Road Safety and Land Use Planning in Urban Areas

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Seminar on Road Safety National Policies and Programs

What is Planning?

- The scientific, aesthetic, and orderly disposition of land, resources, facilities and services with a view to securing the physical, economic and social efficiency, health and well-being of urban and rural communities.

What is Planning?

- Responsible planning has always been vital to the sustainability of safe, healthy, and secure urban environments. Population is growing and, with more people migrating from rural to urban areas, the planning profession must increasingly deal with urbanization issues, such as:
  - conversion of land from natural habitats to urban built areas,
  - maintenance and use of natural resources and habitats,
  - development of transportation related infrastructure,
  - ensuring environmental protection.

What is Planning?

- Not only do planners deal with land use, but also:
  - planning social and community services,
  - managing cultural and heritage resources,
  - creating economic capacity in local communities,
  - addressing transportation and infrastructure, work internationally.

What Do We Mean by Land Use?

- Human development, land management

- Type of use (residential, commercial, industrial, agricultural, etc.)
- Density
- Mix of uses in an area
- Design characteristics

Why Land Use Planning?

- Urban space needs to serve variety of needs:
  - Housing
  - Work
  - Social interaction
  - Nature/Leisure
    - Trees
    - Parks
    - Recreation
    - Functioning ecosystems
  - Mobility
    - People
    - Goods

Example Land Use Types

Residential

Institutional

Commercial

Commercial

Open Space

Agricultural

Why Not

- Individual rights against the collective good
- Freedom against government control
- Lack of respect for laws
- Misuse/abuse of the planning system to serve the more powerful and influential

Impacts of Transportation on Land Use

Transportation is a means to an end, and that end is often determined by local land use decisions

…but

local land use decisions are influenced by transportation demand and infrastructure.

Impacts of Land Use Planning on Transportation and Safety

Land use planning defines:

- the use of a lot
  - the type and intensity of the generated traffic,
  - as well as the way it enters from and exits to the adjacent road

Example of poor Land use and Transport Planning

Challenges in Current Land use pattern in South Africa

- Poorly located low-cost housing and low densities, leading to extensive commuting
- High transport costs
- Unsustainable and inefficient public transport

(Ref: Chapter 11: Impact of current Land-Use Patterns On Public Transport And Human Settlements, Financial and Fiscal Commission, Sabelo Mtantato)

Challenges Results

- Higher government spending in the form of public transport operating subsidies
- Funding framework for built environment highly fragmented
- Uncoordinated infrasturcture investment plans
- Delay in service delivery

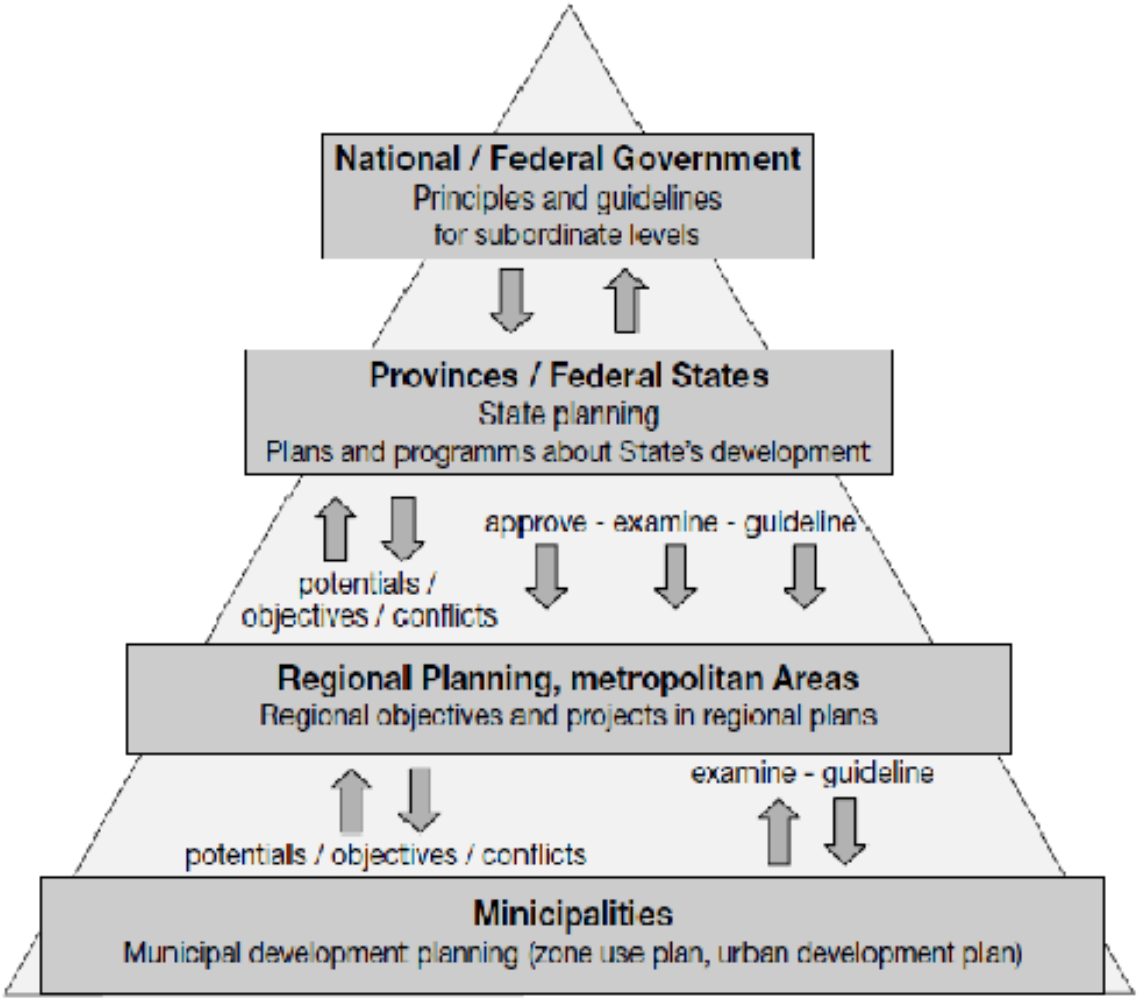
Recommendations

- Coordinate planning and decision
- Coordinate inter sectoral infrastructure investments, planning and development projects
- Cities should be more prescriptive on density. Density is key issue for efficient land use which public transport and various legislation and policies seek to promote
- Wider use of development charges in financing infrastructure associated with with the land development process and public transport subsidies

Coordinated Planning

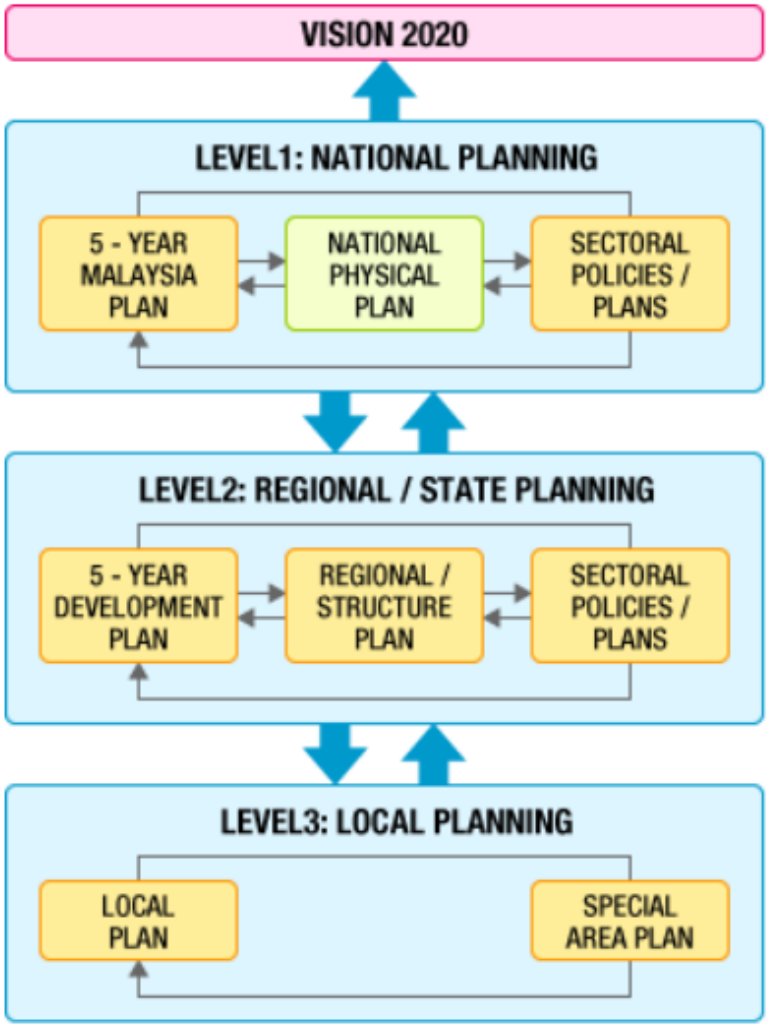
- Who decides about land use
  - National
  - Regional
  - Municipality
  - District
- Who decides about transportation
  - National
  - State/Region
  - Municipality

