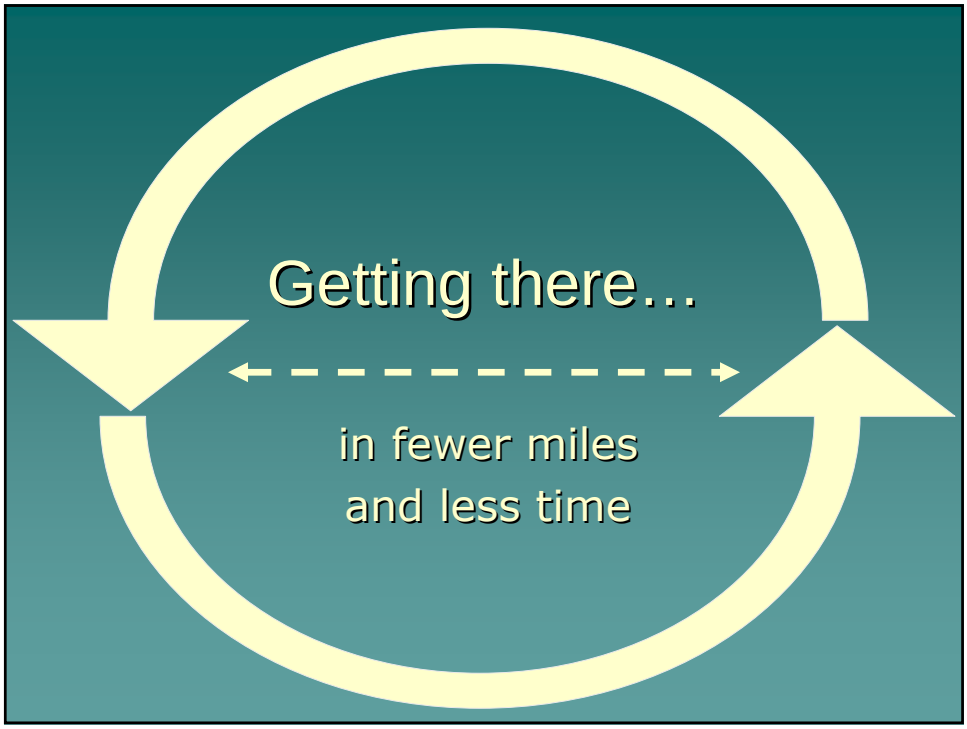
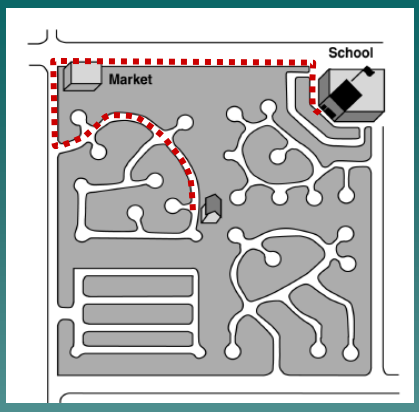


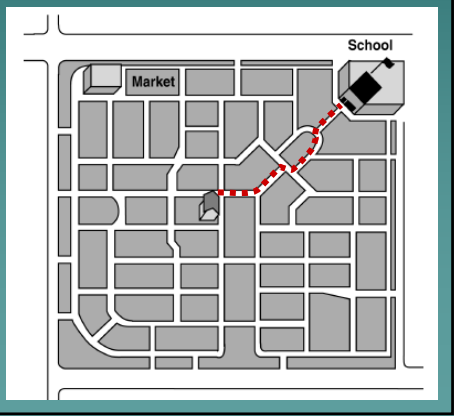
Connectivity Model Ordinance

Brent A. Sweger, P.E.
Kentucky Transportation Cabinet
Division of Planning



Current Conventional
Development Layout

Connected
Transportation Network



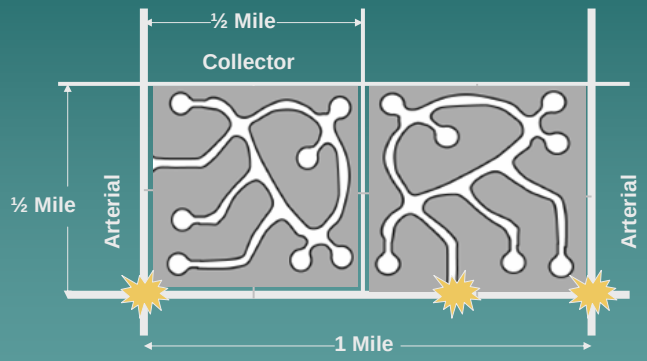
Problems with not Connecting

- Longer trips & travel times
- Strain on arterial capacity
- Congested intersections
- No alternate routes
- Expensive public services
- Infeasible public transportation
- Unpractical ped & bike network

