Bicycle and Pedestrian Level of Service Measures

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Outline

- Why consider bike/peds in road designs? Why are measures needed?
- Bicycle Level of Service / Pedestrian Level of Service overviews, uses
- Policy possibilities
- Resources - including easy-to-use on-line calculator

Why should road designs accommodate bikes & peds?

- It's what people want:

- 53% want more fed $ on bike facilities, even if it means less gas tax for roads
- 50% support requiring roads to have bike lanes or paths, even if it means less space for cars and trucks
- Most bicycling takes place on roads, not separate trails.
- 52% bike trips for recreation, 43% to get to destinations.

- Context-sensitive design

Why should road designs accommodate bikes & peds?

- Arterials and collectors provide the only access, especially in newer, non-grid areas

Why should road designs accommodate bikes & peds?

- Encourage diversion of short trips, for health, environment, less congestion
- Provide for the many who don't drive for economic, age, other reasons

Why should road designs accommodate bikes & peds?

- Bikes/peds will be there to some extent anyway, so better to design for them

Bike/ped performance measures - why?

- “Accommodating bike/ped” a common goal, but very subjective
- Bicyclists’ needs especially tough to know for those lacking experience, training
- Other transportation goals (air quality, congestion) have performance measures
- Mainstream bike/ped planning

Bicycle Level of Service
Pedestrian Level of Service

- Both models developed by Sprinkle Consulting Inc., used throughout USA
- Research based on perception of comfort, safety for range of adults
- Both based on roadway corridor cross-sections and traffic conditions
- Numeric result, grade ranges “A” (best) to “F” (worst)

Bicycle Level of Service

- Measures on-road bicycling conditions, NOT separate trails!
- For mid-block cross-sections, not for intersections
- Applicable for teen and adult cyclists

BLOS input variables

- Motorized traffic: Volume, Speed, % Trucks, % Occupied Parking

- Roadway: # of Lanes, pavement condition, width of outside lane and extra pavement (shoulder/parking/bike lanes)

BLOS model

$$\text{Bicycle LOS} = 0.507 \ln(Vol_{15}/L) + 0.199\, SP_t\, (1+10.38HV)^2 + 7.066(1/PR_5)^2 - 0.005\, W_e{}^2 + 0.760$$

Vol_{15} = volume of directional traffic in 15 minute time period

L = total number of through lanes

SP_t = effective speed limit = $1.1199 \ln(SP_p\text{-}20) + 0.8103$, SP_p is posted speed

HV = percentage of heavy vehicles

PR_5 = FHWA's 5-point surface condition rating (5=best)

W_e = average effective width of outside through lane = $W_t + W_l - \Sigma W_r$

- W_t = total width of outside lane and shoulder/parking pavement
- W_l = width of paving from outside lane stripe to pavement edge
- ΣW_r = width reduction due to encroachments in outside lane

BLOS Levels

Level-of-Service	BLOS Score
A	≤ 1.5
B	>1.5 and ≤2.5
C	>2.5 and ≤3.5
D	>3.5 and ≤4.5
E	>4.5 and ≤5.5
F	>5.5

Sample street

- ADT = 12,000 vehicles/day
- Two 12’ lanes
- No paved shoulders, bike lanes, parking
- 40 mph speed limit
- PR_5 = 4 (good pavement)

- BLOS Score = 4.1 (D)

Lane Width and Striping

Outside lane width		With striping	
10	4.36 (D)		
12	4.14 (D)		
14	3.88 (D)	12 - 2	3.58 (D)
16	3.58 (D)	12 - 4	2.86 (C)
18	3.24 (C)	12 - 6	1.98 (B)

- Extra space benefits cyclists
- Striping particularly helpful

Lane Width and Striping

Pedestrian Level of Service

- Walkers' perception of comfort and safety
- Mid-block cross-sections, including any sidewalks and buffers

PLOS input variables

- Motorized traffic: Volume; Speed; % Occupied Parking
- Roadway: # of Lanes; width of outside lane; width of extra pavement (shoulder/parking/bike lanes)
- Sidewalk: Width; buffer width and type (e.g., tree spacing)

PLOS model

$$\text{Pedestrian LOS} = -1.227 \ln(W_{ol} + W_l + f_P \times \%OSP + f_b \times W_b + f_{SW} \times W_S) + 0.009 (Vol_{15}/L) + 0.0004\, SPD^2 + 6.046$$