Vertical Integration of Different Planning Levels



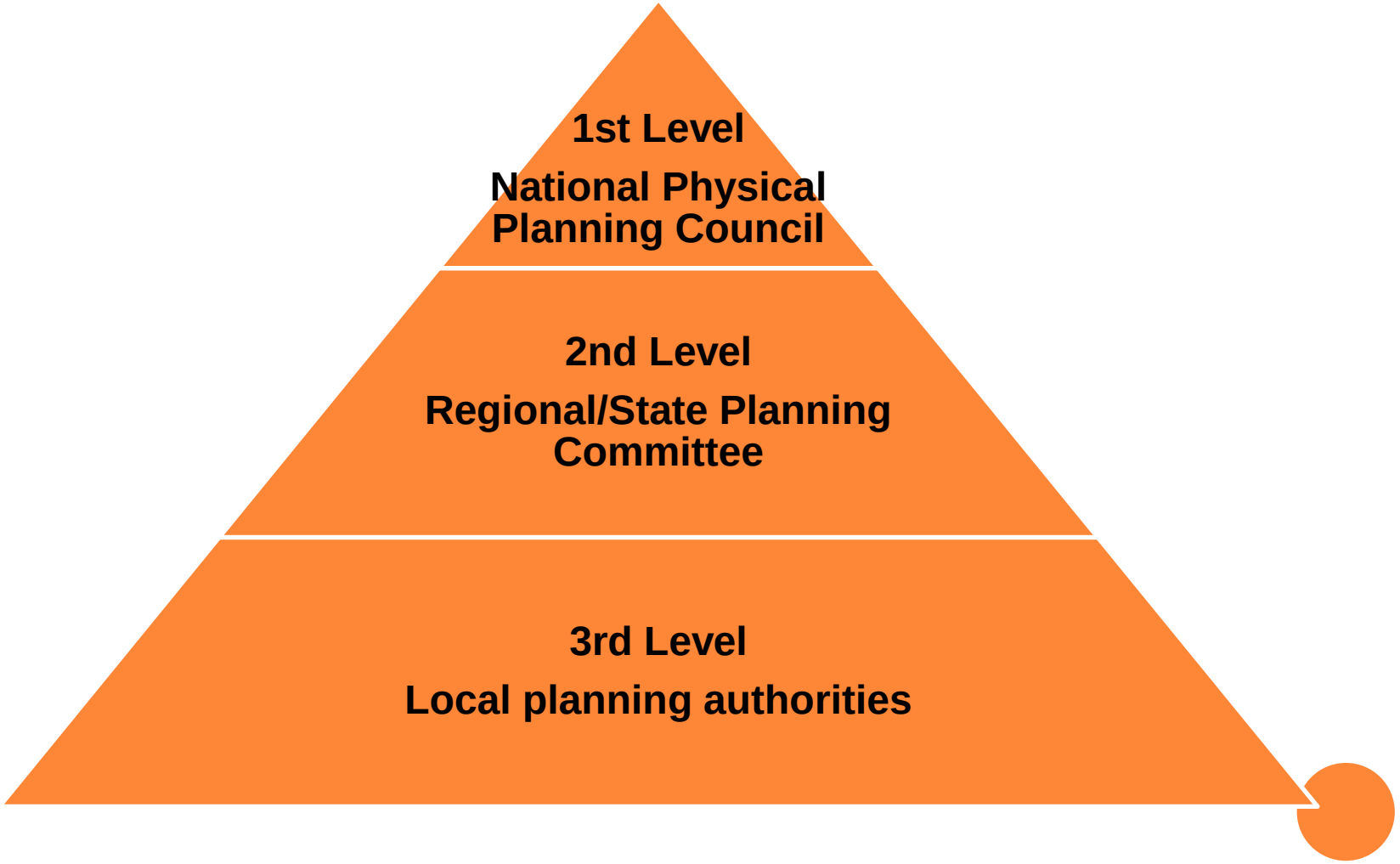
National Development Framework in Malaysia

Figure: National Development Planning Framework

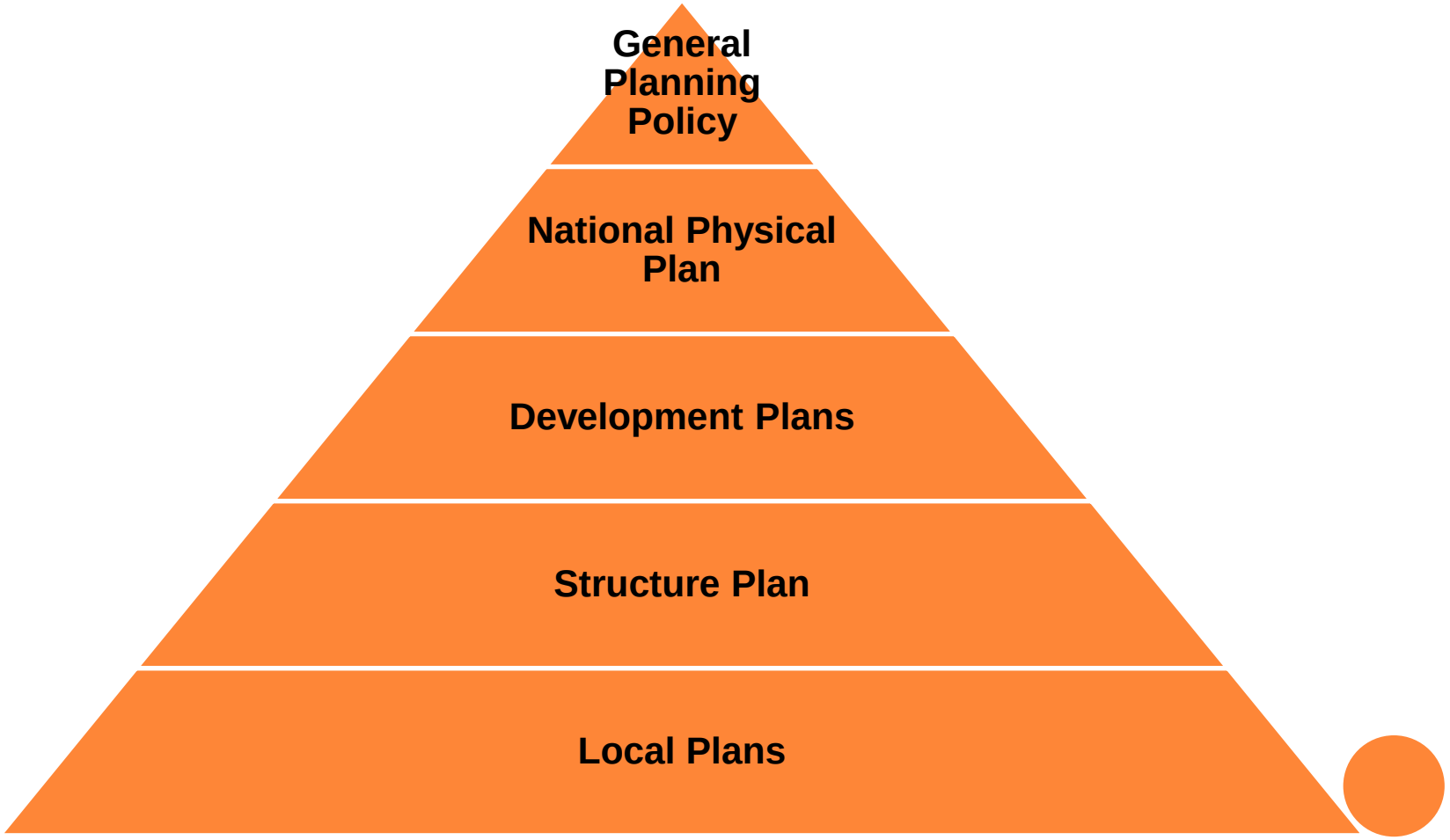


Source: Federal Department of Town and Country Planning, Malaysia (2005) "National Physical Plan"

