Bicycle Safety Feasibility Study

Study Components

- Safety Analysis
- Network Analysis Tool

Safety Analysis

- Crash Reports
  - Fatal: Indiana ’04-’05
  - Injury & PDO: Tippecanoe County ’04-’05
  - Some Reports Incomplete
- Bicycle Volumes Unavailable

Crash Reports

- 23 Fatal Crashes (Indiana ’04 -’05)
  - 14 Fatalities Not at Intersections
  - Common Causes Cited
    - Poor Lighting (10)
    - Erratic/Unsafe Cyclist Behavior (8)
    - Hit and Run Incidents (3)

Crash Reports

- 38 Injury & PDO (Tippecanoe County)
  - Most Crashes at Intersections
  - Common Causes Cited
    - Illegal Cycling on Sidewalks (3)
    - Cyclist Traveling Wrong Way (3)
    - Failure to Yield to Oncoming Bicycle Traffic (4)
    - Cyclists Ignoring Traffic Control Devices (5)

Crash Reports

- Potential Methods to Improve Safety
  - Improve Lighting in High Volume Areas
  - Enforce Sidewalk Ordinances
  - Change Motorist Perception
    - Shared Use Lane Markings
    - Colored Bike Lanes

Measuring Safety

- Available Measures
  - Bicycle Compatibility Index (BCI)
  - Bicycle Level of Service (BLOS)
- Predicting User Perceptions Using Physical Properties
- No Bicycle Volume Factor

Bicycle Level of Service

(Sprinkle Consulting Engineers, Inc.)

- Prescribed Route Cycled by 150 Riders
- Riders Quantified Segment Comfort
- Linear Regression Fit to Factors

Bicycle Level of Service

$$BLOS = a_1 \ln(Vol_{15}/L) + a_2 \ln[SPD_p(1+HV\%)] + a_3 \ln(COM15*NCA) + a_4 (PC_5)^{-2} + a_5 (We)^2 + C$$

- *BLOS* = perceived hazard of the shared-roadway environment
- directional traffic volume in 15-min time period,
- number of through lanes
- posted speed limit
- *%* heavy vehicles
- frequency per mile of uncontrolled vehicular access (e.g., driveways and on-street parking spaces)
- trip generation intensity of the land use adjoining the road segment
- pavement surface condition
- average effective width of outside through lane

Bicycle Level of Service

- Requires Detailed Information
  - Trip Generation
  - Complicated Access/Parking Variable
  - Pavement Conditions
- Not Practical for Network-Wide Use

Bicycle Compatibility Index

(UNC Highway Safety Research Center)

- 202 Cyclists Viewed Videos of 67 Locations
- Cyclists Gave Perceived Comfort Level
- Linear Regression Fit of Factors

Bicycle Compatibility Index

$$BCI = C - a_1BL - a_2*BLW - a_3CLW + a_4CLV + a_5OLV + a_6SPD + a_7PKG - a_8AREA + AF$$

- LB < BCI < UB
- Bicycle Lane or Paved Shoulder present?
- Width of Bicycle Lane or Paved Shoulder
- Curb Lane Width and Vehicle Volume
- Other Lane Vehicle Volume
- 85th Percentile Speed of Traffic
- Presence of a Parking Lane With More Than 30% Occupancy?
- Presence of Residential Roadside Development
- Adjustment Factors for Truck Volumes, Parking Turnover, Right Turn Volumes

Bicycle Compatibility Index

- Requires Simpler Inputs Than BLOS
- More Practical for Network-Wide Use

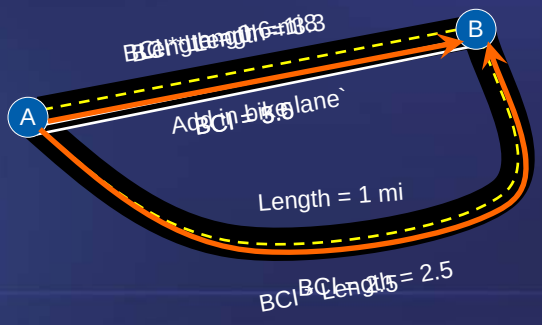
Network Analysis Tool

- Weighted Links
- Aggregate Links Method
- All-to-All Shortest Path Method

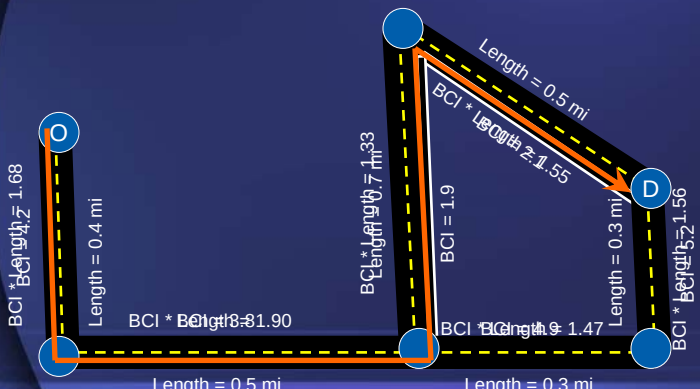
Link Weights

- Assumes Cyclist Makes Route Choice Based on Two Factors
  - Link Length
  - Perceived Safety (BCI)

Bicycle Route Choice



Bicycle Route Choice



Bicycle Level of Service

$$BLOS = a_1 \ln(Vol_{15}/L) + a_2 \ln[SPD_p(1+HV\%)] + a_3 \ln(COM15*NCA) + a_4(PC_5)^{-2} + a_5(We)^2 + C$$

- *BLOS* = perceived hazard of the shared-roadway environment,
- Vol_{15} = volume of directional traffic in 15-min time period,
- *L* = total number of through lanes,
- SPD_p = posted speed limit (a surrogate for average running speed),
- *HV* = percentage of heavy vehicles (as defined in the *Highway Capacity Manual*),
- *NCA* = effective frequency per mile of uncontrolled vehicular access (e.g., driveways and on-street parking spaces),
- *COM15* = trip generation intensity of the land use adjoining the road segment (stratified to a commercial trip generation of 15, multiplied by the percentage of the segment with adjoining commercial land development),
- PC_5 = FHWA's 5-point pavement surface condition rating, and
- W_e = average effective width of outside through lane ($W_e = W_t + W_l - W_d$, where W_t = total width of outside lane (and shoulder) pavement, W_l = width of paving between the outside lane stripe and the edge of pavement, and W_d = effective width (reduction) due to encroachments in the outside lane.)

Bicycle Compatibility Index

$$BCI = C - a_1 BL - a_2 * BLW - a_3 CLW + a_4 CLV + a_5 OLV + a_6 SPD + a_7 PKG - a_8 AREA + AF$$

- *BL* = Presence of a Bicycle Lane or Paved Shoulder
- *BLW* = Bicycle Lane or Paved Shoulder Width
- *CLW* = Curb Lane Width
- *CLV* = Curb Lane Volume
- *OLV* = Other Lane Volume
- *SPD* = 85th Percentile Speed of Traffic
- *PKG* = Presence of a Parking Lane With More Than 30% Occupancy
- *AREA* = Presence of Residential Roadside Development
- *AF* = $f_t + f_p + f_n$
- f_t = Adjustment Factor for Truck Volumes
- f_p = Adjustment Factor for Parking Turnover
- f_n = Adjustment Factor for Right Turn Volumes