W_{ol} = width of outside lane

W_l = width from outside lane stripe to pavement edge (shoulder, parking, bike lanes)

f_P = on-street parking effect coefficient

%OSP = percent of segment with on-street parking

f_b = buffer area barrier coefficient

W_b = buffer width (between edge of pavement and sidewalk)

f_{SW} = sidewalk presence coefficient

W_S = width of sidewalk

Vol_{15} = volume of directional traffic in 15 minute time period

L = total number of through lanes

SPD = average running speed of traffic

PLOS Levels

Level-of-Service	PLOS Score
A	≤ 1.5
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Sample cases

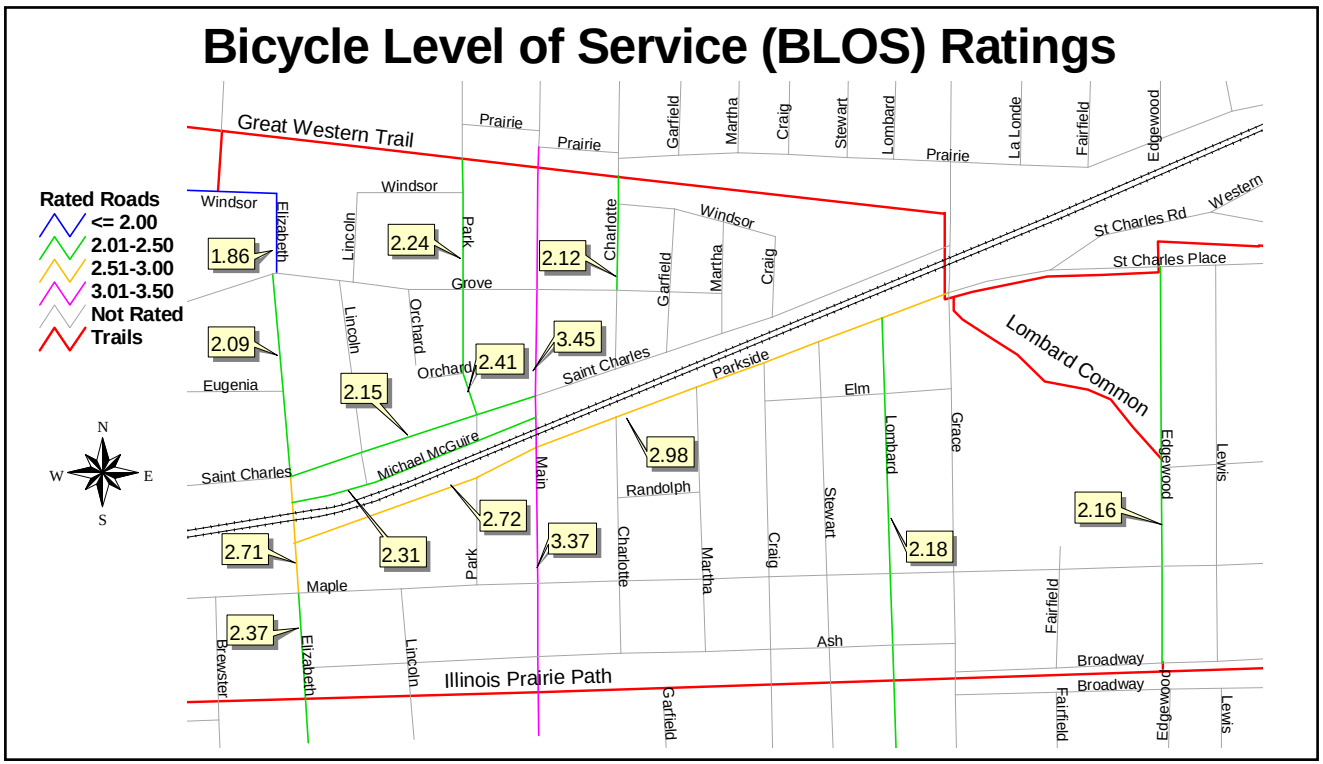
Sample cases

- ADT = 12,000 vehicles/day; Speed = 40 mph
- Two 12’ lanes; No paved shoulders, bike lanes, parking

- No sidewalk: **PLOS = 5.03 (E)**
- 5’ sidewalk, 6’ buffer, no trees: **PLOS = 3.53 (D+)**
- 5’ sidewalk, 20’ buffer, no trees: **PLOS = 3.17 (C)**
- 5’ sidewalk, 6’ buffer, trees every 40’: **PLOS = 3.16 (C)**

BLOS, PLOS Applications

- Pick routes for community bike network
- Identify “weak links” in bike or ped network

