

# Appendix D

## Methods for Determining Concentrations of People



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### Introduction

The underlying compatibility criterion used in this ALUCP is “usage intensity”, or more specifically, the maximum number of people per acre that can be present in a given location at any given time. Actions considered “incompatible” with the compatibility planning policies in this ALUCP would be uses that exceed the maximum intensity. Usage intensity is identified in the *California Airport Land Use Planning Handbook* (Caltrans, January 2002) as the means best suited for assessing land use safety compatibility for airports. Recognition, however, must be given to the fact that “people per acre” is not a common measure employed in other facets of land use planning. As such, this ALUCP utilizes the more common measure of floor area ratio (FAR) as a means of applying usage criteria.

### Counting People

Determining the number of people expected to use a facility at a single point in time involves estimating not just employees, but customers and visitors as well. Exceptions can be made in rare situations when a facility is used for an event it is not designed for (i.e, when a parking lot is used for a fairground), and it is expected that extra precautions be taken as appropriate.

In ideal situations, the actual or intended number of people for which a facility is designed would be known. However, many buildings are constructed without a specific number of occupants in mind, and the use of the site remains unknown until a tenant is found. Other uses can further compound the question of usage intensity when they are open, or have no fixed seating, like malls and athletic fields for example.

Given the lack of measurable occupancy numbers, other sources can be used to determine the number of people in a proposed development.

- *Parking Ordinance:* The number of people present in a given area can be calculated based upon the number of parking spaces provided. Some assumption regarding the number of people per vehicle needs to be developed to calculate the number of people on-site. The number of people per acre can then be calculated by dividing the number of people on-site by the size of the parcel in acres. This approach is appropriate where the use is expected to be dependent upon access by vehicles. Depending upon the specific

assumptions utilized, this methodology typically results in a number in the low end of the likely intensity for a given land use.

- *Maximum Occupancy:* The Uniform or California Building Code (CBC) can be used as a standard for determining the maximum occupancy of certain uses. The chart provided in Table D-1 indicates the required number of square feet per occupant. The number of people on the site can be calculated by dividing the total floor area of a proposed use by the minimum square feet per occupant requirement listed in the table.

Sample calculations based upon parking space requirements and the Uniform Building Code are provided in Exhibit D-1.

## Calculating Usage Intensities

Once the number of people expected to be present over an entire site has been estimated, the usage intensity can be determined. The criteria presented in Chapter 3 of this ALUCP were developed in terms of average intensity over the project site as a whole.

The average intensity is developed by dividing the total number of people expected to use a site by the size of the site itself (e.g., 400 people / 5 acre site = average intensity of 80 people per acre). Once the average usage intensity of a proposed project has been determined, the results can be compared with the criteria set forth in this ALUCP in order to determine consistency.

## Calculating Floor Area Ratio

Floor area ration (FAR), the gross square footage of the building(s) on a site divided by the site size, is a more common measure in land use planning than usage intensity calculations. As such, FAR criteria, as seen in Table 3-2, were integrated into this ALUCP in order to establish usage intensity limits for various types of nonresidential land uses.

FAR, however, does not directly relate to the underlying issue of risk due to the fact that the FAR for different types of buildings can be the same despite their level of use (e.g., a warehouse versus a restaurant). Therefore, in order to make FAR applicable to land use compatibility planning, a connection between usage intensity and FAR needed to be established. To achieve this, assumptions, rooted in the CBC, were made as to how much square footage a person may occupy in a given building (see Table D-1). Once this was determined, the following equation was applied to determine the FAR for a given nonresidential use:

$$\text{FAR} = \frac{(\text{allowable usage intensity}) \times (\text{occupancy load factor})}{43,560 \text{ sq. feet per acre}}$$

In this equation, *usage intensity* is understood in terms of people per acre, and *occupancy load factor* as square feet per person. The guideline for determining usage intensity numbers is found in the *Handbook* (see Appendix C), and the occupancy levels were provided in the CBC (see Table D-2). The FAR limits were calculated from these two numbers using the formula above.

