Intersection Control

CTC-340

Hierarchy of Intersection control

- Level 1 – Rules of the Road
- Level 2 – Assign ROW using YIELD or STOP signs
- Level 3 – Traffic Signalization
  - Selection of Level depends on
    - Which & how many conflicts a driver should be able to perceive and avoid using judgment
      - Traffic controls needed where it is not reasonable for drivers to perceive and avoid a conflict

Hierarchy of Intersection control

- 2 factors affect driver's ability to avoid conflict
  - 1 – driver must be able to see a potential conflict and implement avoidance maneuver (sight distances & avoidance maneuvers)
  - 2 – volume levels that exist must present reasonable opportunities for a safe maneuver (assessment of demand intensity & complexity of potential conflicts)
  - F 16.1 rural farm road
    - Low volume -> low probability of conflict
    - No peds

Basic Rules of the Road

- Spelled out in state vehicle and traffic laws
  - Driver on left must yield to driver on right
  - Turning vehicles yield to thru traffic
  - Drivers must be able to see each other in time to assess potential conflict
  - F 16.2 Sight Triangle
    - Must be large enough so that accidents do not occur

Sight Triangle

- 123, 147, 645 similar triangles
  - $b/(d_B - a) = (d_A - b)/a$
  - $d_B = ad_A /(d_A - b)$
  - Triangle is dynamic
    - It changes as cars approach intersection
    - According to AASHTO both drivers should be able to stop before collision point when they first see each other
    - d_A & d_B must be >= SSD

Sight Triangle

- d_S = 1.47St +S^2/(30(0.348+/-0.01G))
  - Analysis Steps
    - 1 Assume Vehicle A is located SSD from Collision Point (minor street vehicle) ($d_A = d_S$)
    - 2 Use Similar triangles to find d_B This becomes d_{BACT}
    - Find SSD for Vehicle B (d_{Bmin})
    - $d_{BACT} >= d_{Bmin}$
  - Can also look at case where Veh A must travel 18’ past collision point at same time Veh B is 12’ in front of Collision point

Sight Triangle

- $(d_A + 18)/1.47S_A = (d_B + 12)/1.47S_B$
- $d_B = (d_A + 18)S_A/S_B + 12$
- All 4 sight triangles must work to avoid Level 2 control

MUTCD

– Provides guidance and information in four categories – legal aspects
  - Standard – required, mandatory, or specifically prohibited (shall, shall not)
  - Guidance – recommended not mandatory. Deviations allowed if engineering judgment or a study indicates that a deviation is appropriate (should, should not)
  - Option – permissive condition (may. may not)
  - Support – purely informational statement (does not contain shall, should or may)

Level 2 – STOP & YIELD control

- MUTCD provides some guidance
  - Not specific – requires judgment
- TWSC – stop signs on minor streets
  - T 16.1 Warrants
  - MUTCD gives more explicit guidance in dealing with inappropriate use of stop signs
    - Shall not be placed at intersections with traffic signal
    - Shall not be portable or temporary

Level 2 – STOP & YIELD control

- Should not be used for speed control

– AASHTO provides sight distance criteria

- Distance from driver's eye to front of car = 8'
- Distance from front of car to curb line = 10'
- Distance from curb line to center of right most travel lane approaching from the left or Distance from curb line to center of left most travel lane approaching from the right
- $d_{A\text{-}STOP} = 10 + d_{cl}$
- d_{cl} = distance to curb line

Level 2 – STOP & YIELD control

- Required SSD for Vehicle B on main street
- $d_{Bmin} = 1.47 S_{maj} * t_g$
- t_g = average gap accepted by minor street driver
  - Critical Gap = smallest gap accepted by a driver on the minor street to complete a turning movement
  - Varies by turning movement type
  - RT ~ 4.5s, LT~ 7.2s
- If SSD not met then speed limit is reduced

Level 2 – STOP & YIELD control

- Yield Control
  - Requires minor street to slow and cede ROW to vehicles on the major street
  - MUTCD warrants are only options T16.2
- AWSC
  - All streets stop controlled
  - T 16.3

Level 3 – Traffic Signals

- Alternates ROW to specific approaches
- Reduces # of potential conflicts
- MUTCD advantages to signals pg 453
- MUTCD disadvantages to signals pg 454
  - Warrants – MUTCD requires that an extensive study be conducted to determine need for signal
  - Satisfaction of a warrant shall not in itself require installation
  - Signal should not be implemented if none of the warrants are met

Level 3 – Traffic Signals

– Warrants pg 454 - 463