CHAPTER 4. PLANNING CONSIDERATIONS

19. TERMINAL ROADWAY SYSTEM.

a. A single intersection from an off-airport highway generally serves the connecting roadway which directs traffic to the terminal access roadway and the service roads. Service and employee vehicles not destined for the terminal should be diverted onto service roads as soon as possible in order to reduce the possibility of congestion and unnecessary conflict. It is recommended that the passenger terminal roadway consist of a simple one-way loop system circumscribing the public parking area and passing the terminal in a counterclockwise direction to permit right-side loading and unloading of vehicles.

b. To minimize the number of vehicles passing directly in front of the terminal building, parking lot entrances should, where possible, be located prior to the terminal. For the same reason, parking lots should exit onto the roadway system at locations beyond the terminal. It should be possible for automobile drivers who are dropping off passengers at the terminal to have easy access to the parking area. A recirculation roadway ramp linking the ingress and egress portions of the access roadway system should be provided for this purpose. A second parking lot entrance located beyond the terminal should also be considered.

c. At lower activity airports, a multilane roadway can serve both the ticketing and baggage claim areas. This roadway should provide lanes at the terminal curb for cars to park while loading or unloading, for the maneuvering of vehicles, and for through traffic. Traffic leaving the terminal area will follow the remainder of the loop roadway to the connector road and to the highway intersection.

d. Ample separations between locations where drivers must make directional decisions should be provided to avoid confusion. No more than two choices should have to be made by the driver at any location, and adequate directional signing should be incorporated in the roadway system.

e. A schematic roadway system is depicted in Figure 4-1. The diagram is also illustrative of functional relationships of the principal elements of the passenger terminal complex.

20. CIRCULATION AND FUNCTIONAL RELATIONSHIPS.

Routes to and from parking lot(s) and the terminal should be made obvious, must be well signed, and free of obstructions. The simplified direct flow for passengers and visitors is a primary objective in terminal planning. It is important that primary terminal functions and ancillary activities be located with respect to their sequence in the terminal. For example, passengers should not have to carry baggage excessive distances from curbside to the baggage check-in facility. Or upon retrieval at the claim area, passengers should not be expected to transverse long distances. Concessions and rest rooms should be located adjoining primary circulation routes. Enplaning and deplaning passenger

