Access Connections on Opposite Sides of a Roadway

A Technical Memorandum

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ACCESS CONNECTIONS ON OPPOSITE SIDES OF A ROADWAY

When two access connections are to be located on opposite sides of a roadway, a common practice is to align them directly opposite one another. This practice is appropriate in some cases. However, aligning driveways on opposite sides of major undivided roadways or on opposite sides of a divided highway with a narrow median – especially high volume, high speed roadways, results in serious operational and safety problems.

This technical memorandum addresses these problems and identifies where the practice of aligning access connections directly opposite one another may or may not be appropriate. It also includes examples where a change in alignment was made or crossing maneuvers were eliminated.

INTRODUCTION

Some state DOT's regulations and many local government ordinances require access connection on opposite sides of a roadway be aligned directly opposite one another. Local government subdivision regulations commonly define 'jog' and prohibit jogs in subdivision design. A 'jog' occurs when crossing from an access connection on one side of a road to a connection or the other side is one continuous movement instead of a series of two successive right-turns. (See Exhibit 1.)

The roadway centerline separation is what actually results in a right-turn followed by a left-turn, or a left-turn followed by a right-turn, instead of a 'jog' maneuver. Most ordinances define a jog as when the rear right-of-way lines are separated by less than 125 ft. (see Exhibit 2). The 125 ft. separation results from a minimum centerline separation of 175 ft. and a 50 ft. right-of-way. The near right-of-way criteria is used in the regulations because subdivision plats are a description of property and show property lines – those of the parcel being subdivided and those of the lots (parcels) being created by the subdivision. If a 175 ft. centerline separation is sufficient to avoid a jog maneuver, subdivision regulations might define a 'jog" as when the near right-of-way lines are separated by less than 115 ft.