Malaysia Landuse Planning Authorities



Methodology in Land use Planning in Malaysia



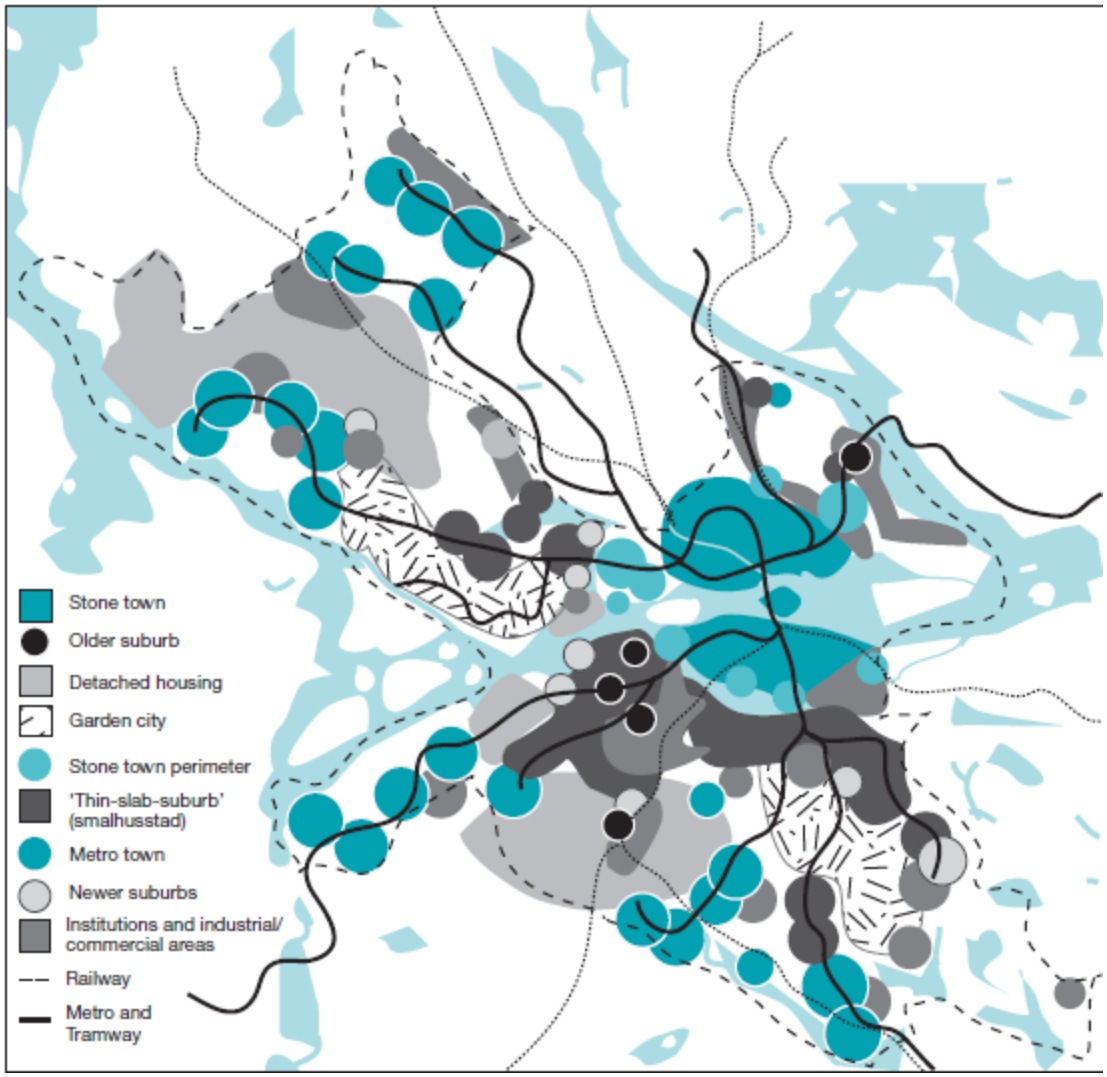
Organizational of planned growth in India: Planning Responsibilities

LEVEL	ACTIONS
Central Government	National Policies: Plan funds, bilateral and multilateral targeted programs aid, coordination, etc.
State Government	State Strategies: Industrial policy, population distribution, urban land policy, regional networks, social services, environmental conservation, etc.
District (Regional) Planning Committee	District or Structure Plan: Regional networks, regional social services, regional environmental conservation, allocation of funds, identification of regional projects, intra and inter district coordination, etc.
Metropolitan Planning Committee	Metropolitan Structure Plan: Metropolitan networks and social infrastructure plans, metropolitan fringe coordination plan, local economic perspective plan, identification of metropolitan projects, formulation of public private partnerships, etc.
Local Govt. Municipal Corporations Mun. Councils	Detailed Development Plans: Project formulation, implementation and monitoring, coordination between ward levels (Ward Level Committees are recommended)
Town Panchayats	For municipal corporations generally with population of 0.3 million and above, consolidation of ward level and other plans and projects, prioritising projects, project investment plan, project outlay, project implementation and monitoring, etc.
Ward and Local Level Committees	Local Specific Action Plans: Local project formulation, implementation and monitoring; coordination with local government; input to the development plan.

ISOCARP, modified by Wuppertal Institute

Intersectoral Planning

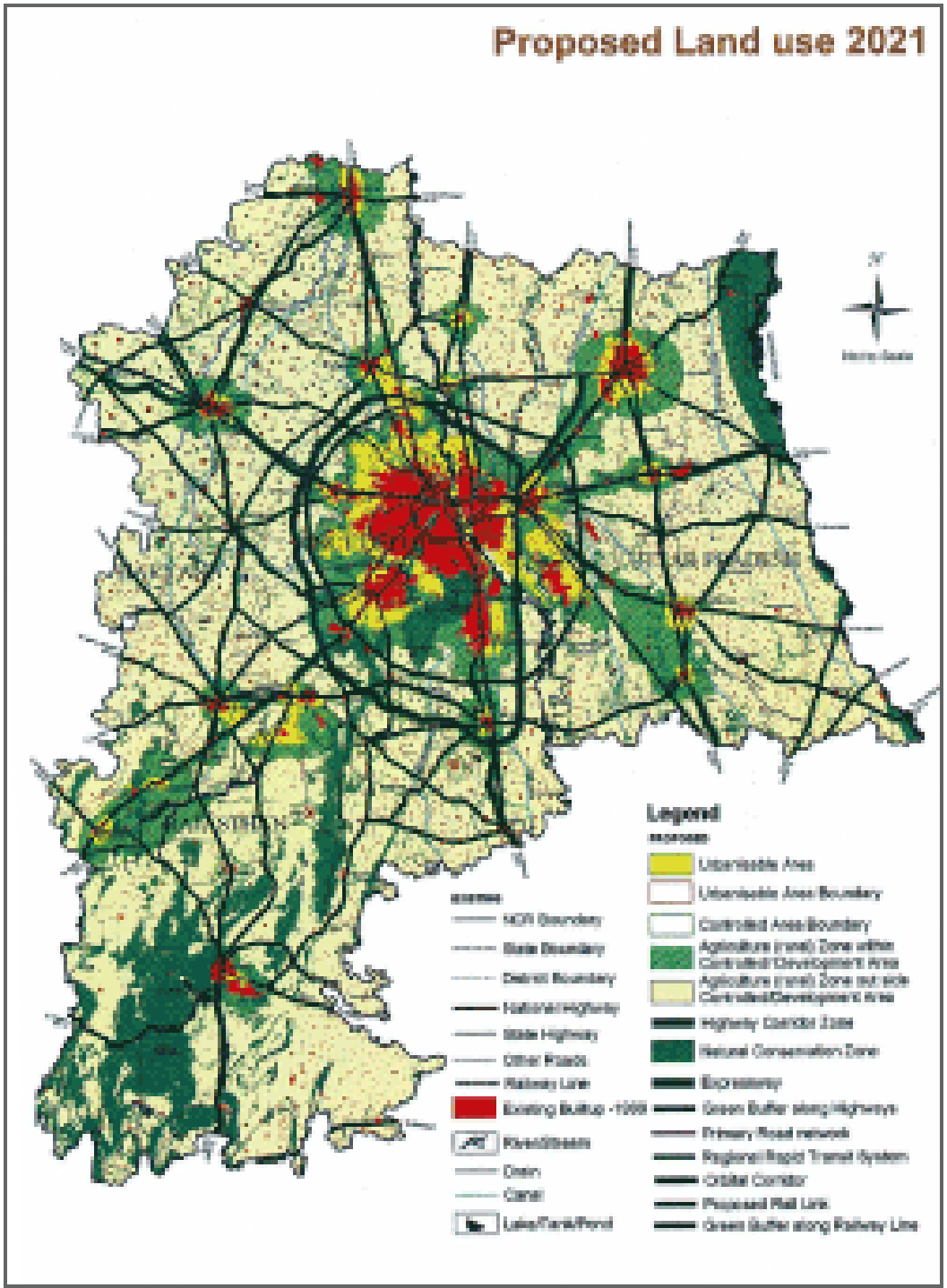
Stockholm Necklace of Pearls



Stockholm's necklace-of-pearls built form

Source: Stockholm Municipality, 2000.

India



QUÉBEC, CANADA

Act respecting land use planning and development

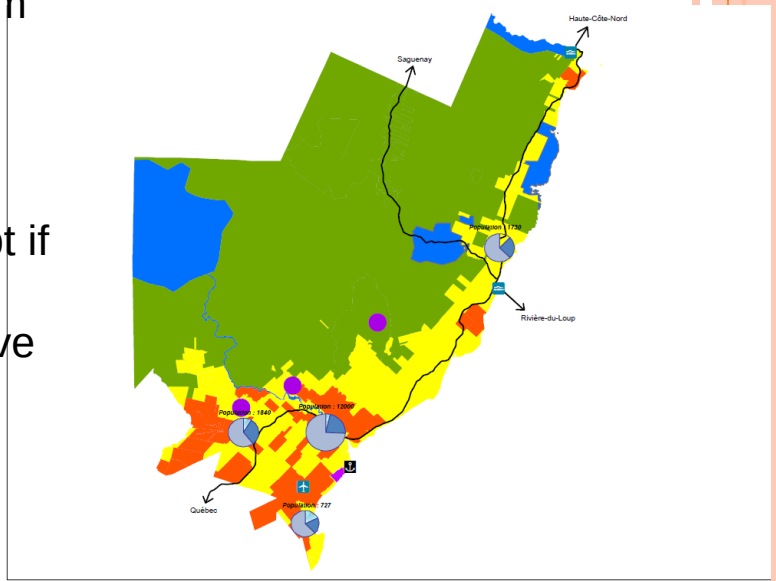
- The Québec government adopts policy directions
- Every RCM must adopt a land use and development plan
  - Mandatory content of the plan:
    - General policies on land use
    - Organization of land transport
  - The RCM plan must be consistent with the government policy directions
- Every local municipality is required to adopt:
  - planning program consistent with the objectives of the RCM plan
  - zoning by-law, a subdivision by-law, a building by-law in conformity with the planning program

Helps to coordinate the decisions of all stakeholders involved

Helps to integrate land use and transportation planning

LAND USE AND DEVELOPMENT PLAN OF RCM CHARLEVOIX-EST, QUEBEC, CANADA

- By-laws about the two main road corridors of the territory: national road 138, and regional road 170
- Corridor and access management measures for lots adjacent to the roads in rural and peri-urban areas :
  - Zoning restrictions: no commercial activities, conditions for the construction of residences
  - Severe subdivision regulations: minimal width for the lots to be created (up to 120 m; 50 m elsewhere)
  - Only one driveway by lot, except for some commercial activities
  - No more intersection with the roads, except if the Québec department of Transportation accepts and agrees that there is no negative impact on road safety and capacity.