**EXHIBIT D-1****Example 1**

*Proposed Development:* Two office buildings, each two stories and containing 20,000 square feet of floor area per building. Site size is 3.0 net acres. Counting a portion of the adjacent road, the gross area of the site is 3.5± acres.

**A. Calculation Based on Parking Space Requirements**

For office uses, assume that a county or city parking ordinance requires 1 parking space for every 300 square feet of floor area. Data from traffic studies or other sources can be used to estimate the average vehicle occupancy. For the purposes of this example, the number of people on the property is assumed to equal 1.5 times the number of parking spaces.

The average usage intensity would therefore be calculated as follows:

- 1)  $40,000 \text{ sq. ft. floor area} \times 1.0 \text{ parking space per } 300 \text{ sq. ft.} = 134 \text{ required parking spaces}$
- 2)  $134 \text{ parking spaces} \times 1.5 \text{ people per space} = 200 \text{ people maximum on site}$
- 3)  $200 \text{ people} \div 3.5 \text{ acres gross site size} = 57 \text{ people per acre average for the site}$

Assuming that occupancy of each building is relatively equal throughout, but that there is some separation between the buildings and outdoor uses are minimal, the usage intensity for a single acre would be estimated to be:

- 1)  $20,000 \text{ sq. ft. bldg.} \div 2 \text{ stories} = 10,000 \text{ sq. ft. bldg. footprint}$
- 2)  $10,000 \text{ sq. ft. bldg. footprint} \div 43,560 \text{ sq. ft. per acre} = 0.23 \text{ acre bldg. footprint}$
- 3) Building footprint < 1.0 acre; therefore maximum people in 1 acre = bldg. occupancy = 100 people per single acre

**B. Calculation Based on Uniform Building Code**

Using the UBC (Appendix C1) as the basis for estimating building occupancy yields the following results for the above example:

- 1)  $40,000 \text{ sq. ft. bldg.} \div 100 \text{ sq. ft./occupant} = 400 \text{ people max. bldg. occupancy (under UBC)}$
- 2)  $400 \text{ max. bldg. occupancy} \times 50\% \text{ adjustment} = 200 \text{ people maximum on site}$
- 3)  $200 \text{ people} \div 3.5 \text{ acres gross site size} = 57 \text{ people per acre average for the site}$

*Conclusions:* In this instance, both methodologies give the same results. For different uses and/or different assumptions, the two methodologies are likely to produce different numbers. In most such cases, the UBC methodology will indicate a higher intensity.

**EXHIBIT D-1 CONT.****Example 2**

*Proposed Development:* Single-floor furniture store containing 24,000 square feet of floor area on a site of 1.7 net acres. Counting a portion of the adjacent road, the gross area of the site is 2.0 acres).

*A. Calculation Based on Parking Space Requirements*

For furniture stores, the county requires 1 parking space per 400 square feet of use area. Assuming 1.5 people per automobile, the average usage intensity would be:

- 1) 24,000 sq. ft. bldg. x 1.0 parking space per 400 sq. ft. = 60 required parking spaces
- 2) 60 parking spaces x 1.5 people per space = 90 people maximum on site
- 3) 90 people ÷ 1.26 acres gross site size = 72 people per acre average for the site

Again assuming a relatively balanced occupancy throughout the building and that outdoor uses are minimal, the usage intensity for a single acre would be estimated to be:

- 1) 24,000 sq. ft. bldg. footprint ÷ 43,560 sq. ft. per acre = 0.55 acre bldg. footprint
- 3) Building footprint < 1.0 acre; therefore maximum people in 1 acre = bldg. occupancy = 90 people per single acre

*B. Calculation Based on Uniform Building Code*

For the purposes of the UBC-based methodology, the furniture store is assumed to be consist of 50% retail sales floor (at 30 square feet per occupant) and 50% warehouse (at 500 square feet per occupant). Usage intensities would therefore be estimated as follows:

- 1) 12,000 sq. ft. retail floor area ÷ 30 sq. ft./occupant = 400 people max. occupancy in retail area
- 2) 12,000 sq. ft. warehouse floor area ÷ 500 sq. ft./occupant = 24 people max. occupancy in warehouse area
- 3) Maximum occupancy under UBC assumptions = 400 + 24 = 424 people
- 4) Assuming typical peak occupancy is 50% of UBC numbers = 212 people maximum expected at any one time
- 5) 212 people ÷ 1.26 acres = 168 people per acre average for the site

With respect to the single-acre intensity criteria, the entire building occupancy would again be within less than 1.0 acre, thus yielding the same intensity of 168 people per single acre.

*Conclusions:* In this instance, the two methods produce very different results. The occupancy estimate of 30 square feet per person is undoubtedly low for a furniture store even after the 50% adjustment. The 72 people-per-acre estimate using the parking requirement methodology is probably closer to being realistic. As part of the general plan consistency process, ALUCs and local jurisdictions should decide which method or combination of methods is to be used in reviewing development proposals.

Source: Caltrans, California Airport Land Use Planning Handbook, January 2002.

**TABLE D-1  
OCCUPANCY LEVELS – CALIFORNIA BUILDING CODE**

Use	Minimum Square Feet per Occupant
1. Aircraft Hangars (no repair)	500
2. Auction Rooms	7
3. Assembly Areas, Concentrated Use Without Fixed Seats (auditoriums, churches, dance floors, lobby accessory to assembly occupancy, lodge rooms, reviewing stands, stadiums, waiting areas)	7
4. Assembly Areas, Less Concentrated Use (conference rooms, dining rooms, drinking establishments, exhibit rooms, gymnasiums, lounges, stages)	15
Gaming	11
5. Bowling Alley (assume no occupant load for bowling lanes)	4
6. Children's Homes and Homes for the Aged	80
7. Classrooms	20
8. Congregate Residences	200
9. Courtrooms	40
10. Dormitories	50
11. Dwellings	300
12. Exercising Rooms	50
13. Garage, Parking	200
14. Health-Care Facilities	80
Sleeping Rooms	120
Treatment Rooms	240
15. Hotels and Apartments	200
16. Kitchen - Commercial	200
17. Library Reading Room	50
Stack Areas	100
18. Locker Rooms	50
19. Malls	Varies
20. Manufacturing Areas	200
21. Mechanical Equipment Room	300
22. Nurseries for Children (Daycare)	35
23. Offices	100
24. School Shops and Vocational Rooms	50
25. Skating Rinks	50 on the skating area; 15 on the deck
26. Storage and Stock Rooms	300
27. Stores - Retail Sales Rooms	
Basements and Ground Floors	30
Upper Floors	60
28. Swimming Pools	50 for the pool area; 15 on the deck
29. Warehouses	500
30. All Others	100

Source: *California Building Code* (2001), Table 10-A.

