

- Do not mix operational patterns between interchanges, lane continuity, or interchange types.
 - Provide lane balance and basic number of lanes on the freeway.
 - Provide sufficient spacing between interchanges to allow proper signing distances to decision points.
4. **Fixed-Objects.** Because of traffic operations at interchanges, many fixed objects may be located within interchanges (e.g., signs at exit gores, bridge piers, rails). Avoid locating these objects near decision points, make them breakaway, or shield them with barriers or impact attenuators. Make any concrete footings flush with the ground line. See Chapter 38 for additional guidance on roadside safety.
 5. **Controlled Ramp Terminals.** The designer must ensure that ramp/crossroad intersections have sufficient capacity so that the queuing traffic at the crossroad intersection does not backup onto the freeway. Also, sufficient access control and intersection sight distance must be maintained along the crossroad to allow the ramp intersection to work properly.
 6. **Wrong-Way Maneuvers.** Provide channelized medians, islands, and adequate signing to minimize wrong-way possibilities. Avoid designs that may result in poor visibility, confusing ramp arrangements, or inadequate signing.
 7. **Weaving.** Areas of vehicular weaving may create a high demand on driver skills and attentiveness. Where practical, design interchanges without weaving areas by changing the sequence of ramps, increasing the spacing between ramps, or removing the weaving areas from the highway mainline by using collector-distributor roads.
 8. **Pedestrians and Bicyclists.** Use signing and lane markings to increase awareness of pedestrians and bicyclists. Signing, crosswalks, barriers, over and underpasses, bridge sidewalks, and other traffic control devices may be required to manage traffic movements and to control pedestrian and bicycle movements.

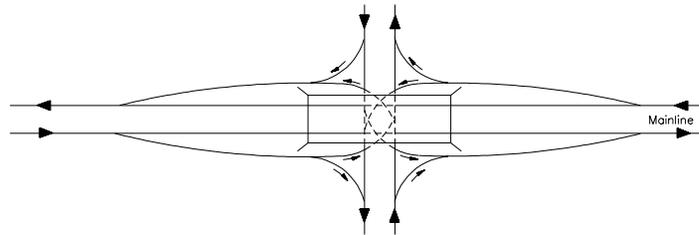
37-2.16 Distance Between Successive Freeway Ramp Terminals

Successive freeway ramp terminals may be placed relatively close to each other especially in urban areas. The distance between the terminals should provide for vehicular maneuvering, signing, and capacity. Figure 37-2D provides recommended guidelines for spacing distances of various freeway ramp terminals. The criteria in Figure 37-2D should be considered for the initial planning stages of interchange location. The final decision on the spacing between freeway ramp terminals must satisfy the level-of-service criteria. This will be determined by conducting a detailed capacity analysis using the *Highway Capacity Manual*. Where the distance between the tapers of successive entrance and exit terminals is less than 1500 ft (450 m), connect the two

Summary of Comments on Chapter_37_080624.pdf

Page: 6

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and accommodate



SINGLE-POINT URBAN DIAMOND INTERCHANGE
Figure 37-3H

- At the intersection of the ramps with the crossroad, the design typically includes flatter curves for turning radii which allows left turns to be completed at higher speeds.

Disadvantages

- Special pavement markings and a centrally located diamond-shaped island are required to guide the left-turning drivers through the intersection.
- There is a significantly wider pavement area for pedestrians to cross and may create greater delays in traffic when compared to the conventional diamond.
- Because of wide pavement areas, it requires longer signal clearance times.
- It has a higher cost than the conventional or compressed diamond because of the need for a long, single-span structure and the need for retaining walls or reinforced earth walls along the mainline.
- In the case of the mainline over a crossroad, lighting is required under the structure.

37-3.05(b) Design Considerations

The interrelationship of the design elements is extremely important in the design of single-point diamond interchanges (SPUI). Therefore, every effort should be made to use the desirable values for all design features of the interchange. See NCHRP 345 *Single-Point Urban Interchange Design and Operational Analysis* for complete design details. Figures 37-3I and 37-3J illustrate the typical layout for a SPUI. In addition, consider the following:

37-3(13)

allow an interchange to operate at a better level of service than is possible with loops. Figures 37-3W and 37-3X illustrate common directional and semi-directional ramps and/or roadways. Left-hand exits and entrances should be avoided.

Directional or semi-directional interchanges are most often provided in urban or suburban areas at freeway-to-freeway or freeway-to-arterial intersections. In rural areas, there is generally an insufficient traffic volume to justify the use of directional or semi-directional ramps in all quadrants. A directional interchange provides the highest possible capacity and level of service, but it is often costly to construct due to the number of structures required and amount of embankment.

No uniform design procedures can be established for directional or semi-directional ramps at interchanges due to the great variety of configurations. Loop ramps and weaving sections, where used, are designed as discussed in Sections 37-3.06 and 37-3.07. Because motorists perceive that higher operating speeds are possible on directional and semi-directional roadways, the alignment of these facilities should be as free flowing as practical.

37-3.10 Selection

Typically, several interchange types will be evaluated for potential application considering the following:

- compatibility with the highway system and functional classification of the intersecting highway;
- route continuity and uniformity with adjacent interchanges;
- level of service for each interchange element (e.g., freeway ramp terminal, ramp proper, ramp/crossroad terminal);
- operational and safety considerations (e.g., signing);
- availability of access control along the crossroad;
- road-user impacts (e.g., travel distance and time, convenience, comfort);
- driver expectancy;
- topography and geometric design;
- right-of-way impacts and availability, construction and maintenance costs, and potential for stage construction;
- accommodation of pedestrians and bicyclists on crossroad;