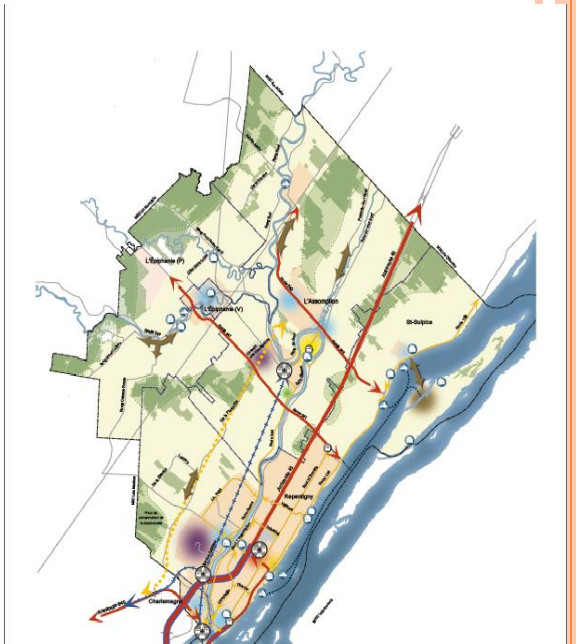
LAND USE AND DEVELOPMENT PLAN OF RCM DE L'ASSOMPTION, QUEBEC, CANADA

Major trip generators

- A traffic and safety impact study should be realized prior to their authorization by a local municipality
  - Hw to preserve the safety and efficiency of the road network
  - How to promote active and transit transportation
- The Regional Transit authority must give its opinion on the study

Major freight trip generators

- Local municipalities are invited to insure the safety and efficiency of the road or/and rail networks
- Access management measures along major roads



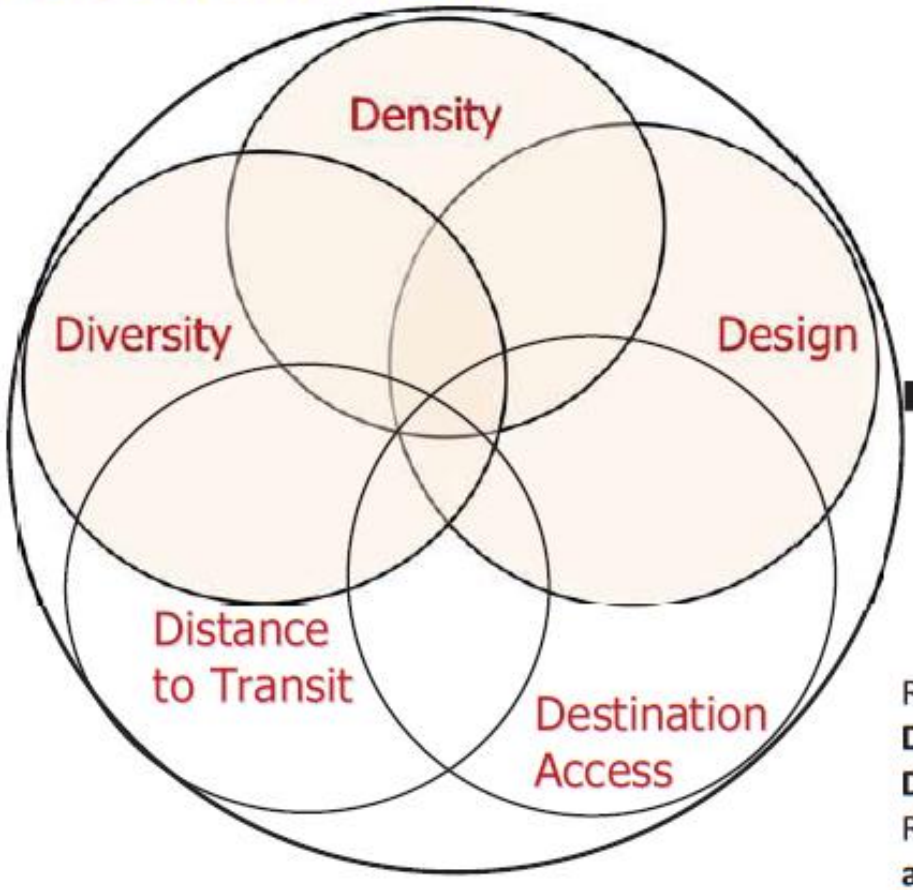
Development Impact on Transportation

Certain characteristics of the built environment tend to affect travel behavior in predictable ways. These characteristics are:

- Density in terms of dwelling units or jobs per acre
- Diversity of land uses within any given area
- Design of the pedestrian and bicycling environment
- Design Destinations; proximity
- Distance to transit
- Development scale
- Demographics
- Demand Management

Travel & the "D"s

5D's of the Built Environment

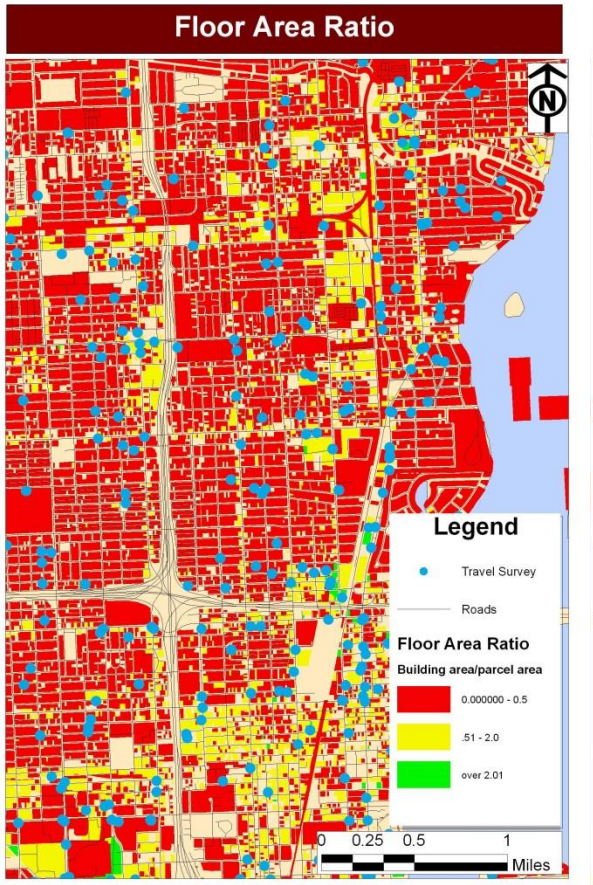


Impacts

R. Cervero & K. Kockelman, **Travel Demand and the 3Ds: Density, Diversity, Design**, *Transportation Research*, 1996; R. Ewing & R. Cervero, **Built Environment and Travel,** *TRR,* 2001; *JAPA*, 2010

Density

- Residential
  - Number of residential units per acre
- Commercial
  - Floor area ratios for particular land use categories



Diversity

- Mix of land uses in a given community or area
- Balance of jobs, housing, shopping, schools, and other daily needs and services.
- Greater land use diversity puts more destinations within a convenient walking or bicycling distance

Design & Destinations

- Measurin
  - Measure
    - Miles of
    - Numbe
    - Connec
  - Measure
    - Presen