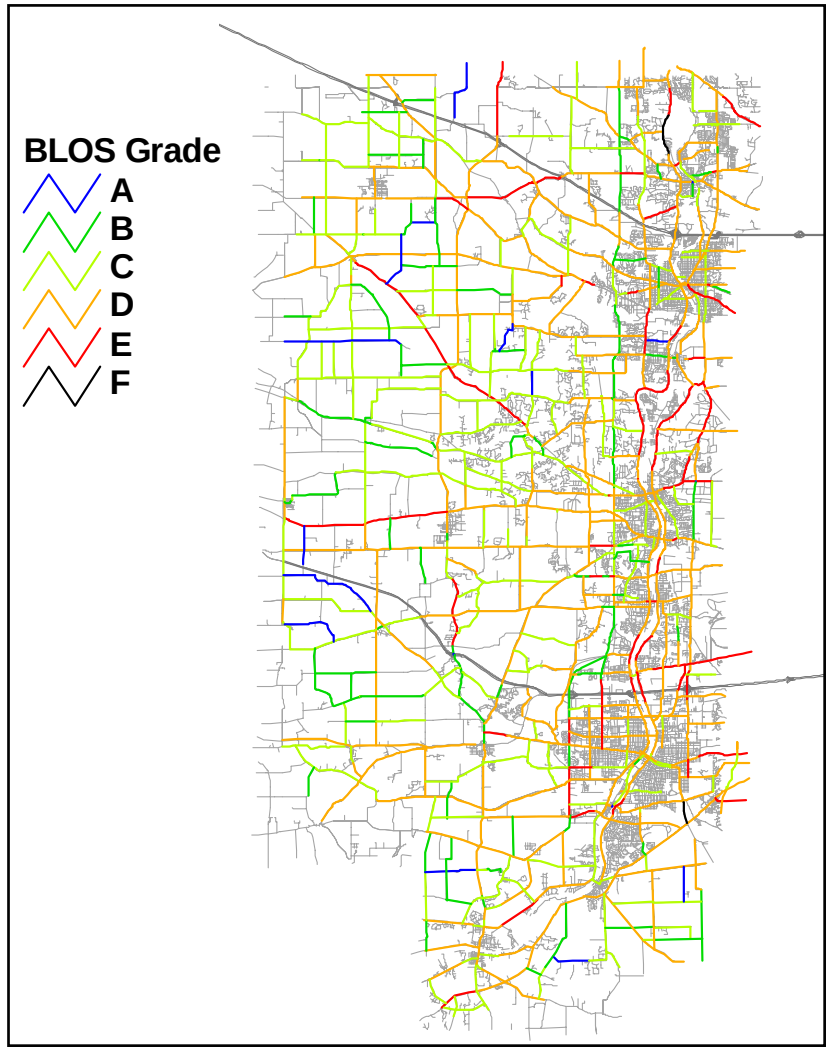


BLOS, PLOS Applications

- Prioritize sites needing improvement
- Evaluate alternate treatments during design - providing flexibility to engineers

BLOS, PLOS Applications

- Develop a suitability map to help with route selection



BLOS, PLOS as policy tools

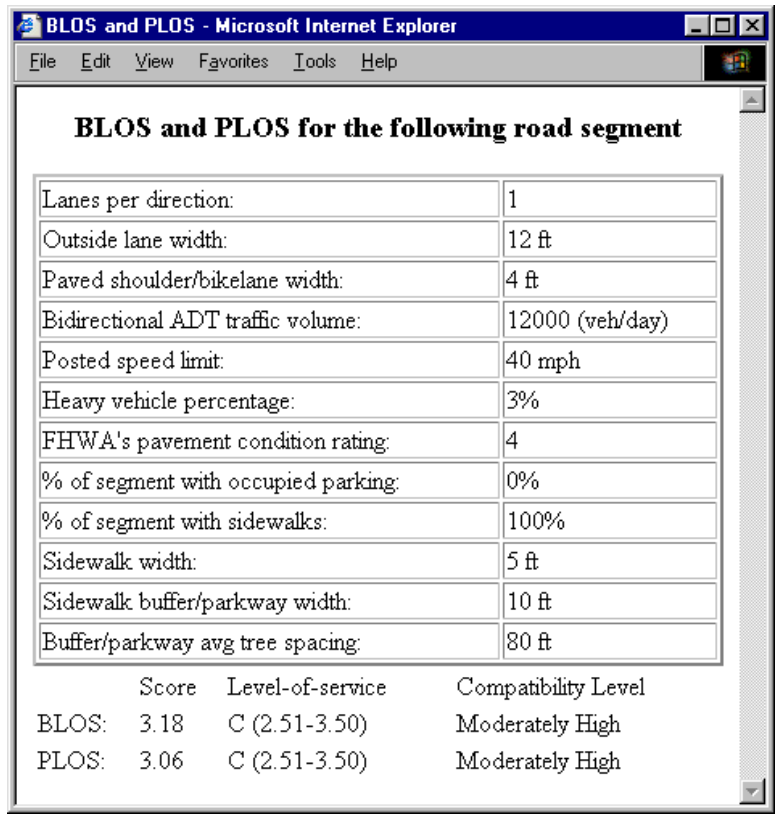
- Performance measures can be tied to goals and policies for all road projects
- Policies can range from simply reporting bike/ped impact up to target LOS levels