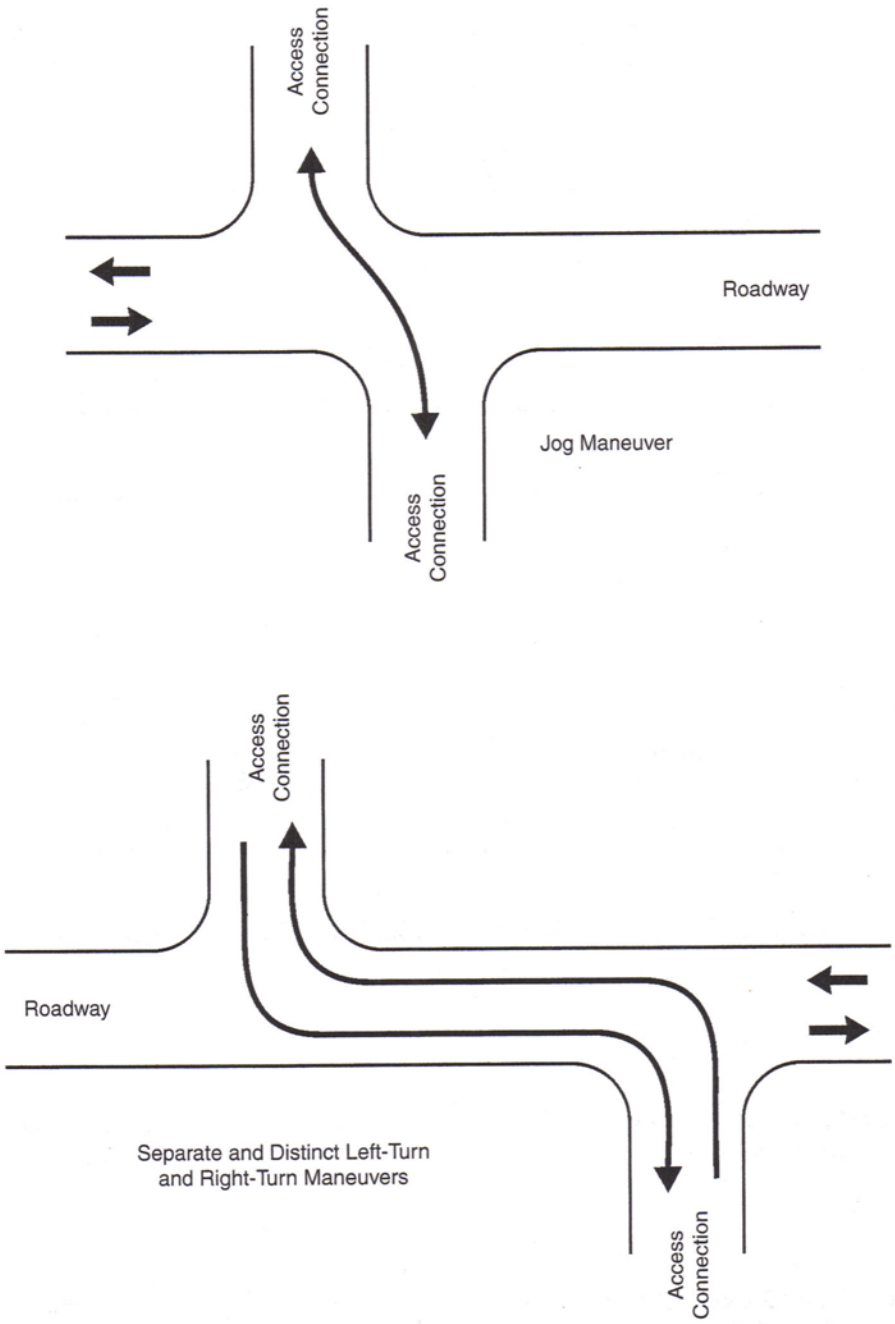
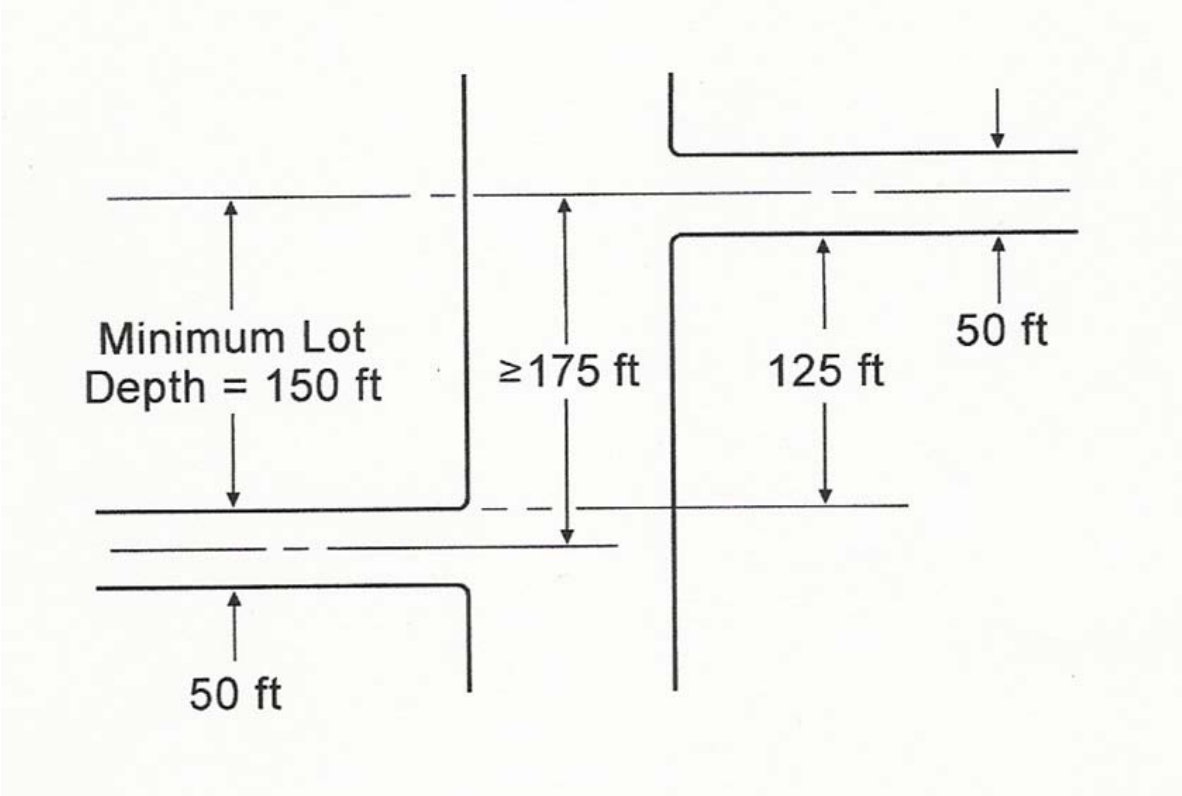


Exhibit 1: Schematic of a Job Maneuver and Separate Left turns/Right turns.