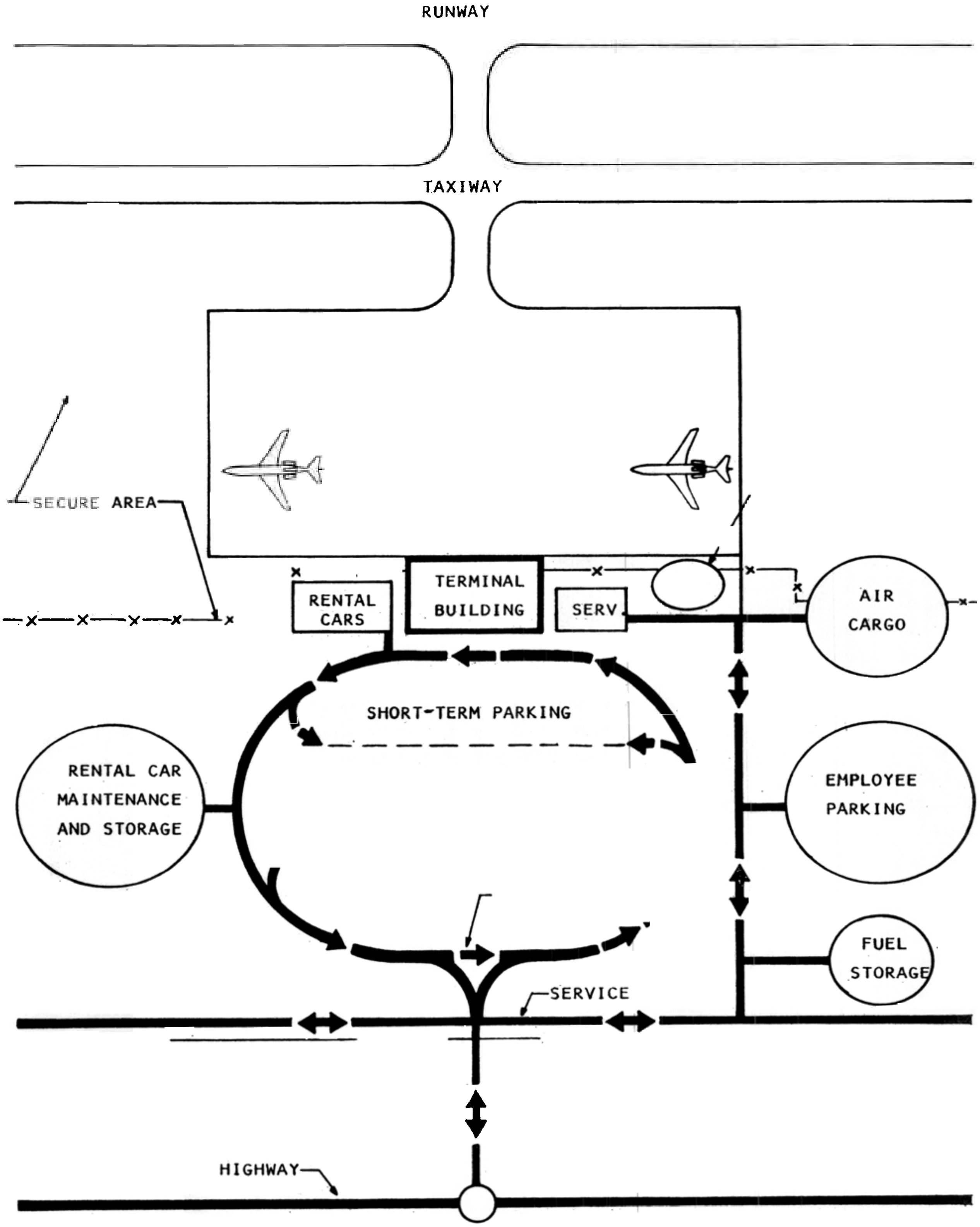


FIGURE 4-1. TERMINAL SITE RELATIONSHIP DIAGRAM

circulation should be separated to the extent practical. Conflicts between the movement of baggage and pedestrians should be avoided. Functional relationships of key elements and the passenger and baggage flows are shown in Figure 4-2.

21. AIRCRAFT PARKING CONFIGURATIONS. Aircraft parking variations and the resulting terminal configurations are shown in Figure 4-3.

a. Linear. When the number of aircraft parking positions does not exceed four to six, the linear aircraft parking layout is efficient. In this configuration, aircraft parking positions are located in a single row, usually parallel to the terminal. Aircraft are served by a centrally located departure lounge(s) within the terminal. To protect passengers from inclement weather, enclosed concourses or covered passageways extending from the departure lounge(s) toward the aircraft parking positions are desirable.

b. Pier. The pier concept consists of a canopy walkway, an enclosed corridor, or a building pier with aircraft parked on either side. This layout becomes efficient when a larger number of aircraft parking positions are required or the site limits linear expansions.

22. SINGLE VERSUS MULTILEVEL - VERTICAL ASPECT.

a. Ground Level Boarding. At most nonhub airport terminals, passengers board aircraft by walking short distances from the terminal or departure lounge across the aircraft parking apron. Access to the aircraft is provided either by mobile stair unit or by stairways that are self-contained in the aircraft. Inclined loading bridges are also employed at some locations. The loading bridge is able to adjust to the varying aircraft door heights and swing clear of maneuvering aircraft. The slope of the loading bridge should not exceed 8%. This method of boarding offers a higher degree of passenger service and may be desirable at terminals where extreme climate conditions exist.

b. Second Level Boarding. The higher cost of construction associated with locating departure areas on the second level of the terminal with direct boarding of aircraft via loading bridges can seldom be justified at nonhub terminals. However, where forecasts indicate that such a terminal scheme will be feasible and desirable in some future phase of development, the terminal design should provide for vertical building expansions to avoid costly future building modifications.

c. Unusual Topographic Features. At most nonhub airports, the passenger terminal enplaning and deplaning functions and aircraft parking apron are at the same level. Airport and terminal sites are not always located on relatively flat terrain. When natural conditions cause the passenger terminal site to be located above or below the aircraft apron, careful study and innovative adaptation to the topographical features can often result in a planning benefit. The use of split-level or two-level