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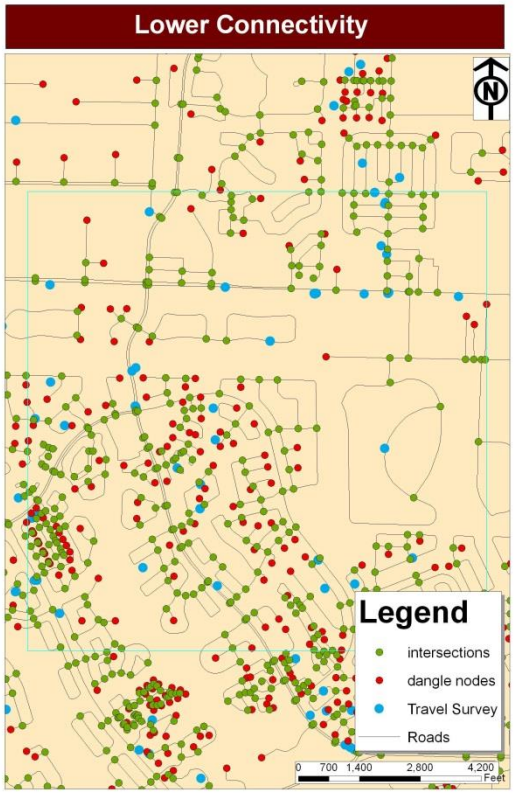
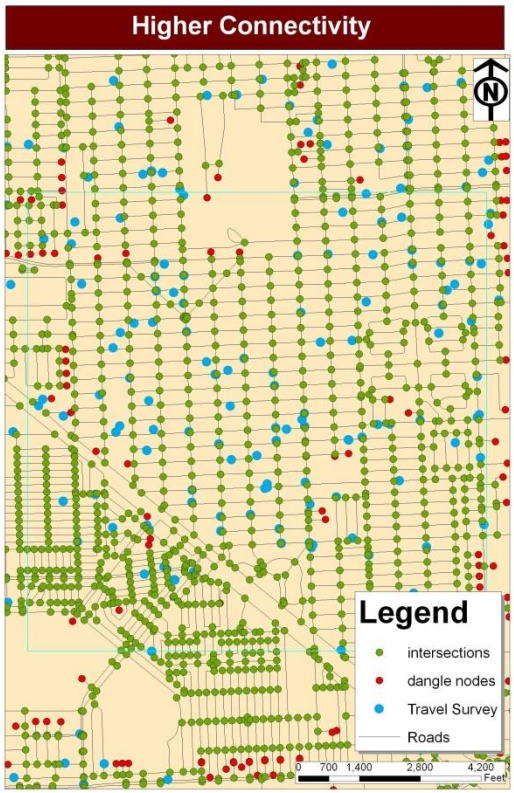


CNR = .72



CNR = .96

Land Use Mix

Pho

Single-Use

Mixed-Use

IMPACT OF LAND USE ON TRANSPORTATION

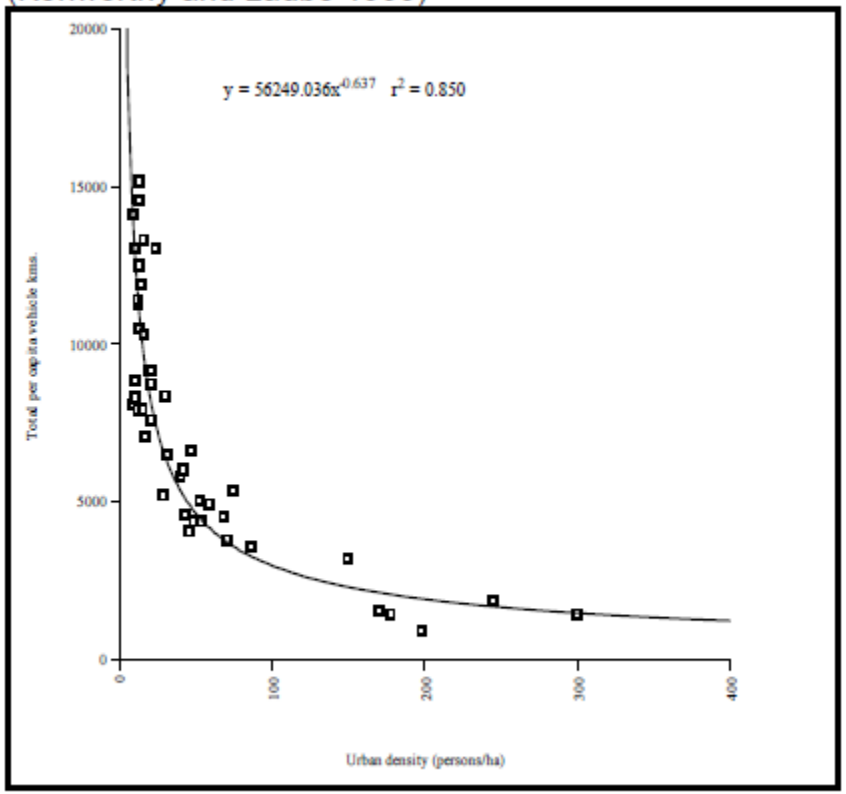
- Transport investments shape urban form
- Increased density improves public transport

IMAGES AND MAPPING COURTESY OF URBAN DESIGN 4 HEALTH

IMPACT OF LAND USE ON TRANSPORTATION

- Increased density increases crash frequency but reduces severity
- Increased density reduces per capita traffic fatalities
- Increased density tends to increase traffic friction (interactions among road users) which reduces traffic speeds

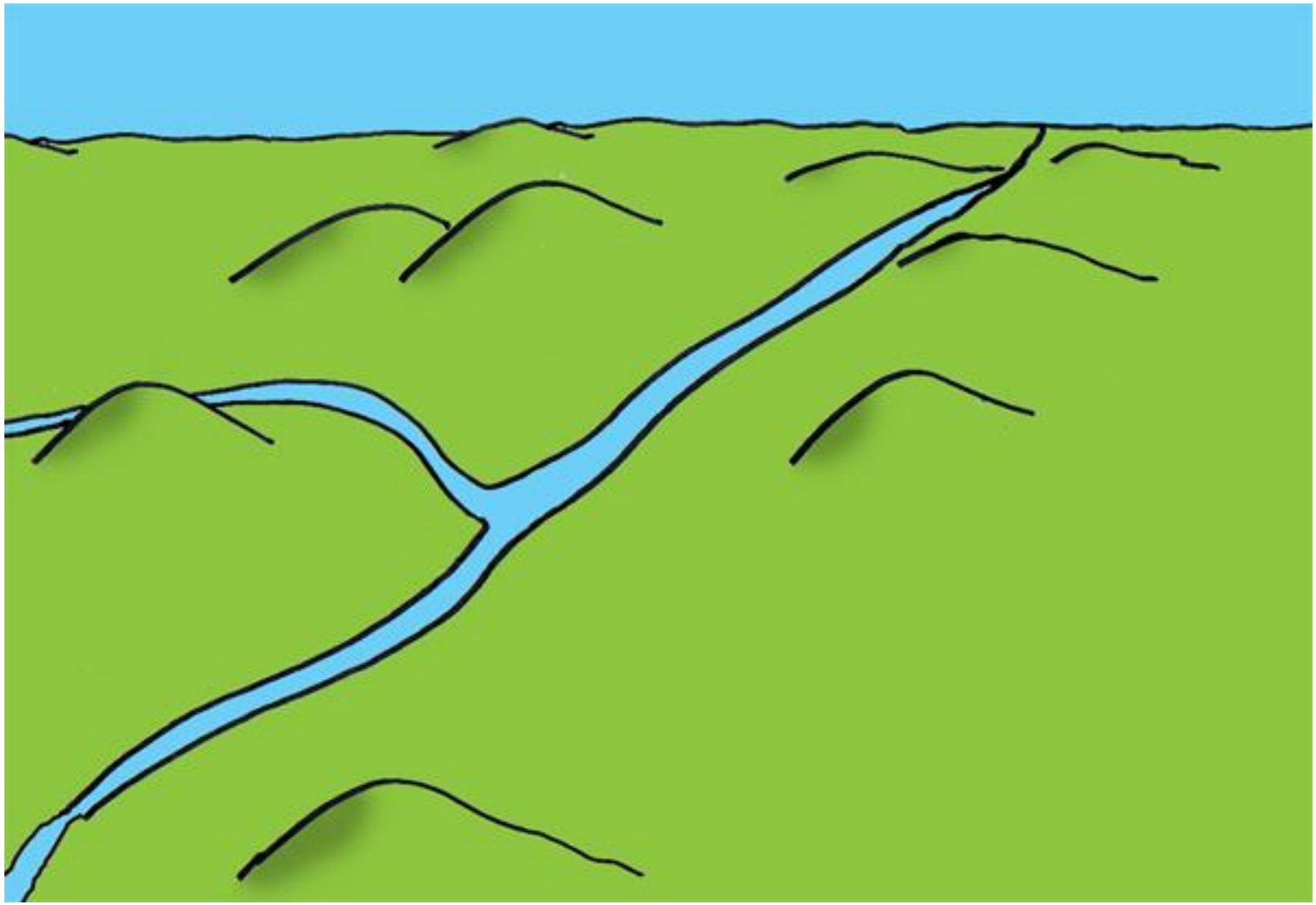
Figure 4 **Urban Density and Motor Vehicle Travel**
(Kenworthy and Laube 1999)