Exhibit 2: Spacing Required to Avoid a "Jog" Intersection



The separation distance in subdivision regulations has been used as the separation of access connections, public roadways as well as private driveways, on opposite sides of a major roadway. This likely occurred because the individuals: 1) did not understand the rationale for the separation distance specified in the subdivision ordinance, and 2) did not appreciate the difference between locating two local streets on opposite sides of a residential collectors and access connections on opposite sides of a high volume major roadway.

RATIONALE FOR PERMITTING OR PROHIBITING CROSSING MOVEMENTS

The logic for placing access connections directly across from each other is that crossing maneuvers can be made directly from one connection to the other. And, left-turn-in maneuvers from opposing directions do not involve a conflict, nor do left-turns out from the opposing access connections. This logic is rational so long as traffic volumes are low such that the opportunities to make a crossing maneuver are many times the number of crossing maneuvers.

At moderate to high volumes the opportunity to make a crossing maneuver is very limited. The Minnesota DOT (Minn/DOT) recognized this and evaluated the crossing opportunities. The Minn/DOT analysis used **total conflicting volume** – not just main road volume. For example, total conflicting volume for left-turns from an access connection consists of both through movements on the major roadway plus the crossing movements from an opposing access connection. Right-turns from an opposing access connection will also contribute to conflicting volume on a 2-lane roadway. While right-turns from an opposing connection may not be

considered as conflicting volume on a 4-lane roadway, drivers making the left-turn tend to yield to the opposing right-turns.

The MinnDOT analysis indicates that on a 2-lane roadway, very few crossing maneuvers, or left-turns from an access connection, can be made with low risk when the conflicting volume exceeds about 1,000 vph. At a crossing, or crossing plus left-turn, volume of 50 vph, the average delay is about 30 seconds when the main-roadway through volume is 1000 vph. Thus, a major roadway is not able to accommodate minor roadway or access connection movements without long delays, even at low volumes. Research has shown that drivers accept increasingly shorter gaps, and make unsafe maneuvers, as delay increases.

The analyses for 4-lane roadways with a narrow median (passenger cars must cross both traffic streams in one maneuver) differs from that with a wide median (a driver of a passenger vehicle can take refuge in the median and thus complete the crossing in two stages). The MinnDOT analysis used the HCM procedures using the critical gap.

The critical gap is defined as the gap, in seconds, that is rejected as often as accepted. Or, 50 percent of drivers reject gaps that are shorter and 50 percent accept gaps that are longer.

Accepted practice is that designs should accommodate most drivers. Additionally, it is increasingly recognized that roadway design needs to consider elderly drivers. Research demonstrates that elderly drivers require longer gaps [1]. A gap that considers elderly drivers or that is accepted by most drivers (say 85% of drivers) is much longer than the critical gap. Hence, the total conflicting volume (or conversely, the cross-road volume) would be considerably lower than in the graphs developed for MinnDOT.

Spacing Standards

A centerline-to-centerline offset spacing of 175 feet as illustrated in Exhibit 3 is commonly considered to be adequate for low volume local roadways (ADT # 250) intersecting a moderate volume collector (ADT . 3000). Observation suggests that an offset spacing of 1320 ft. appears to be adequate where a right turn is made from a low volume roadway to a high speed, high volume major highway followed by a left turn from the major highway to another low volume roadway.

