

## **CE 466 Highway Geometric Design Homework 3 Solutions**

### Problem 1

- (a) The current functional classification of Houghton is as an “Urban Collector” (p. 3). Alternatives considered in the study include a “Major Urban Arterial”, a freeway, a parkway, and a rural highway (p. 14). For the interim roadway (up to 2030), the recommendation is to classify Houghton as a Major Urban Arterial (pp. 18-22), with the final build-out (after 2030) of a combination of Major Urban Arterial and Urban Parkway (p. 23).
- (b) There is a design year of 2030 for the interim facility with build-out after 2030. This seems about 25 years in the future, when much of the land use in this area has been built out. From this perspective, the 2030 design year is probably reasonable.
- (c) Specific traffic analyses were conducted for the major intersections in the corridor; these are summarized using the level of service for each approach to each intersection in Tables 11 and 12 (pp. 16-17). Note that these tables only give the level of service; they actually do not provide any specific values of average delay, which is the basis for the level of service measurement. You can also see that the level of service ranges from LOS A to D for one alternative (Alternative 2, Table 11) and from LOS A to LOS E for another alternative (Alternative 3, Table 12).
- (d) Design speeds for urban arterials were 55 mph, with a design speed for the freeway alternatives at 70 mph. In this case, one might argue that the operating speed will probably be dictated by signal timings. However, with 1-mile signal spacing at build-out, I would say that operating speeds are likely to be closer to the given design speed (55 mph) in this case.

### Problem 2

- (a) Specific “existing” route conditions include (pp. 3-11):
  - The current roadway functional classification
  - The current roadway widths, lanes, turn lanes, median treatments, and other roadside features
  - Elements in the horizontal and vertical alignment
  - Pavement types and condition
  - Existing right-of-way widths along the corridor, and associated jurisdictions
  - Traffic conditions at major intersections (16 in the corridor)
  - Current traffic volumes on Houghton roadway segments and cross-streets
  - Simulation-based LOS for major intersections
  - Warrant analyses for traffic signals at current unsignalized intersections
  - Crash data for 1999 to 2001
  - Existing land uses / property development
  - Drainage and hydrology (cross-street drainage and watersheds)
  - Soil conditions
  - Topography
  - Existing utilities (electric, wastewater, drinking water, natural gas, communications, railroad)
  - Existing (bridge) structures
  - Current noise issues and mitigation strategies
  - Air quality hot spots and mitigation strategies
  - Hazardous materials sites
  - Recreational facilities, “biological resources” (animal and plant habitat)
  - Scenic route designation
  - Washes
  - Historical and archeological sites

(b) Criteria for evaluation of alternative alignments include (stolen verbatim from p. 11):

- Roadway geometry
- Safety considerations
- Community impacts
- Drainage requirements
- Traffic forecasts and associated impacts on roadway geometry
- Traffic operations considerations and capacities

(c) Using information on pp. 21-23, the environmental impacts by segment include:

Segment 1: Two major washes (Agua Caliente Wash and Tanque Verde Creek) must be crossed; this leads to the requirement for 401 and 404 permitting from the Army Corps of Engineers.

Segment 2: Two high-priority hazardous materials sites; major wash (Pantano Wash); access to Secrist Middle School and playground. The hazardous materials sites must be cleaned up before the new roadway can be built. The Pantano Wash may also require 401 and 404 permitting. Finally, the roadway's proximity to the school requires special access considerations.

Segment 3: Minor wash crossings; Southeast Regional Park. The preferred alignment does move further away from the park, reducing noise and air quality impacts. The wash crossings may require 401 and 404 permitting from the Army Corps of Engineers.

Segment 4: None.

(d) See above (and p. 10). The major issues include: (1) Begin the permitting process through the Army Corps of Engineers for any wash crossings that fall under their purview; (2) Conduct a survey for biological resources; (3) Conduct remediation of the high-priority hazardous materials sites; (4) Consider sound walls and access management to reduce noise impacts on adjacent properties.

### Problem 3

Access management has its own section in this document (pp. 17-18). The major strategy is to maintain Houghton as an urban major arterial by limiting access. This is a dilemma because this may require "retro-fit" (i.e., removing access for some private drive that already has it). Such actions are indeed controversial – just look at what they are trying to do on Grant now, and how much business opposition that has generated.

Specific recommendations and guidelines for access management in this report include:

- Signalized intersections, spaced at 1-mile intervals
- Medians throughout
- Gradually remove available access to ½-mile intervals for public roads and private access at a minimum of 450 ft intervals.
- Consider right-in, right-out access (i.e., no left turns in or out).