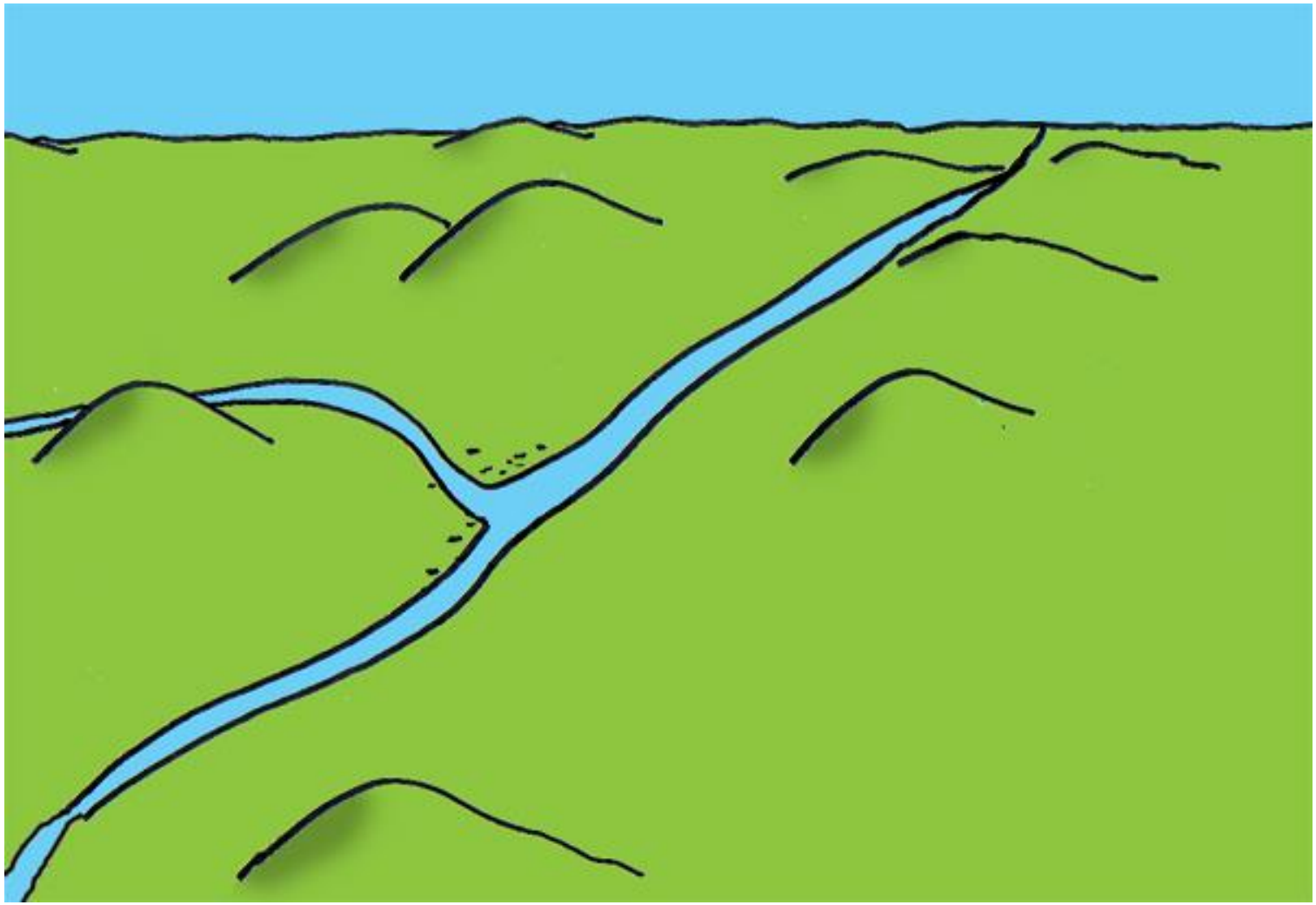


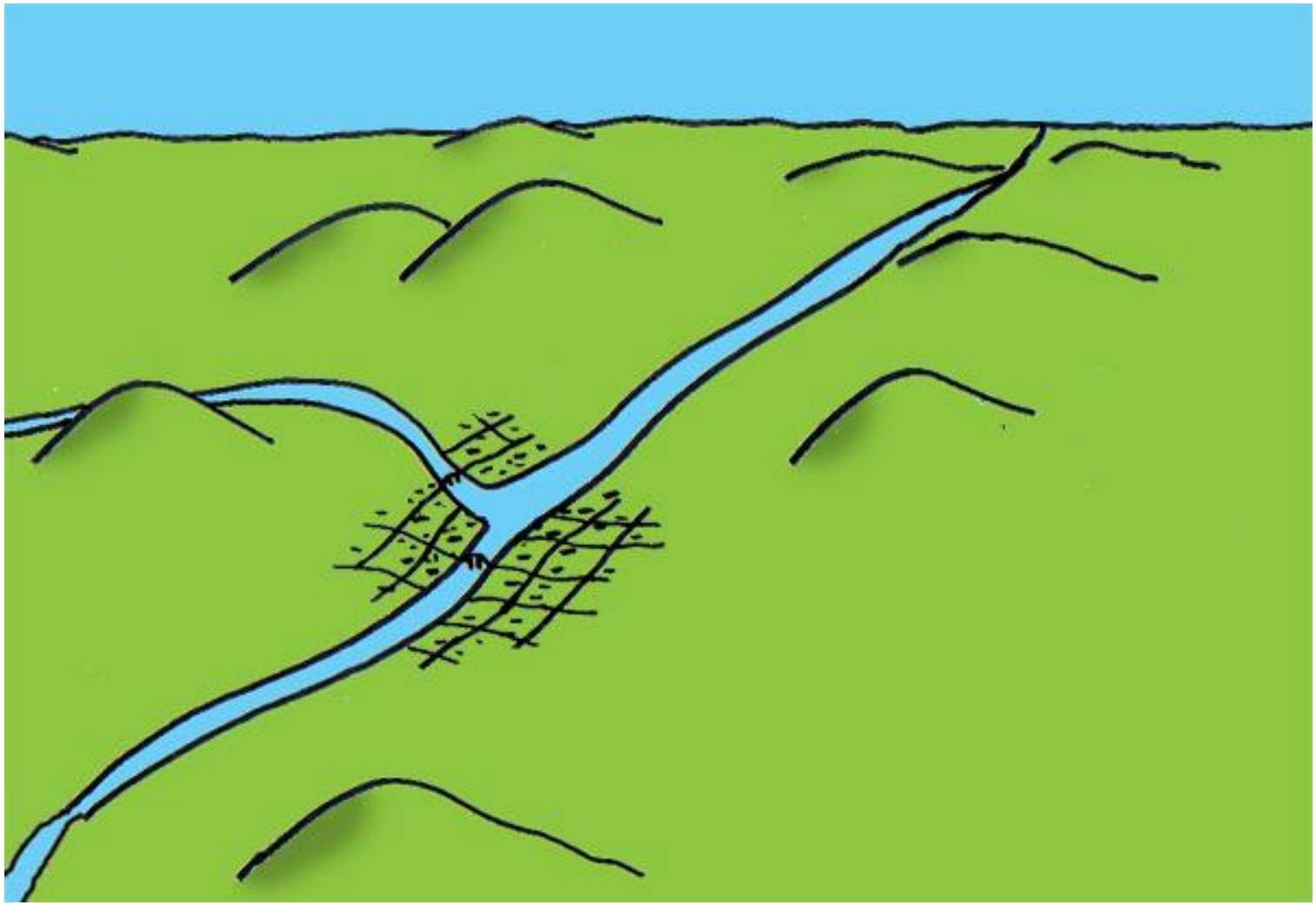
Each square represents a major city. Per capita vehicle use tends to decrease with density.

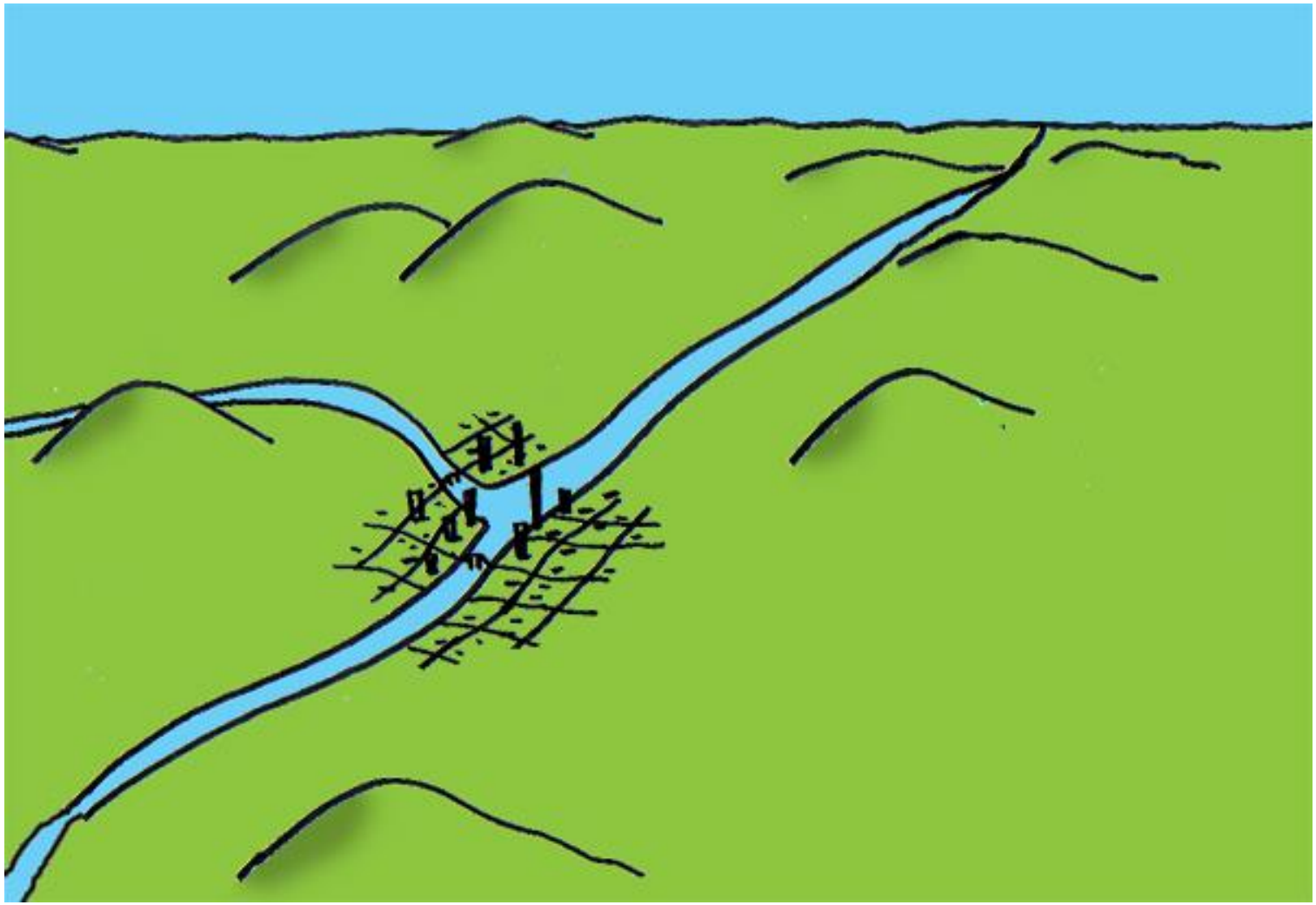
Why is it hard to get Mixed Use?