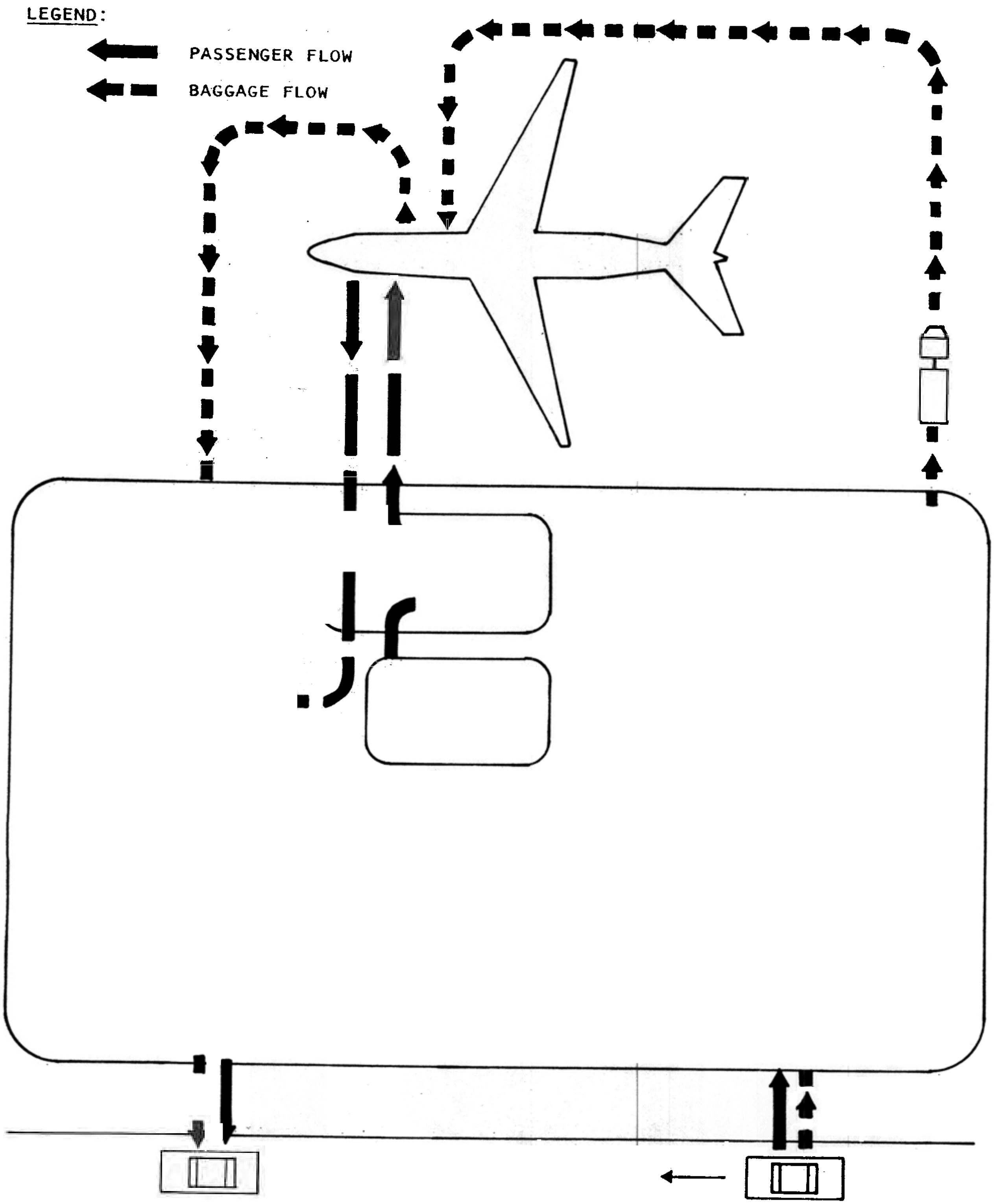
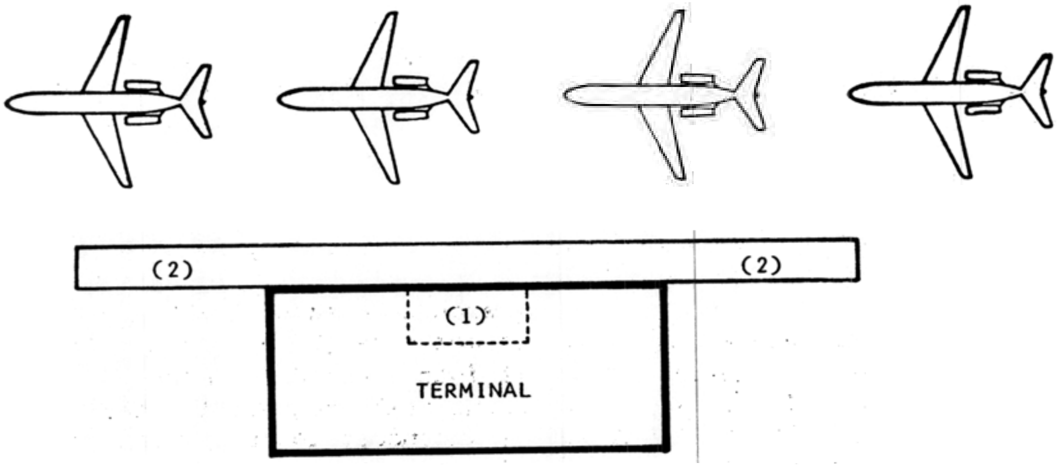