**TABLE D-2  
OCCUPANCY TYPES – CALIFORNIA BUILDING CODE**

Group and Division	CBC Section	Description of Occupancy
A-1	303.1.1	A building or portion of a building having an assembly room with an occupant load of 1,000 or more and a legitimate stage.
A-2		A building or portion of a building having an assembly room with an occupant load of less than 1,000 and a legitimate stage.
A-2.1		A building or portion of a building having an assembly room with an occupant load of 300 or more without a legitimate stage, including such buildings used for educational purposes and not classed as a Group E or Group B Occupancy.
A-3		A building or portion of a building having an assembly room with an occupant load of less than 300 without a legitimate stage, including such buildings used for educational purposes and not classed as a Group E or Group B Occupancy.
A-4		Stadiums, reviewing stands and amusement park structures not included within other Group A Occupancies.
B	304.1	A building or structure, or a portion thereof, for office, professional, or service-type transactions, including storage of records and accounts; eating establishments and drinking establishments with an occupant load of less than 50.
E-1	305.1	Any building used for educational purposes through the 12th grade by 50 or more persons for more than 12 hours per week or four hours in any one day.
E-2		Any building used for educational purposes through the 12th grade by less than 50 persons for more than 12 hours per week or four hours in any one day.
E-3		Any building or portion thereof used for day-care purposes for more than six persons.
F-1	306.1	Moderate-hazard factory and industrial occupancies include factory and industrial uses not classified in as Group F, Division 2 Occupancies.
F-2		Low-hazard factory and industrial occupancies include facilities producing noncombustible or nonexplosive materials that during finishing, packing or processing do not involve a significant fire hazard.
H-1	307.1	Occupancies with a quantity of material in the building in excess of those listed in Table 3-D that present a high explosion hazard as listed in Section 307.1.1.
H-2		Occupancies with a quantity of material in the building in excess of those listed in Table 3-D that present a moderate explosion hazard as listed in Section 307.1.1.
H-3		Occupancies with a quantity of material in the building in excess of those listed in Table 3-D that present a high fire or physical hazard as listed in Section 307.1.1.
H-4		Repair garages not classified as Group S, Division 3 Occupancies.
H-5		Aircraft repair hangars not classified as Group S, Division 5 Occupancies and heliports.
H-6	307.1 and 307.11	Semiconductor fabrication facilities and comparable research and development areas when the facilities in which the hazardous production materials are used, and the aggregate quantity of the material is in excess of those listed in Table 3-D or 3-E.
H-7	307.1	Occupancies having quantities of materials in excess of those listed in Table 3-E that are health hazards as listed in Section 307.1.1.
I-1.1	308.1	Nurseries for the full-time care of children under the age of six (each accommodating more than five children), hospitals, sanitariums, nursing homes with nonambulatory patients and similar buildings (each accommodating more than 5 patients [for SFM] six patients or children).
I-1.2		Health-care centers for ambulatory patients receiving outpatient medical care which may render the patient incapable of unassisted self-preservation (each tenant space accommodating more than five such patients).
I-2		Nursing homes for ambulatory patients, homes for children six years of age or older (each accommodating more than five persons [for SMF] six patients or children).
I-3		Mental hospitals, mental sanitariums, jails, prisons, reformatories and buildings where personal liberties of inmates are similarly restrained.
M	309.1	A building or structure, or a portion thereof, for the display and sale of merchandise, and involving stocks of goods, wares or merchandise, incidental to such purposes and accessible to the public.
R-1	310.1	Hotels and apartment houses, congregate residences (each accommodating more than 10 persons).
R-2.1		<i>Residential care facilities for the elderly (each accommodating more than six nonambulatory clients).</i>
R-2.2		<i>Residential care facilities for the elderly (each accommodating more than six ambulatory clients).</i>
R-2.1.1		<i>Residential care facilities for the elderly (each accommodating six or less nonambulatory clients).</i>
R-2.2.1		<i>Residential care facilities for the elderly (each accommodating six or less ambulatory clients).</i>
R-2.3		<i>Residential-based licensed facilities providing hospice care throughout, accommodating more than six bedridden clients.</i>
R-2.3.1		<i>Residential-based licensed facilities providing hospice care throughout, accommodating six or less bedridden clients.</i>
R-3		Dwellings, lodging houses, congregate residences (each accommodating 10 or fewer persons).
S-1	311.1	Moderate-hazard storage occupancies including buildings or portions of buildings used for storage of combustible materials not classified as Group S, Division 2 or Group H Occupancies.
S-2		Low-hazard storage occupancies including buildings or portions of buildings used for storage of noncombustible materials.
S-3		Repair garages where work is limited to exchange of parts and maintenance not requiring open flame or welding, and parking garages not classified as Group S, Division 4 Occupancies.
S-4		Open parking garages.
S-5		Aircraft hangars and helistops.
U-1	312.1	Private garages, carports, sheds and agricultural buildings.
U-2		Fences over 6 feet (1829 mm) high, tanks and towers.

Source: California Building Code (2001), Table 3-A