3 Parts to Connectivity

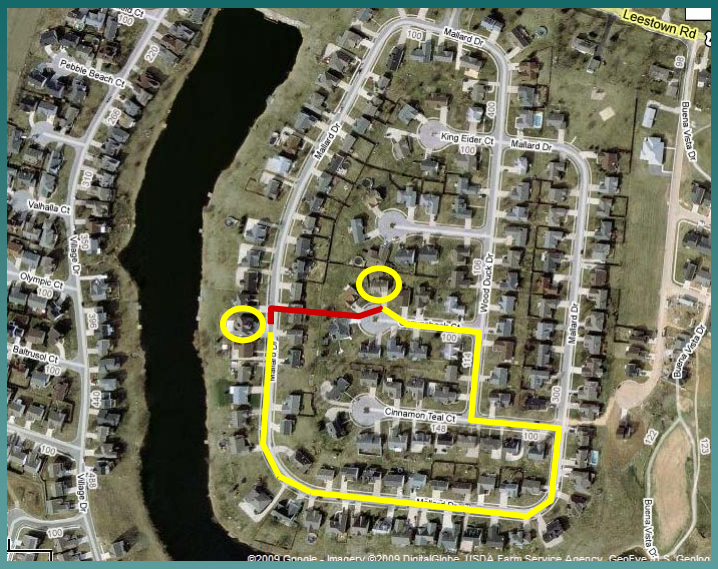
1. Systemwide Network
2. Internal: within development
3. External: between developments

Systemwide Connectivity



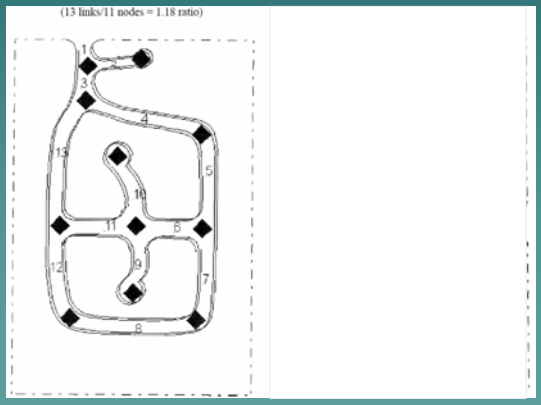
Internal Connectivity

Cul-de-sacs, Grid or Combination?

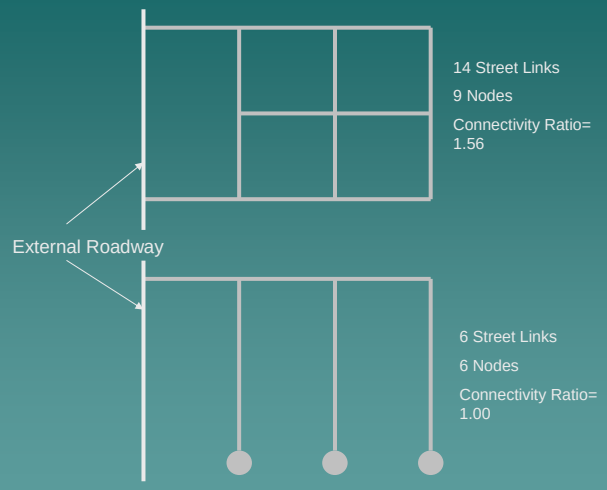


Connectivity Index

CI = # links / # nodes



Diamond = Node
Number = Link



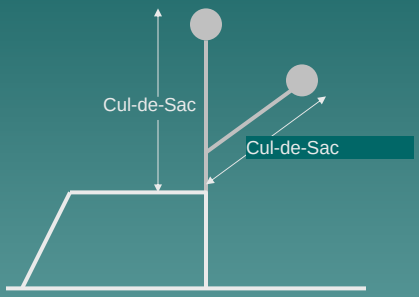
What value for CI do you set?