FIGURE 4-2. DIAGRAM OF PASSENGER TERMINAL CIRCULATION AND FUNCTIONAL RELATIONSHIPS

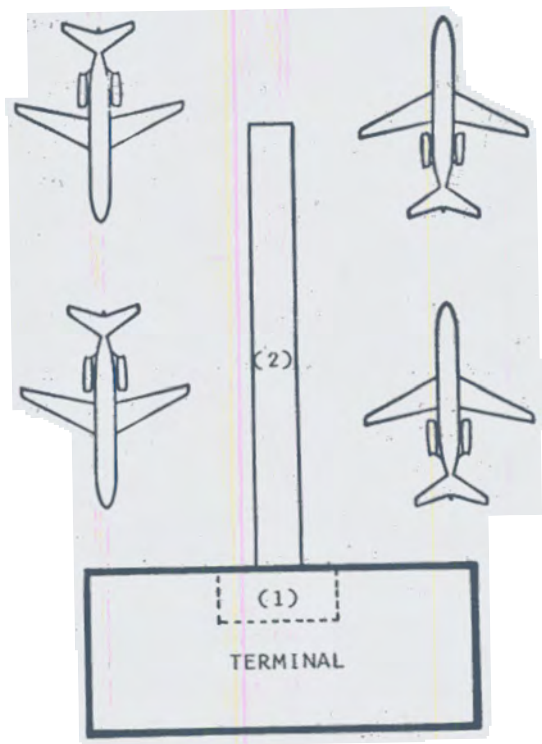


LINEAR SYSTEM

LEGEND:

(1) CENTRALLY LOCATED SECURE DEPARTURE AREA

(2) FENCED, COVERED, OR ENCLOSED WALKWAY



PIER SYSTEM

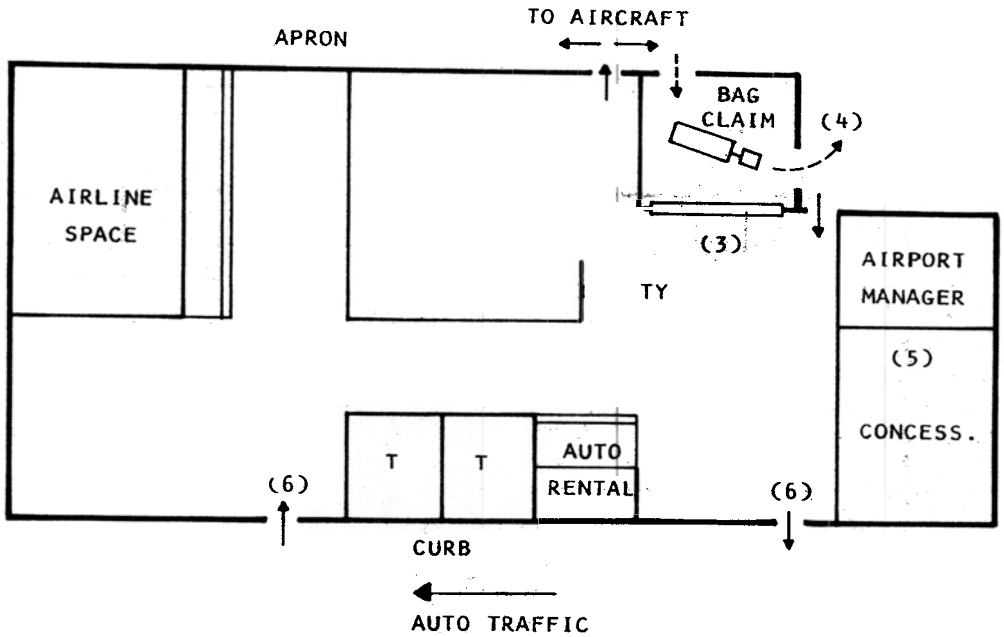
FIGURE 4-3. AIRCRAFT PARKING AND TERMINAL CONFIGURATIONS terminal concepts may become economically feasible and provide a more functional planning solution than might be possible on a level site. As in single-level buildings, provisions must be made for the handicapped (see paragraph 37).