Exhibit 3: Minimum Offset for Access Connections on Opposite Sides of a Roadway

Speed (mph)	Offset[(1)] (feet)
# 30	∃175
35	330
40	660
50	990
∃55	1320

[(1)]Measured centerline-to-centerline of access connections on opposite sides of a roadway

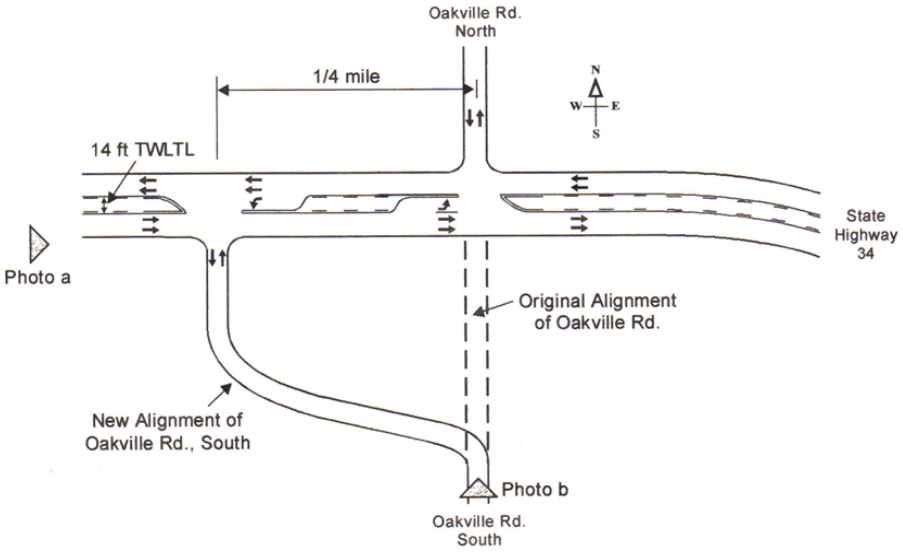
Source: Transportation and Land Development, Table 6-1

CORRECTIVE ACTIONS

Access connections on opposite sides of a roadway will function safely when roadway volumes and crossing volumes are low. However, operational and safety problems develop when traffic volumes increase and corrective action is necessary. Where development of abutting property has not yet occurred, one of the legs of the minor roadway might be relocated. Exhibit 4 illustrates such an application. One of the minor road legs of a 4-way intersection was relocated so as to create two offset 3-way intersections.

A right-turn followed by a left-turn can accommodate a sizable volume without signalization. And, if the left-turn needs to be signalized, it can be done without interfering with traffic progression on the major roadway.

A left-turn onto a major roadway followed by a right-turn from the major roadway would require signalization of the 3-way intersection at which left-turns are made onto the major roadway. This could interfere with traffic progression unless the 3-way intersection was located at, or close to, the adopted uniform traffic signal interval. Signalization of an isolated intersection on a high speed, high volume roadway in an undeveloped area as in this example would create rear-end collisions.



A:

Schematic Illustration of the Relocated Minor Roadway

B: Signing in Advance of the Pair of 3-way Intersections

Commentary: Crashes involving a 4-way intersection on Oregon State Highway 84 in an undeveloped area were a serious a problem. Crossing two lanes of traffic approaching from one direction, the 14 ft. wide continuous two-way left-turn lane and then the two lanes of traffic approaching from the other direction had to be made in a single movement. Simultaneous gaps in the two traffic stream provided insufficient opportunities even for a very small crossing volume.

Exhibit 4: Example of Relocation of a Minor Roadway to Change a 4-Way Intersection into Two Offset 3-Way Intersections

Other solutions such as a median barrier and directional median openings will depend upon whether the roadway is undivided, has a continuous two-way left-turn lane, or has a median, and, where there is a median, the median width.

2-lane or 4-lane undivided

- Install a barrier of flexible pylons extending several hundred feet in both directions either side of the access connections. This solution is applicable where the access connections are directly opposite or where they are offset and the offset distance is inadequate.

Continuous two-way left-turn lane (TWLT)

- Replace the TWLTL with a raised landscaped median to restrict movements to right-in/right-out only

- Install a raised landscaped median with a directional median opening (allowing left-turns from the public roadway but prohibiting crossing and left-turns from the access connection on onto the roadway). Where the TWLTL width is 14 ft. or more, the directional opening may be designed for left-turns from both directions on the roadway. Where the TWLTL is less than 14 ft., the directional opening should be designed for left-turns from one direction only. Consideration as to the choice as to which connection will have left-turns in, and which will not, include: a) alternative access (the directional median opening given to the property not having alternative access, or the less extensive alternative), and b) traffic generation (the directional opening going to the property generating the most traffic).

Narrow median width #12 ft.

- Close the opening

Narrow median, width 12 to 14 ft.

