPERATIONS

A. Airline Apron Vehicles
   1. 27 baggage cart tractors
   2. 135 baggage and freight carts.
   3. 10 fuel trucks (if hydrant fuel system is not incorporated)
   4. 10 lavatory trucks
   5. 10 potable water trucks (if potable hydrant system is not incorporated)
   6. 10 tugs (tractors to move planes)
   7. 10 heater/AC trucks (to condition air inside aircraft during layover)
   8. 10 ground power unit trucks (unless fixed power source installations are installed)
   9. 10 catering service trucks

*Specifications included in appendix.
SITE ANALYSIS

MACRO-CONTEXTUAL: THE SITE REGION

A. SOIL

From a soil survey commissioned by the United States Department of Agriculture, soil conservation service for Vanderburgh County, Indiana, and conducted by the Purdue University Agricultural Experiment Station in June 1976, the following soil types were determined to be on and around the existing airport site: Zipp silty clay (Zp), birds silt loam (Bd), Hosmer silt loam (HoB2), Muren silt loam (MuB2), McGary silt loam (Mr), and Wakeland (Wa). Their various properties are listed on Table 1. Their location on the site can be seen in Fig.
### Table 1: Soil Properties

<table>
<thead>
<tr>
<th>Soil Series and Symbol</th>
<th>Depth to Seasonal High Water Table</th>
<th>Frost-Heave Potential</th>
<th>Depth from Surface</th>
<th>USDA Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zipp (Zp)</td>
<td>0-1</td>
<td>Moderate</td>
<td>0-64</td>
<td>Silty Clay</td>
</tr>
<tr>
<td>Birds (Bd)</td>
<td>0-1</td>
<td>High</td>
<td>0-60</td>
<td>Silt Loam</td>
</tr>
<tr>
<td>Hosmer (HoB2)</td>
<td>76</td>
<td>Moderate</td>
<td>0-73</td>
<td>Silt Loam</td>
</tr>
<tr>
<td>Muren (MuB2)</td>
<td>3-6</td>
<td>Moderate</td>
<td>0-60</td>
<td>Silt Loam</td>
</tr>
<tr>
<td>McGary (Mr)</td>
<td>1-3</td>
<td>Moderate</td>
<td>0-60</td>
<td>Silt Loam</td>
</tr>
<tr>
<td>Wakeland (Wa)</td>
<td>1-3</td>
<td>High</td>
<td>0-60</td>
<td>Silt Loam</td>
</tr>
</tbody>
</table>

### Table 2: Soil Characteristics

<table>
<thead>
<tr>
<th>Soil Series and Symbol</th>
<th>Permeability</th>
<th>Available Water Capacity</th>
<th>Reaction</th>
<th>Shrink-Swell Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IN./HR.</td>
<td>IN./IN. OF SOIL</td>
<td>PH</td>
<td></td>
</tr>
<tr>
<td>Zipp (Zp)</td>
<td>0.06</td>
<td>0.19 - 0.21</td>
<td>6.1 - 7.8</td>
<td>High</td>
</tr>
<tr>
<td>Birds (Bd)</td>
<td>0.06 - 0.20</td>
<td>0.21 - 0.23</td>
<td>5.6 - 7.3</td>
<td>Low</td>
</tr>
<tr>
<td>Hosmer (HoB2)</td>
<td>0.60 - 2.00</td>
<td>0.22 - 0.20</td>
<td>5.1 - 6.0</td>
<td>Low</td>
</tr>
<tr>
<td>Muren (MuB2)</td>
<td>0.60 - 2.00</td>
<td>0.19 - 0.24</td>
<td>5.1 - 6.5</td>
<td>Moderate</td>
</tr>
<tr>
<td>McGary (Mr)</td>
<td>0.60 - 2.00</td>
<td>0.22 - 0.24</td>
<td>5.6 - 7.3</td>
<td>Moderate</td>
</tr>
<tr>
<td>Wakeland (Wa)</td>
<td>0.60 - 2.00</td>
<td>0.22 - 0.24</td>
<td>5.6 - 7.3</td>
<td>Low</td>
</tr>
</tbody>
</table>
ENVIRONMENT

Physical: The existing airport site contains 1,127.46 acres of which 150 acres are in the clear zone of the airport proper. Approximately 500 acres of farmland is under contract. Because of its function, the majority of the site is flat, but topographical changes occur on the eastern sector of the site. The vegetation is generally grass area or soybeans. There are, however, deciduous trees on the north-west corner and eastern sector of the site.