23. FLEXIBILITY AND EXPANSIBILITY. The financial feasibility aspects of terminal planning and design, as discussed in Chapter 2, must be considered along with the flexibility and expansibility of the building.

a. Flexibility. A terminal building should be adaptable to permit alterations in interior layout and use to accommodate the ever-changing procedures and requirements. Flexibility built into a building encompasses all or portions of the following: using nonbearing walls and partitions; converting spaces to uses other than originally intended; locating various facilities so additions or enlargements will impose the least disruption to continued operation; selecting materials and methods of construction adaptable to remodeling; and installing mechanical and electrical systems that do not require substantial reworking for partition changes. All architectural, structural, and mechanical elements in design detail and specifications should reflect these considerations. Designers should be cautioned that the use of some materials can cause other problems. External metal walls, for example, can reflect electronic signals that can cause serious disruption of airport navigation equipment.

b. Expansibility. Growth of the aviation industry generates requirements for expanded facilities to accommodate the operational requirements of airport terminals. An airport terminal building should be planned to accept additions with a minimum of demolition or disruption of its functions. Provisions for expansion should be made primarily laterally and/or vertically. A structure of a simple rectangular configuration rather than of irregular or curved shape lends itself more readily to this type of expansion. End walls of the building should not be bearing walls. Elements such as vertical circulation, toilet accommodations, kitchen facilities, and other mechanical installations are best situated in the building so that relocation of these costly and vital installations will not be necessary when expansion occurs. Where vertical expansion or additions are likely, the original structural system should be designed to carry the future loads. The passenger service counter, waiting room, airline operational spaces, and baggage claim area may require periodic expansion. They should be planned so that enlargement will be a relatively simple and inexpensive operation. Typical errors often made in terminal plans that restrict expansion and compromise efficiency are depicted in Figure 4-4. For comparison, Figure 4-5 is illustrative of a more functional, expansible small passenger terminal.

24. AESTHETIC CONSIDERATIONS. The airport terminal is an important civic building. As the gateway to the community, it should reflect the character and aesthetic aspirations of its citizens. Artwork can be combined with the building design to give public spaces individuality and to present an image of the local culture and architectural heritage. Visual clues to the social and economic preoccupation of the region can be provided, and ethnic