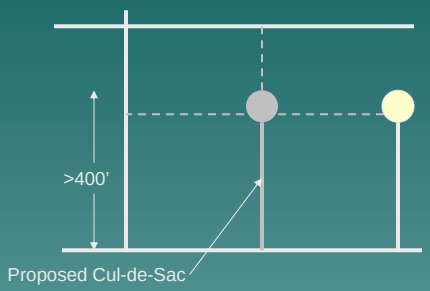
- Desirable for high connectivity: 1.60
- Reasonable level: 1.40
- Better than nothing: 1.20

Cul-de-Sac Length

- Long cul-de-sacs create longer trips
- Issues with emergency response and school buses
- Recommended to be less than or equal to a normal block length

How do you measure the length?

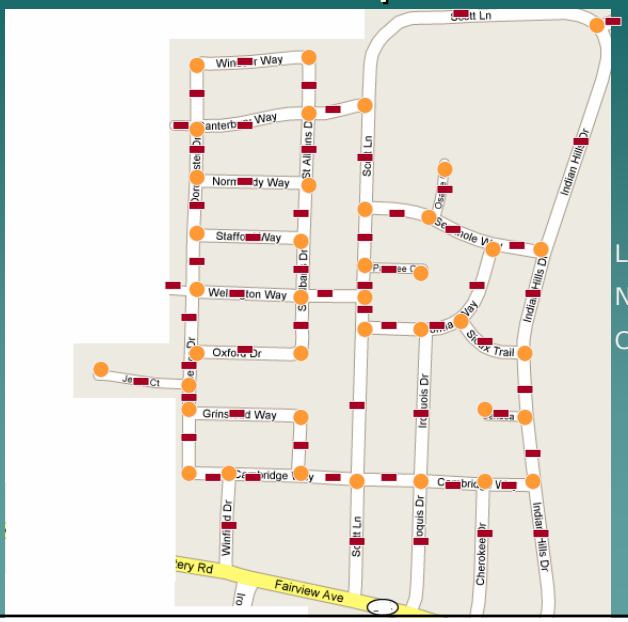




≤400’ would be typical

≤660’ with ped connections

Example



Links = 58

Nodes = 39

CI = 1.49

External Connectivity

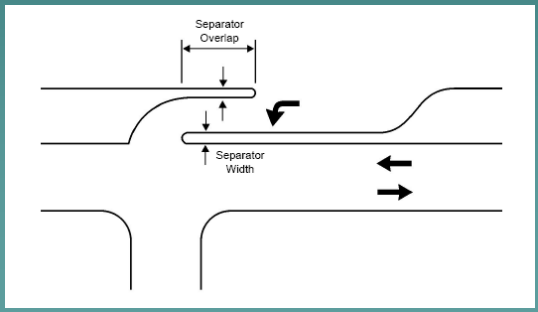
Creating community cohesiveness

Do you need just a simple external connection or will a planned collector road, frontage/backage road be necessary to accommodate the growth?

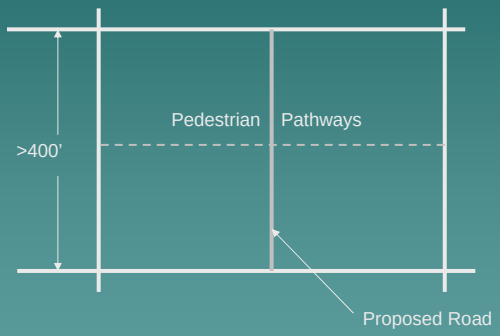
External Connectivity

- Require stubbed out connections to all abutting properties
- Connection spacing requirements:
  - Maximum of 660′
  - Desirable length of blocks = 400′
- Ped connections for blocks >400′