3 levels of increasing policy commitment

- 1) Raise awareness: calculate and report before-and-after BLOS and PLOS
- 2) Provide incentive: include measures in road project selection
- 3) Policy requirement: meet a certain BLOS/PLOS level

Calculate and report before-and-after scores

- Each project proposal includes BLOS and PLOS - report scores in TIP?
- Use simple on-line calculator form
- Raises awareness of project impact, easy to do



Use as incentive during road project selection

- In selection criteria or formulas, include BLOS and PLOS terms
- Credit (or discredit) for post-project scores, and/or before-to-after change
- Terms could be weighted by simple demand-side criteria or other analysis

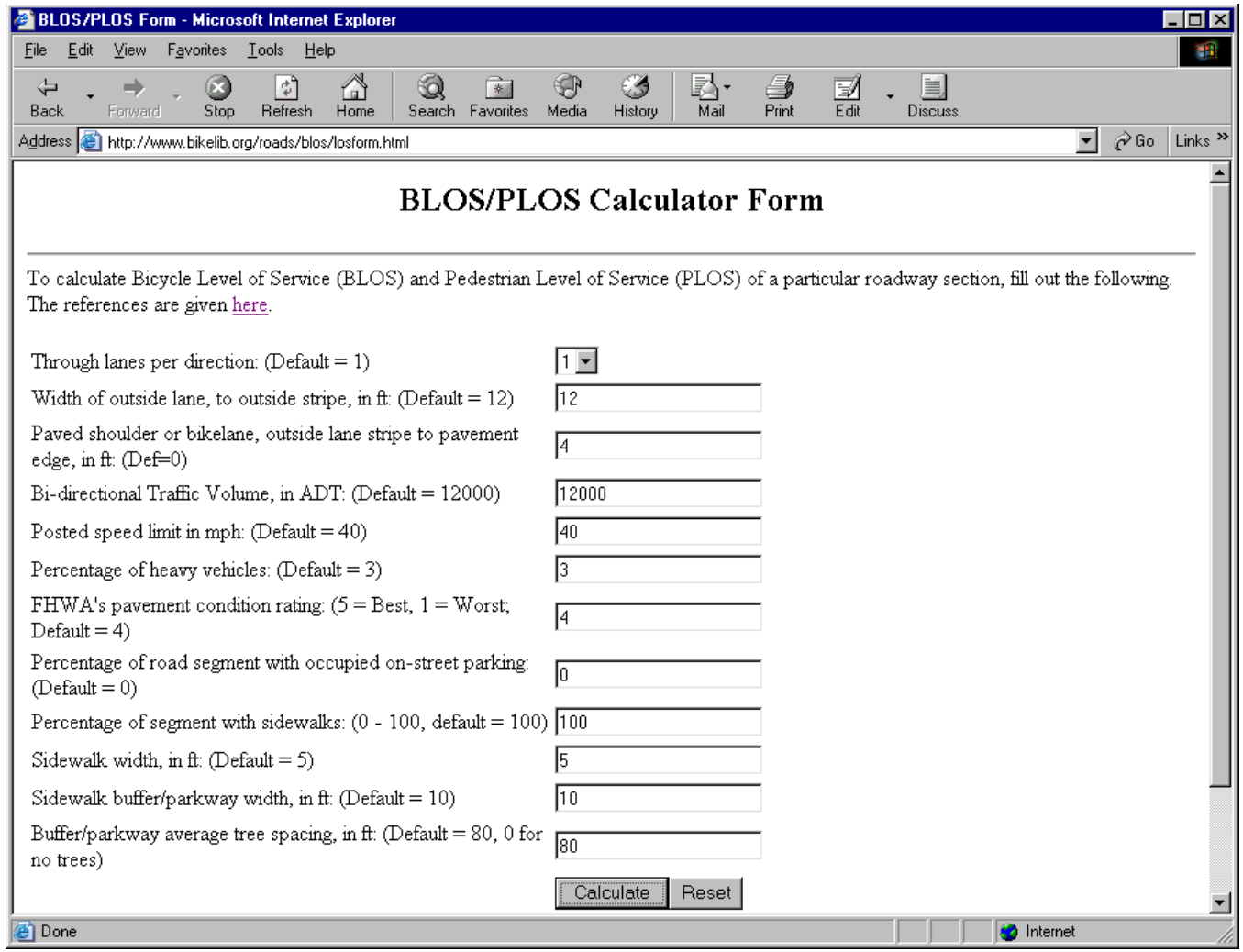
Policy requirement examples