(1) TICKET COUNTER EXPANSION REQUIRES REORIENTATION AND MAJOR RECONSTRUCTION

(2) QUEUES AT SECURITY CLEARANCE BLOCK CIRCULATION

(3) BAGGAGE CLAIM EXPANSION RESTRICTED

(4) CROSS TRAFFIC - BAG CARTS AND PEDESTRIANS

(5) OFFICE AND CONCESSIONS BLOCK LOGICAL BUILDING EXPANSION

(6) BUILDING FUNCTIONS IN WRONG SEQUENCE TO MATCH ARRIVING AND DEPARTING VEHICLES

FIGURE 4-4. EXAMPLE OF TERMINAL PLANNING DEFICIENCIES

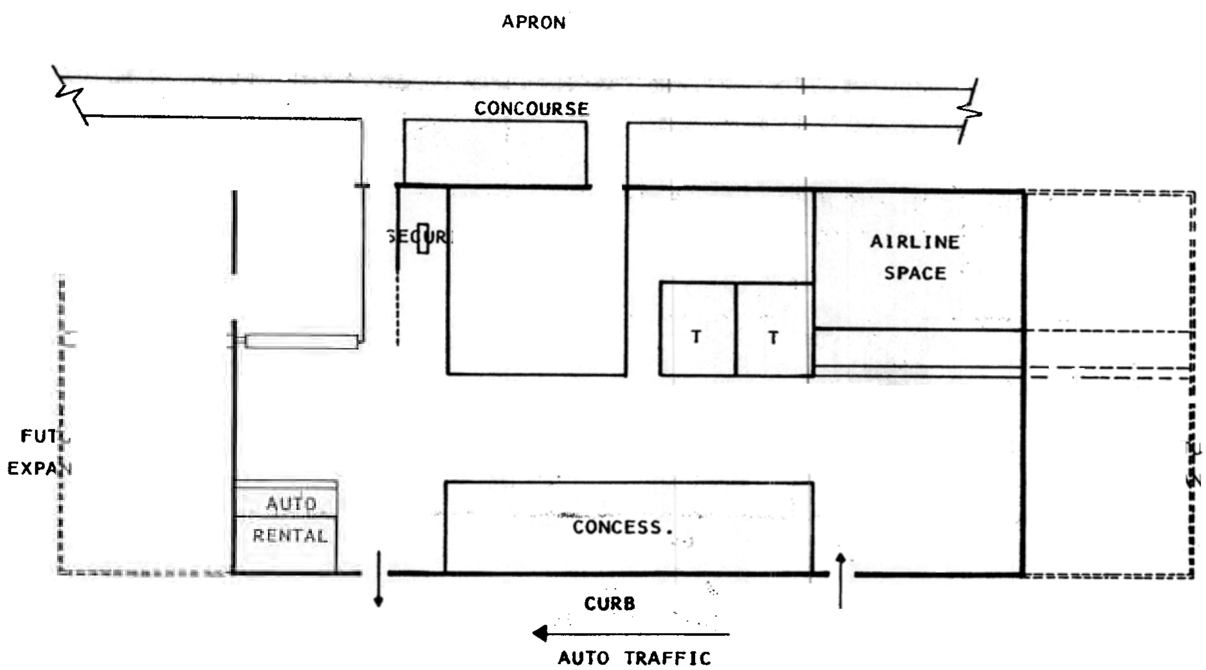


FIGURE 4-5. EXAMPLE OF A FUNCTIONAL TERMINAL LAYOUT

sensibilities and identification can be expressed. FAA programming criteria permit the use of ADAP grant-in-aid funds for incorporating expanded design arts concepts and principles in airport terminal building projects. However, Federal participation in airport terminal development does not mean that any particular style of architecture will be imposed on the planner. Each community is free to select the architectural style and treatment that expresses local wishes and needs. An investment in the design of airport terminals can produce humane and pleasant places, improve the travel environment, and benefit the community. Caution should be exercised, however, to avoid extravagant monumental buildings, as these are not consistent with the ever-changing requirements of the aviation industry. In addition, Federal funds may not be adequate or available for overly ambitious design concepts. Qualified professional architects/engineers working with agreed-upon budgets and work programs can design imaginative solutions that will be a source of civic pride while reflecting the functional parameters and flexibility necessary for a successful terminal. If there is question concerning ADAP eligibility of incorporating particular design arts concepts in the terminal building plan, FAA Airports District or Regional Offices should be consulted.

CHAPTER 5. PEAKING AND DEMAND FORECASTS

25. PASSENGER FORECASTS. Passenger forecasts are employed in determining future terminal quantitative requirements.

a. Use. Passenger forecast data are used in the development of terminal space requirements, number of aircraft parking positions, automobile parking needs, and peak airport vehicular traffic demands. Forecasts are customarily made for 5-, 10-, and 20-year periods. The forecast data are used in preparing a master plan of the full development of the terminal to accommodate orderly, incremental additions or expansion of facilities. The initial stage of construction of airport terminal facilities should be designed to accommodate, comfortably, the forecast demands 5 years from the proposed date for occupancy.

b. Sources. There are a number of sources for passenger forecasts that may be obtained for a specific airport. These include: a current airport master plan developed under the FAA-sponsored PGP; FAA's published Terminal Area Forecasts; forecasts developed by the Air Transport Association or the airlines serving the airport; airport management; local or regional planning agencies; state and metropolitan airport system plans; or early airport studies or reports.

c. Translating Forecasts to Peak Demands. Airport terminals and related vehicle access and parking are planned, sized, and designed to accommodate peak passenger demands of the forecast periods.