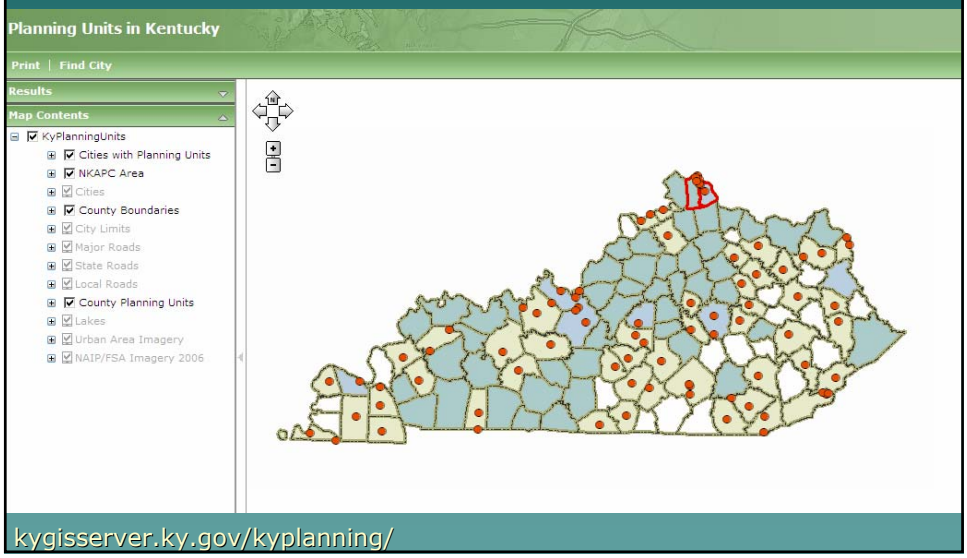
- For major arterials:
  - Intersection spacing may be greater to facilitate traffic flow/safety
  - Intersection movements may be limited with median

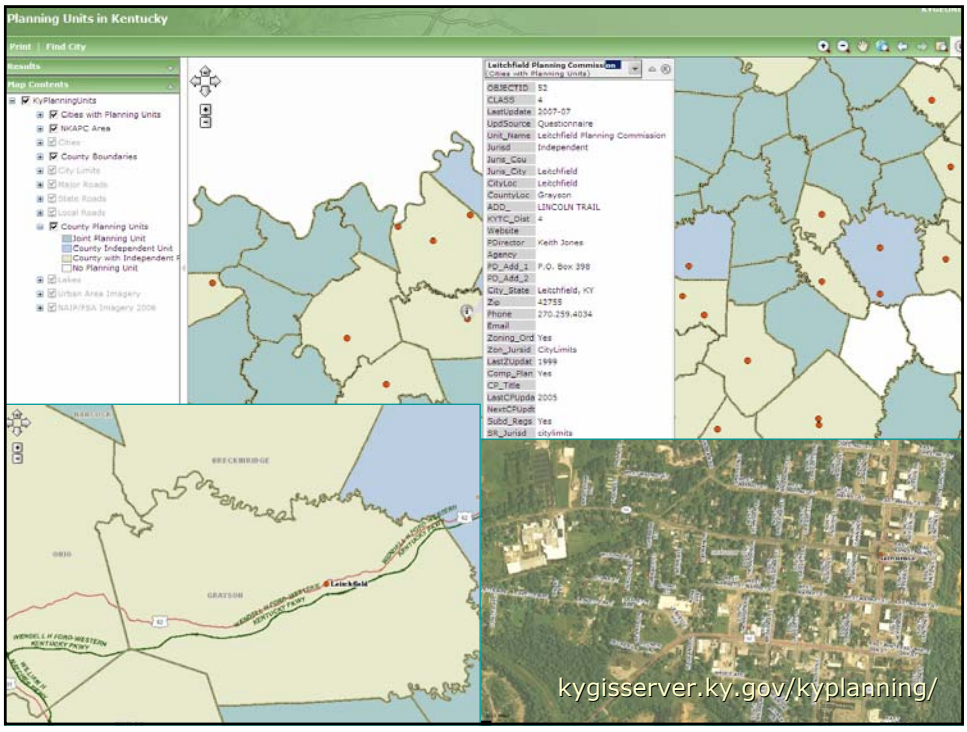


Pedestrian Connections



New P&Z Database Website





In conclusion…

- Connectivity is critical to create:
  - A cohesive community
  - Mobility
  - Efficiency of services
  - A multimodal transportation system
- Connectivity is accomplished in 3 ways:
  - Systemwide
  - Internal
  - External

Brent A. Sweger, P.E.
502-564-7183
brent.sweger@ky.gov

Congestion Toolbox
congestion.kytc.ky.gov

Planning & Zoning Interactive Map
kygisserver.ky.gov/kyplanning/

Using the Bicycle Safety Index to Assess Your Community Connections for On-Road Cycling

Michael Galbraith,
H.W. Lochner, Inc.
Engineers and Planners

The Bicycle Safety Index

- Introduced 1987 in Chattanooga-Hamilton Co. TN Regional Planning Commission
- Revised 1994 by Bruce Epperson for "Toward a Cycling Level of Service Standard"
- Cited in Transportation Research Board National Cooperative Highway Research Program Report 456, 2001
- Represents a standard between the USDOT/NHTSA Bikeability Checklist and USDOT/FHWA Bicycle Compatibility Index.