- Close the median opening
- Replace a full median opening with a directional opening for left-turns from one direction only

Narrow median, width 14 to 18 ft.

- Replace a full median opening with a directional opening for left-turns from one direction
- Replace a full median opening with a directional opening for left-turns from both directions

Wide Medians, width ∃18 ft.

- Replace a full median opening with a directional opening for left-turns from both directions

Examples

The following are examples of treatments that were implemented to mitigate safety or operational problems that occurred where access connections were located on opposite sides of a major roadway.

Commentary: The median is of sufficient width to provide refuge for a passenger vehicle but not a larger vehicle. Closure of the opening changed a 4-way intersection to two T-intersections with right-in/right-out movements only.

Location: US 33 southeast of Columbus, Ohio

Exhibit 5: Example of a Median Opening Closure on a Major Rural Highway

Commentary: Installation of a nontraversable median on US 36 in Boulder, Colorado, eliminated crossing and left-turn maneuvers. The landscaped median clearly communicates that the two opposing driveway are right-in/right-out only. The median landscaping provides aesthetic quality without obstructing view of the opposite side and confuse drivers into thinking the roadway on this side of the median is a 2-way street.

Exhibit 6: Example of a 4-Way Intersection Created by the Intersection of Two Opposing Driveways and a Major Urban Roadway

Commentary: A nontraversable median on a major urban arterial roadway converted a 4-way intersection with a minor street to opposing 3-way intersections with right-turns only. The tree line, buildings and street lights suggest continuity of the minor street. The median landscaping does not adequately communicate the change.

Exhibit 7: Example of a 4-way Intersection of an Urban Arterial and a Minor Urban Street into Opposing 3-way Intersections

Commentary: A 4-way Intersection of a major urban arterial was created when a driveway was located directly opposite a collector street. A barrier eliminates crossings and left-turns onto the urban arterial.

Location: Santa Rita Blvd., Pleasanton, California

Exhibit 8: Example of the Conversion of a Full Median Opening into a Directional Opening

Suggested Practices

High traffic volumes are a characteristic of arterial roadways and major collectors. Hence, access connections should not be permitted directly opposite one another on undivided roadways or opposite a median opening that is not signalized or is not located so as to be suitable for signalization at some future date. This issue should be addressed in planning and management of the public roadway system as well as in the management and permitting of access to highways and streets.

The Colorado Code, for example, addresses this issue by requiring that intersections on major roadways be located at ½-mile intervals. Corridor planning, site plan review and approval, and driveway permitting can be used to avoid safety and operational problems resulting from development on opposite sides of a roadway.

There are substantial operational advantages of left-turns from a major roadway to an access connection (left-in). Compared to left-turns on to a major roadway from an access connection (either a minor public roadway or a private driveway left-out). These include the following:

1) Higher capacity: Left-in movements conflict with a single traffic stream (opposing traffic) whereas left-out movements conflict with two traffic streams (vehicles approaching from both the left and the right). If there is an access connection on the opposite side of the road, left-out movements conflict with right-turns, left-turns and crossing movements from the opposing connection.

2) Where a median or isolated left-turn lane/bay is provided, left-in movements at location that does not conform to an adopted uniform traffic signal interval that can be signalized without disrupting traffic progression. Whereas signalization of a left-out at a location that does not conform to an adopted uniform signal spacing interval will interfere with efficient traffic progression.

Situations where a left-turn/u-turn between signalized intersections may be advantageous include:

1) The left-in/u-turn lane will alleviate problems at a downstream signalized intersection. The left-turn/u-turn lane can be signalized and the signal incorporated into a coordinated signal system so it will not conflict with efficient progression on the major roadway.

2) The u-turn will provide improved accessibility to and from businesses fronting on, and having right-in/right-out only access to the major roadway.

References

1. L. Staplin, K. Lococo, S. Byington, and D. Harkey, “Highway Design Handbook for Older Drivers and Pedestrians,” Report No. FHW-RD-01-103, Federal Highway Administration, U. S. Department of Transportation, October 2001.

2. V. G. Stover and F. J. Koepke, Transportation and Land Development, Institute of Transportation Engineers, 2002.

3. Access Management Manual, Transportation Research Board of the National Academies, 2003.