(1) Facilities should be provided to accommodate normal high levels of activity (peaks) that can be expected to occur during the forecast year. Planning for absolute peak demands; i.e., the greatest demands anticipated, will result in impractically oversized and under-utilized facilities except for rare occasions. Facility-sizing guidelines, presented in this circular, are based on forecasted: total peak hour passengers (enplaned and deplaned); peak hour enplaned passengers; peak hour deplaned passengers; and annual enplaned passengers. Chapter 6 covers the subject of facility sizing in detail.

(2) FAA's AC 150/5360-7, Planning and Design Considerations for Airport Building Development, current edition, describes a methodology for translating forecasted passenger activity into design peak hour demands. The procedure utilizes historic and projected passenger levels and aircraft movements to develop a hypothetical design day activity table from which passenger peaking activity can be analyzed. The circular also provides "average" peaking charts and rules-of-thumb for rough estimating of various peak hour demand activities.

(3) In lieu of developing a detailed design day activity analysis, a simple and accurate method of determining peak hour demands involves the use of current and most recent historical data or peak hour activities and facility usage at the airport under study. Current data can be obtained

from airline station records of hourly enplanements and deplanements (total passengers) for a minimum 2-week period. From an analysis of this data, a typical peak hour level of activity can be determined. As a guideline, this level of activity is one which is anticipated to occur at least 100 to 150 times a year (or, as an average, approximately two or three times weekly) during busy 60-minute periods. The current peak hour activity levels must be adjusted to account for the peak months of activity, if the data is obtained in other than a typically busy month of passenger activity. This can be done by comparing enplaned passenger counts in the month when the data was collected to enplaned passenger counts during the typical peak months of the preceding year and, if necessary, adjusting the peak level upward or downward proportionately. This calculated peak hour/peak month count is then divided by the total number of enplaned passengers for the most recent 12-month period to arrive at a peaking factor expressed as a percentage of annual enplaned passengers. This peaking factor will decrease gradually as total annual enplanements increase. (The rate of decrease in peaking factors varies from airport to airport. It is advisable to consult with airline facilities planners and FAA Airports District Office representatives for assistance on this matter.) The resultant factor when applied to forecasted passenger enplanements for the design year will yield the approximate total peak hour passengers anticipated for that year. Enplaning and deplaning design peak hour passenger levels can be determined separately by following a similar procedure or by assuming that both enplaning and deplaning peak hour passengers equal 60% to 70% of total peak hour passengers. This is a rule-of-thumb percentage that has proved to be quite accurate.

(4) The facility sizing graphs in Chapter 6 are designed to be utilized with design peaking levels obtained from either procedure discussed above.

26. PEAKING CHARACTERISTICS. Peaking characteristics vary from airport to airport and thus influence the planning, sizing, and design of passenger terminal facilities in different ways. The most commonly encountered peaking characteristics influencing passenger terminal planning are described below.

a. Aircraft Apron. Current peak use characteristics of the terminal apron can be determined from arrival and departure times listed in airline schedules. Off-schedule operations should be considered when scheduled flights are closely spaced, timewise--i.e., a delay in a departure would increase the peaks of aircraft parking. At nonhub airports, the airlines usually stagger their schedules of aircraft on the ground to minimize staffing of ground servicing personnel. This procedure tends to hold peak demand for aircraft parking positions to a minimum. Airports in locations with seasonal attractions, such as resorts, tend to have higher than normal peak demand for aircraft parking positions. Additional aircraft parking positions may also be required because of interline connecting schedules or other scheduling influences at locations where more than one airline serves a nonhub airport. Quantification of aircraft parking position requirements is dealt with in paragraph 28.

b. <u>Passengers</u>. Passenger peaking and airline aircraft peaking generally occur during the same periods. However, a late arrival or departure of a scheduled flight may result in more than the usual number of aircraft on the ground at the same time and, consequently, may result in a larger than normal number of passengers and visitors present in the terminal.