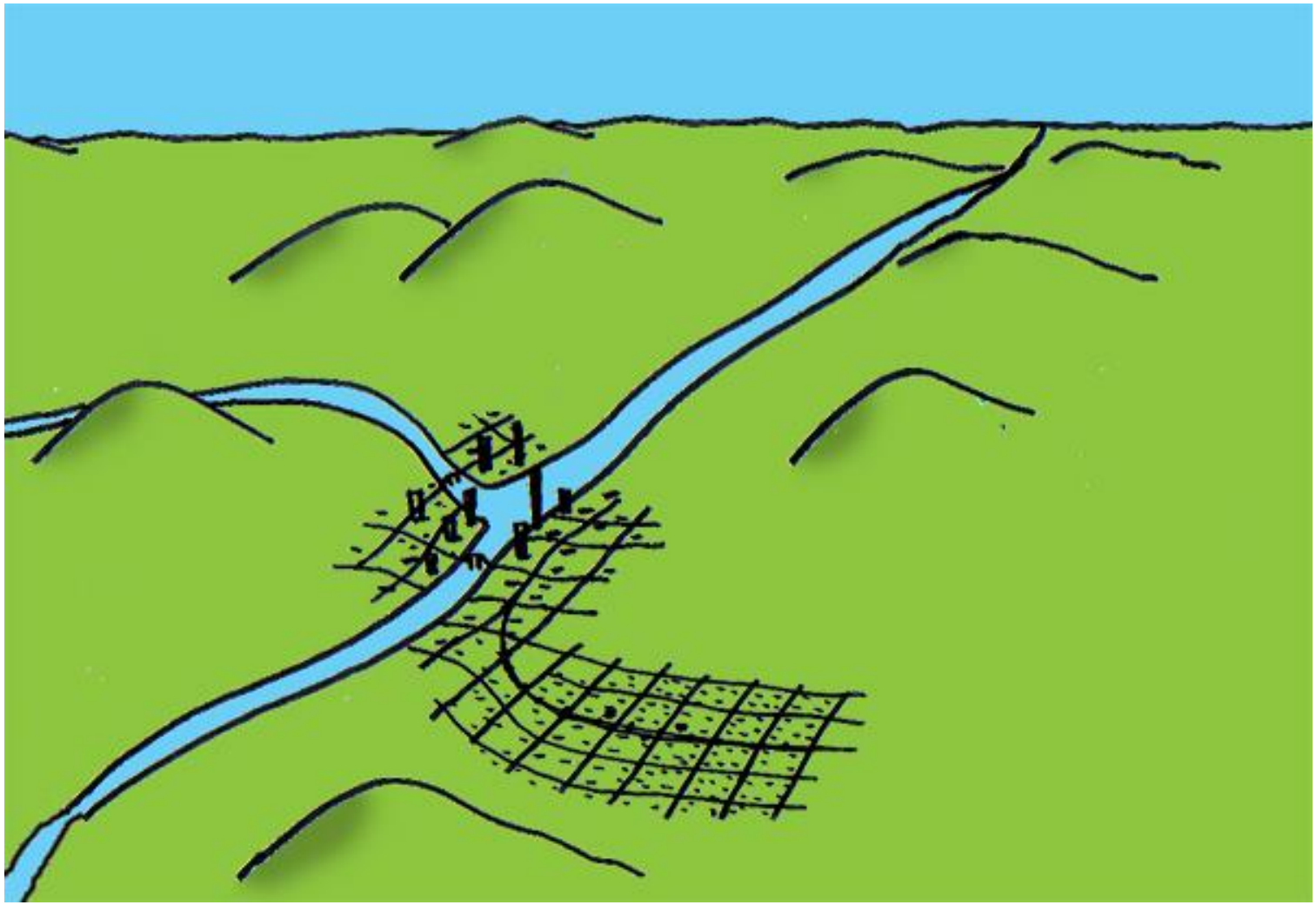
- Land use laws that separates uses
- An automobile-oriented culture
- Concerns about schools and public safety
- Racism and racial tension
- Inadequate ecological awareness
- Global economic change in an information age
- National policies and spending programs
- Methods of local government revenue generation
- Owners' concerns over property values