- New roads & roads requiring ROW acq: BLOS of “C” or better, “B” or better in areas of higher demand. PLOS similar.
- All projects: maintain or improve scores - Do NOT worsen conditions!

On-line BLOS/PLOS calculator

- www.bikelib.org/roads/blos/losform.html

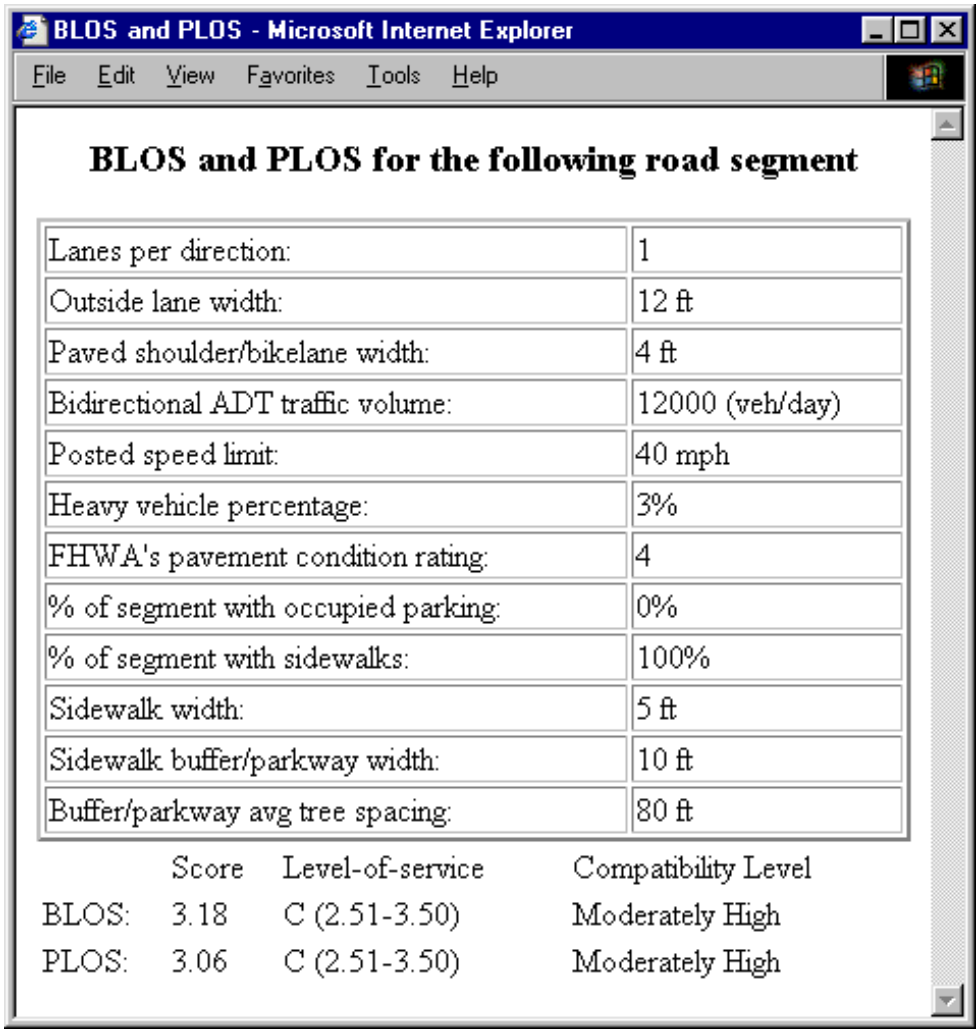
First, enter data into form



On-line BLOS/PLOS calculator

- www.bikelib.org/roads/blos/losform.html

Then, result window pops up with scores



Other Resources

- Bicycle LOS: Landis et al., TRB 1578
  Pedestrian LOS: Landis et al, TRB 1773 Sprinkle Consulting - 813-949-7449
- AASHTO's Guide for the Selection of Bicycle Facilities (1999) - Ped version soon
- www.bicyclinginfo.org and www.walkinginfo.org (Pedestrian and Bicycle Information Center)