(1) <u>Airline Schedules</u>. Peaking of passenger activity at airports with only a few daily flights is a result of airline scheduling considerations rather than marketing forces. When the annual volume of passenger traffic is in the upper range of the nonhub category, passenger peaking characteristics are predominatly influenced by the character of the air travel market. At airports where the preponderance of the passengers are traveling for business purposes, peaking usually occurs in the early morning hours with the attendant aircraft peaking. Evening peaks for such business travelers are normally spread over longer periods than morning peaks.

(2) <u>Seasonal or Special Event Traffic</u>. Airports with seasonal passenger traffic characteristics or traffic generated by special events usually have passenger peaking characteristics spread over more hours of a day than airports with predominatly business travel. The spreading or sustaining of these peaks is attributable to the availability of aircraft, airline scheduling, and flexibility of the passengers' arrival or departure hour.

c. <u>Nonpassengers</u>. In addition to passengers, terminal occupants are usually in three categories--each there for different purposes and some contributing to peak occupancy.

(1) <u>Meeters/Greeters</u>. Persons accompanying an enplaning passenger into the terminal or meeting a deplaning passenger usually arrive coincidentally with the peaking of passengers. These people add to the demand for public spaces and facilities and for concessions. The greeter-per-passenger ratio varies with the nature of the passenger traffic. Generally, lower ratios, such as one-to-one, are found where business travel is predominant; and higher ratios, such as two-or-more-to-one, when vacation travel is predominant. This characteristic should be verified when planning a terminal. Special events, such as the arrival or departure of public figures, can impose heavy greeter loads on facilities. It is neither functionally nor financially sound to size facilities for such rare occasions.

(2) <u>Visitors</u>. The impact of visitors and sightseers is normally of minor importance in the sizing of nonhub airport passenger terminal facilities--an exception might be a popular restaurant which attracts the general public because of food quality, price, or some unique feature.

(3) <u>Employees</u>. Employees do not normally impact the sizing of passenger terminal facilities at the smaller passenger volume airports. They are usually occupied in processing of passengers and baggage and servicing aircraft during peaks; and thus have no significant demand on the public or concession facilities of the terminal during peak activity.

d. Vehicles. The peaking of automobiles affects the design of the on-airport roadway system, the passenger unloading/loading curbs at the terminal, and the parking lots.

(1) Personal Automobiles. The on-airport ingress and egress roadways at nonhub airports usually do not present problems at normal peak periods. Peak demands at the enplaning curb occur about one-half hour prior to flight departures and at the deplaning curb immediately following arrivals. Passenger dropoffs at the enplaning curb create peaks greater than pickups at the deplaning curb since deplaned baggage is most frequently hand carried to the parked car.

(2) Public Vehicles. At nonhub airports, taxis, limousines, buses, and courtesy vehicles are generally not significant factors in peak demand at the terminal curb. However, at resort areas and airports with unusual peaking characteristics involving public transportation vehicles, consideration should be given to providing designated unloading/loading areas.

(3) Employee and Service Vehicles. Terminal employees' vehicles precede or follow the passenger peaks, and thus their contribution to peak traffic is minimal at smaller airports. If a problem exists, service vehicles can be required to make deliveries or pickups during offpeak hours, thereby not compounding peak vehicular traffic problems.

(4) Parking Lots. Public parking lot usage usually generates three peaks at nonhub airports--a short period before departing flights, another short period prior to arriving flights, and a relatively longer period during the week. The latter is of the greatest significance because the quantity of parked automobiles at approximately midweek usually establishes parking lot size. This happens because of the buildup of departing air travelers' vehicles usually occurring from Sunday through Wednesday. However, at some airports, special situations may generate parking peaks on weekends. Peaking characteristics of rental car storage is usually the inverse of public parking demand. The peak number of rentals occurs typically on the airport over the weekends, with the inventory lowest during the midweek. The weekend accumulations of rental cars are usually parked in service areas. However, ready-and-return-car parking spaces are normally provided in proximity to the passenger terminal to accommodate the checkout peaks in the early part of a week and the return peaks later in the week.