Social: Because the parameter contextual elements are void of social indicators, it is difficult to surmise a social analysis. Extending to the residential ring around the contextual elements, it is possible to extract a high income social influence, but it is questionable if this provides a valid indicator.

Emotional: The emotional context is a disparity of congestion and intense activity on the one side, and beauty and tranquility on the other. Flanked on the southern, wester, and north-western boundaries by the anxiety, stress, and noise of a busy highway and manufacturing plant, it is refreshingly balanced to the north-east and east by wooded areas and soybean fields, as well as a cemetery at the crest of a hill. Combined, they evoke an unusual emotional context, varying with the element you have proximity with.

CLIMATE

The site being located in Vanderburgh County, it has an invigorating climate because both polar and tropical airflow pervade the area. Pleasant, cloudless days are interspersed with some rainy days throughout the year. Rainfall,
generally adequate in all seasons, favors diversified farming. In some summers when moisture utilization is high, however, a month of below-average rainfall adversely affects lawns, pastures, and crops.

Changes in weather occur every few days as a result of the passing of weather fronts and the presence of associated centers of low and high pressures. In general high pressure is followed by lower temperatures, lower humidity, and sunny days and low pressure by increasing temperatures, increasing southerly winds, higher humidity, and rain or showers. Weather is the least active late in summer and the most active and accompanied by greater temperature changes in winter.

For annual temperatures and precipitations, see Table 2.
<table>
<thead>
<tr>
<th>Month</th>
<th>Average daily maximum</th>
<th>Average daily minimum</th>
<th>Average monthly maximum</th>
<th>Average monthly minimum</th>
<th>Average monthly total</th>
<th>One year in 10 will have—</th>
<th>Days with snow cover of 1 inch or more</th>
<th>Average depth of snow on days with snow cover of 1 inch or more</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches</td>
<td>Inches</td>
<td>Inches</td>
<td>Inches</td>
<td>Inches</td>
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<td>January</td>
<td>43</td>
<td>26</td>
<td>64</td>
<td>6</td>
<td>0</td>
<td>1</td>
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<td>February</td>
<td>47</td>
<td>23</td>
<td>66</td>
<td>11</td>
<td>3.2</td>
<td>1.0</td>
<td>0</td>
<td>2.9</td>
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<tr>
<td>March</td>
<td>55</td>
<td>35</td>
<td>76</td>
<td>19</td>
<td>4.3</td>
<td>1.5</td>
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<td>1.7</td>
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<tr>
<td>April</td>
<td>69</td>
<td>47</td>
<td>83</td>
<td>32</td>
<td>4.0</td>
<td>1.3</td>
<td>0</td>
<td>1.7</td>
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<tr>
<td>May</td>
<td>78</td>
<td>55</td>
<td>89</td>
<td>45</td>
<td>4.2</td>
<td>1.7</td>
<td>0</td>
<td>0</td>
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<tr>
<td>June</td>
<td>87</td>
<td>65</td>
<td>95</td>
<td>53</td>
<td>3.7</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
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<tr>
<td>July</td>
<td>90</td>
<td>67</td>
<td>98</td>
<td>58</td>
<td>3.8</td>
<td>1.5</td>
<td>0</td>
<td>0</td>
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<tr>
<td>August</td>
<td>89</td>
<td>66</td>
<td>97</td>
<td>55</td>
<td>3.1</td>
<td>1.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>September</td>
<td>83</td>
<td>57</td>
<td>94</td>
<td>45</td>
<td>2.9</td>
<td>.8</td>
<td>0</td>
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<tr>
<td>October</td>
<td>72</td>
<td>46</td>
<td>85</td>
<td>33</td>
<td>2.6</td>
<td>.4</td>
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<tr>
<td>November</td>
<td>55</td>
<td>34</td>
<td>75</td>
<td>21</td>
<td>3.2</td>
<td>1.0</td>
<td>0</td>
<td>1.4</td>
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<tr>
<td>December</td>
<td>45</td>
<td>28</td>
<td>65</td>
<td>10</td>
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<td>68</td>
<td>46</td>
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<td>82</td>
<td>41.6</td>
<td>30.9</td>
<td>53.5</td>
<td>12.0</td>
</tr>
</tbody>
</table>

1 Average annual maximum.

2 Average annual minimum.
ORIENTATION ANALYSIS

PREVAILING WINTER WINDS VARYING FROM WEST TO NORTH-WESTERLY

PREVAILING SOUTH-WESTERN SUMMER WINDS

US 41

0 200 500 1000

N