The Bicycle Safety Index

continued

- A calculation comparing roadway attributes
- Measures features such as lane widths, traffic volumes, and speed limits
- Includes values for pavement factors, potholes or RR crossings, and location factors, presence of curb-side parking and adjacent land use, for example.

The Bicycle Safety Index

continued

Index range:

- 0-3 = Excellent; Extremely favorable for safe bicycle operation
- 3-4 = Good; Conducive to safe operation but with some restrictions
- 4-5 = Fair; Of marginal desirablity for safe biking
- 5 or above = Poor; Roadway conditions of questionable desirability.
- Roughly equivalent to AASHTO A-B-C levels of bicycle rider types.

The Bicycle Safety Index

continued

BSI = [AADT/(Lx3100)]+(S/48)+{(S/48)X[(4.25-W)X1.635]}+PF+LF

where:

- BSI=bike safety index for specific roadway segment
- AADT=average annual daily traffic
- L=number of traffic lanes
- S=speed limit (kilometers per hour)
- W=width of outside lane (meters)
- PF=pavement factors
- LF=location factors

The Bicycle Safety Index

continued

Project involved streetscape improvements on US 25 in Georgetown, KY.

Configuration is four lanes with parking on west side at store fronts.

Access points numerous in section.

Plans are for curbs and sidewalks to be replaced and a road diet i.e.:

- Four travel lanes reduced to one per direction
- Continuous center turn lane
- Parking is retained for store fronts.

The Bicycle Safety Index

continued

Existing Conditions

The Bicycle Safety Index

continued

Existing roadway attributes and conditions on US 25 north of Main St. (US460):

- AADT = 18,000
- L=number of traffic lanes = 4
- S = speed 40.5 kmh (25 mph x 1.62)
- W = width of outside lane in meters (11 feet x .305) = 3.35 meters

The Bicycle Safety Index

continued

Begin with [AADT/(Lx31000]

Average annual daily traffic on US 25 in Georgetown:

- 18,000

L=number of traffic lanes = 4 x 3100

- 12,400

18,000/12,400 = 1.45

The Bicycle Safety Index
continued

Next calculate (S/48)

Speed limit in kilometers where 25 mph posted speed is multiplied by 1.62 to get kmh:

- 25x1.6 = 40

40/48

- 0.83

And so far
[1.45]+(0.83)

The Bicycle Safety Index
continued

Next calculate {(S/48)X[(4.25-W)X1.635]}
We know S/48 = 0.83, so

- {(0.83)X
- [(4.25-3.35 (=outside lane width in meters) = 0.9)
- 0.9 X 1.635 = [1.471]
- {(0.83) X [1.471] = 1.221}

And so far [1.45] + (.83) + {1.221}

The Bicycle Safety Index

continued

Next add the pavement factors and location factors. Each factor includes a value:

- Cracking 0.50
- Patching 0.25
- Weathering 0.25
- Potholes 0.25
- Rough edges 0.25
- RR Crossings 0.25
- Rough RR Cross 0.50
- Drainage grates 0.50

- Angle parking 0.75
- Parallel parking 0.25
- Right-turn lane 0.25
- Raised median -0.50
- Center-turn lane -0.20
- Paved shoulder -0.75
- Grades (severe) 0.50
- Grades (mod.) 0.20
- Curves (freq.) 0.35
- Restricted sight distance 0.50
- Numerous drives 0.25
- Comm. or ind. LU 0.25

The Bicycle Safety Index

continued

Add to formula those factor values representing conditions.

- Pavement factor;
  Drainage grates = 0.50
- Location factors;
  Moderate grade = 0.20
  Parallel parking = 0.25
  Total for location = 0.45

So [1.45] + (.83) + {1.221} + 0.5 + 0.45 = BSI of 4.451 or Fair "of marginal desirability."

