

CE 466 / 566 Highway Geometric Design Homework 2 Solutions

Problem 1

- (a) Arterials are primarily intended to serve mobility goals, and to provide access to collectors and major traffic generators. Principal arterials in some cases have very limited or controlled access. The lower level of access is intended to help accommodate higher traffic volumes at relatively high speeds. They serve longer-distance trips, including some through-traffic (for principal arterials) and longer-distance trips within the urban area. A short discussion may be found on pages 10-12 in the Green Book, and again at the beginning of Chapter 7 (page 447 and following).
- (b) In the City of Tucson's Major Roads and Streets Plan, they define an arterial as a street carrying volumes over 12,000 vehicles per day, and are intended to serve major trip generators, cross-town trips, and connections to freeways and to other arterials. The Plan also notes that they are generally spaced one mile apart.

Generally, the function of an arterial is consistent between the City's Plan and the Green Book, except that the City is more specific about design volumes. The City, however, adds more specific information on the average daily traffic and on the spacing of intersections. However, the Green book does make some mention of spacing of arterials of around 1 mile, depending on whether it is a principal or minor arterial, on pages 11-12.

The City's Plan also includes a notion of a "Gateway Route", as described on pages 5-6 as being in an important regional corridor, with significant traffic generators for visitors, and volumes over 30,000 veh/day. This functional classification is a bit different than the typical "principal arterial" in the Green Book, in that the City routes are designed toward the transportation needs of Tucson visitors. So, this is a slightly different animal in terms of the roadway function.

- (c) For comparison, one might use the City's 4- and 5-lane cross-sections (Figures 3 and 4 in the Plan) and the corresponding comparable designs for Pima County (Figure 2-9 and Figure 2-7, respectively). [The larger arterial designs (6-lane cross-sections) are similar to the 4- and 5-lane cross-sections, except with an extra 12-ft middle lane added.]

For the 4-lane cross-sections, the designs are similar, but there are subtle differences. The County uses a standard 24' median (20' minimum) for its designs, while the city uses a more modest 20' median as its standard. With the median, the county adds an extra foot to the inner lane (13', versus 12' for the city) as "shy distance" from the median. The county also includes a 6' shoulder area, while the city includes an extra 5' (or 17' total) in the inner lane as a shoulder and bicycle area.

The slightly higher "shy distances" on the left and right sides (an extra foot wider than the City) suggest that the Pima County design may give drivers greater confidence, and hence may drive a bit faster (all other things being equal).

The designs with a two-way left-turn lane (TWLTL) are very similar, with a 12' TWLTL and 12' lanes. The City adds an extra 5' to the outside lane for a shoulder and for bicycling needs, while the county has a 6' shoulder. These designs are very similar. Whether or not the extra foot in the shoulder of Pima County's design could be an interesting topic of debate.

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Problem 2

- (a) Probably the largest (constraining) vehicle one might see on Grant would be a transit bus (CITY-BUS) and a WB-50. These vehicles certainly would be seen regularly on Grant, with the combination of bus routes and major retail establishments in the corridor.

In addition, other users might also control part of the design along Grant. For sidewalks and crosswalks, pedestrians will control the design; for bike lanes, bicycle users will control the design. Also, there are some constraints associated with the use of passenger cars, particularly on areas that might have frontage roads: the lane widths and on-street parking options would be governed by the size of the passenger car.

- (b) and (c):

Specific elements one might mention here include:

- Width of crosswalks (minimum 8 ft)
- Width of sidewalks (8 ft in current cross-sections)
- Bike lane widths (6 ft in current cross-sections)
- Toucan crossings

- Bus pull-outs

- Parking lane (7 ft in current cross-sections, which seems a bit tight)
- Access lanes on frontage roads (10 ft in current cross-sections, not likely to accommodate larger vehicles very well)

- 11-ft travel lanes (smaller than Pima County and City of Tucson design guidelines)
- 17-ft median (lower than Pima County and City of Tucson design guidelines)
- Length of left-turn bays
- Cut-outs for WB-50's to make U-turns at the indirect lefts
- Turn radii at curbs and medians