The Bicycle Safety Index

continued

Planned new roadway attributes and conditions for US 25 segment north of Main St. (US 460):

- AADT = 18,000
- L=number of traffic lanes = 2 = result of lane diet
- S = speed 40.5 kmh (25 mph x 1.62)
- W = width of outside lane in meters (14 feet x .305) = 4.27 meters = result of lane diet.

The Bicycle Safety Index

continued

Begin again with [AADT/(Lx31000]

- 18,000

L=number of traffic lanes = 2 x 3100

- 6200

[18,000/6200] = 2.9 (cf. old value 1.45)

The Bicycle Safety Index
continued

Next calculate (S/48)

Speed limit of 25 mph not changed so value is the same for new roadway:

- 25x1.62 = 40.5

40.5/48

- 0.83

And so far
[2.9]+(0.83) (cf. old value 1.45+0.83)

The Bicycle Safety Index
continued

Next calculate {(S/48)X[(4.25-W)X1.635]}
We know S/48 = 0.83, so

- {(0.83)X
- [(4.25-4.27 (=outside lane width in meters) = -0.02)
- -0.02 X 1.635 = [-0.0327]
- {(0.83) X [-0.0327] = -0.0271}

And so far [1.45] + (.83) + {-0.027}

The Bicycle Safety Index

continued

Add to formula those pavement and location factor values representing conditions.

- Drainage grates replaced by curb box inlets and pavement is new:
  Pavement factor = 0
- Location factors
  Moderate grade = 0.20
  Parallel parking = 0.25
  BUT CCTL = -0.20
  Total for location = 0.25

The Bicycle Safety Index

continued

So [2.9]+(0.83)+{-0.027}+0.0+0.25 = BSI 3.953 or

Good

"Refers to roadway conditions still conducive to safe bicycle operation, but not quite as unrestricted as in the 0 to 3 excellent case."

The Bicycle Safety Index

continued

WHY NEW IS "GOOD?"

What improvements contribute to lower BSI?

- Wide outside lanes provide parking with room for cyclists to maneuver to left of door zone.
- CCTL provides overtaking motorists room to pass on left.
- Drainage grates replaced by curb inlets.

Generally and by common sense:
Higher speeds (>35), narrower lanes (<11'), and high traffic volumes (>10-12k) contribute to higher BSI scores and lower safety for bicycling on roadways.

The Bicycle Safety Index

continued

Questions?

Thank you

Michael Galbraith
H.W. Lochner, Inc.
1040 Monarch St., Ste. 300
859-224-4476x224
mgalbraith@hwlochner.com
metro_biking@insightbb.com

Resources for More Information on Pedestrian and Bicycle Facility Planning

WEB SITES

Following are web sites where you can find more information about the issues of pedestrian and bicycle facility planning in federal, state, MPO, and local transportation projects.

ACTIVE TRANSPORTATION
www.activetransportation.org

AMERICA WALKS - THE NATIONAL COALITION OF WALKING ADVOCATES
http://americawalks.org

BENEFIT-COST ANALYSIS OF BICYCLE FACILITIES
ACTIVE COMMUNITIES/TRANSPORTATION (ACT) RESEARCH GROUP
http://www.bicyclinginfo.org/bikecost

BICYCLE FRIENDLY COMMUNITY RESOURCES
www.bicyclefriendlycommunity.org

FHWA BICYCLE AND PEDESTRIAN PROGRAM
www.fhwa.dot.gov/environment/bikeped

LEAGUE OF AMERICAN BICYCLISTS
www.bikeleague.org

NATIONAL CENTER FOR BICYCLING AND WALKING
www.bikewalk.org

PEDESTRIAN AND BICYCLE INFORMATION CENTER
HIGHWAY SAFETY RESEARCH CENTER, UNIVERSITY OF NORTH CAROLINA
www.bicyclinginfo.org

U.S. DOT FHWA THE NATIONAL PEDESTRIAN SAFETY CAMPAIGN
www.safety.fhwa.dot.gov/local_program/pedcampaign

U.S. DOT FHWA TURNER-FAIRBANKS HIGHWAY RESEARCH CENTER
www.tfhrc.gov/safety/pedbike