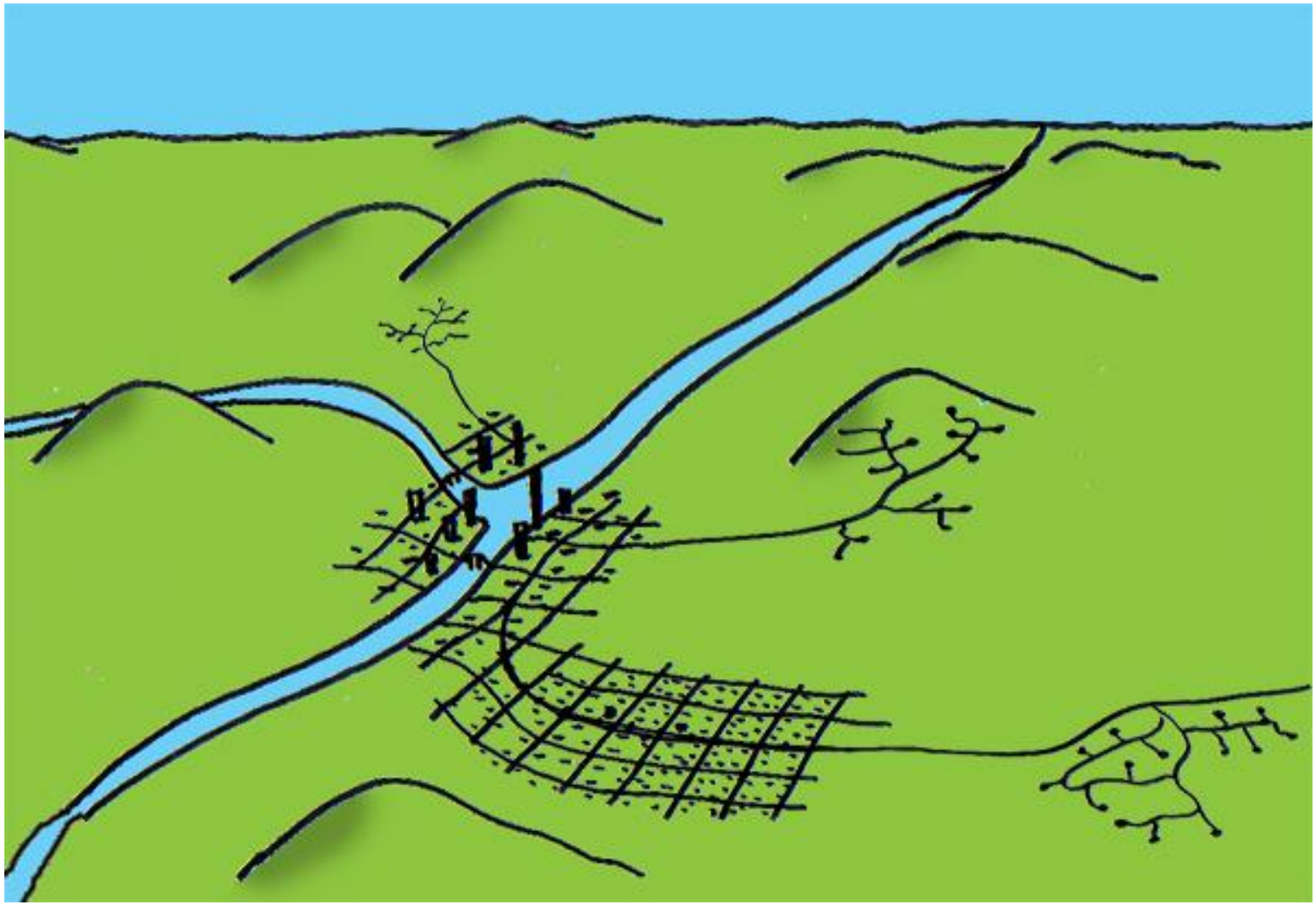




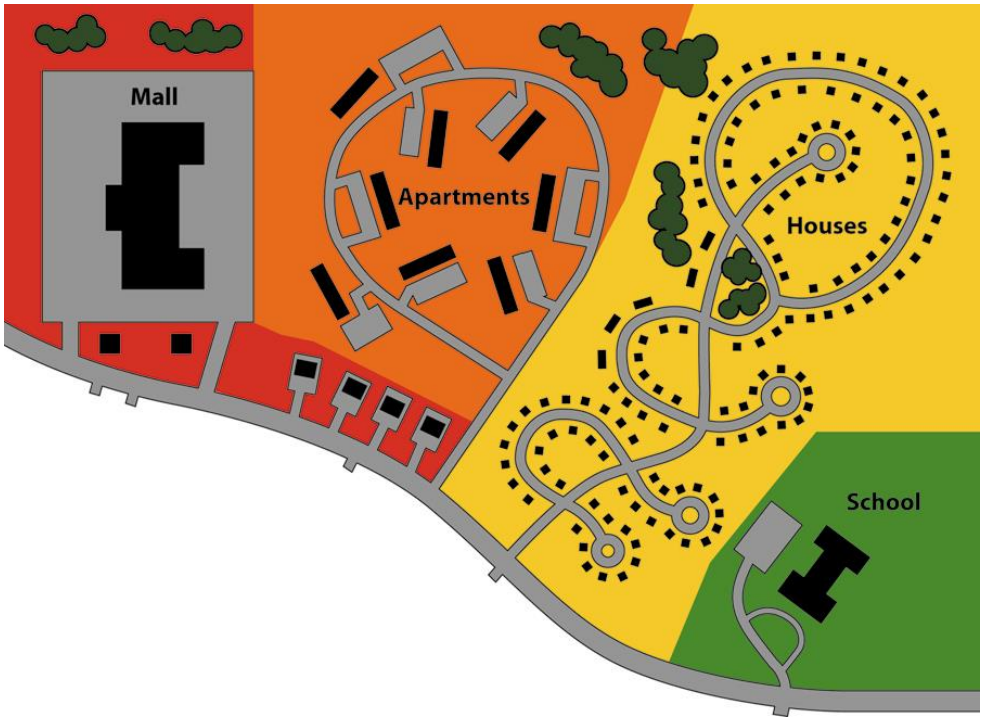


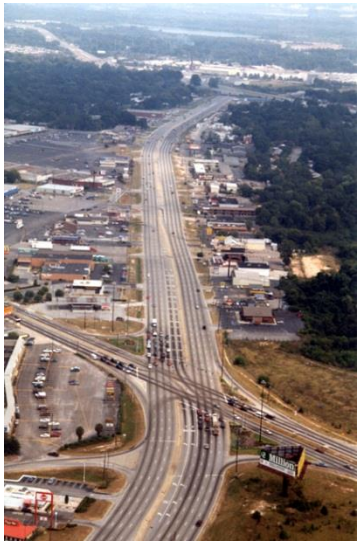


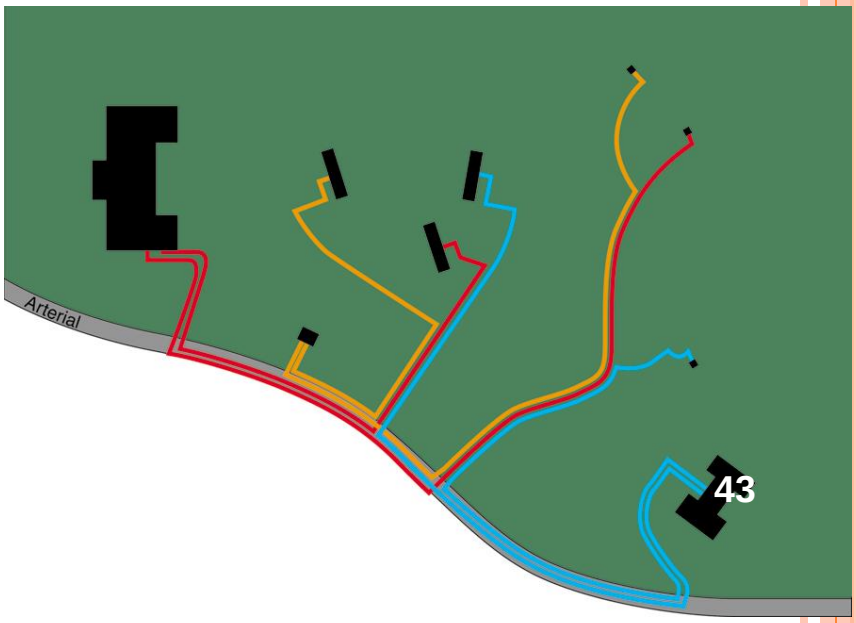


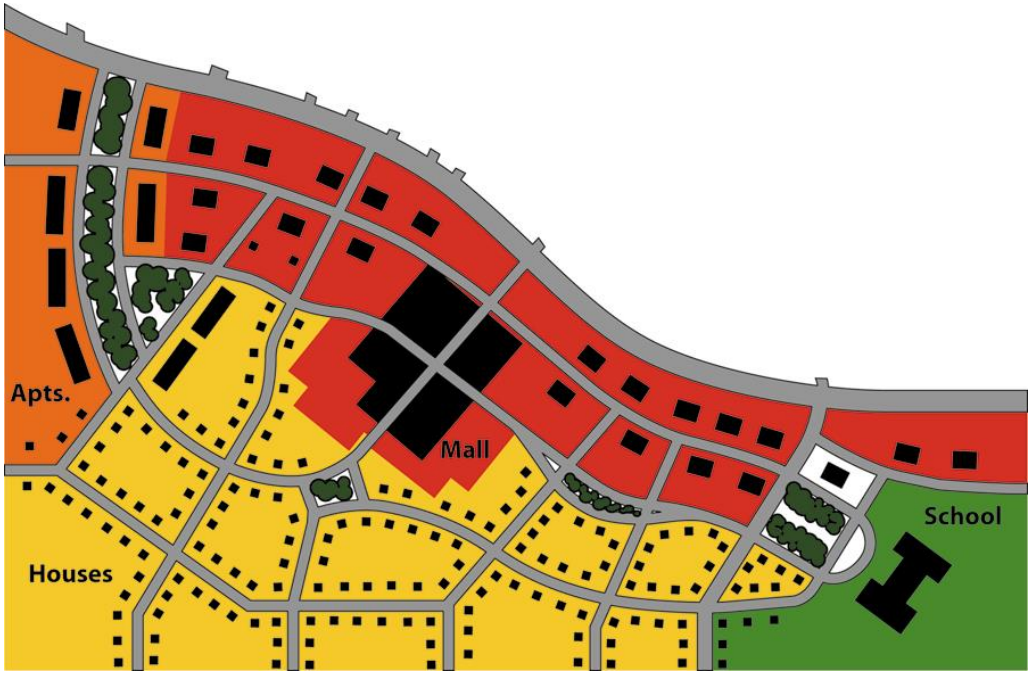


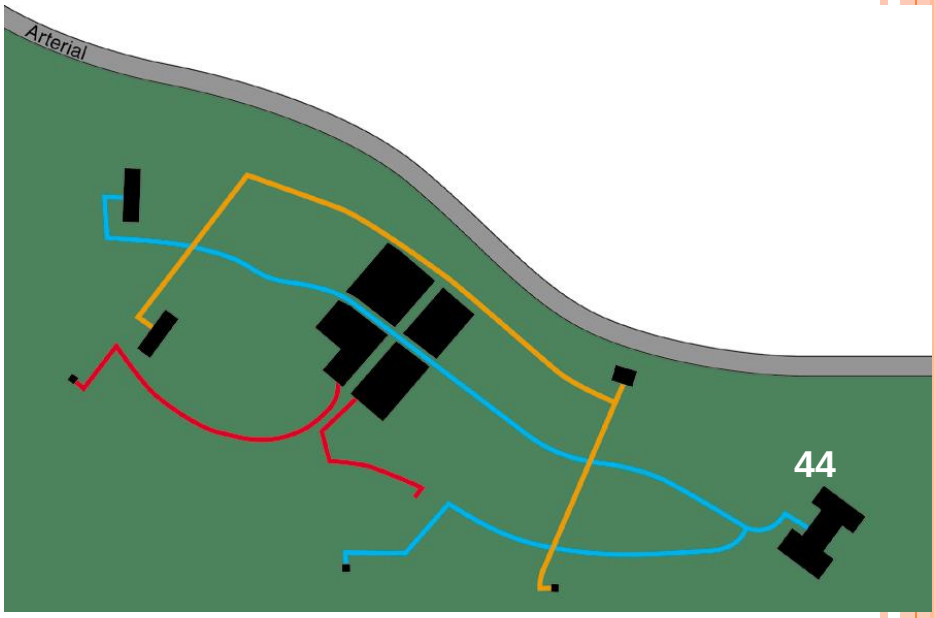
Transportation should support land use


Mall
Apartments
Houses
School




Arterial

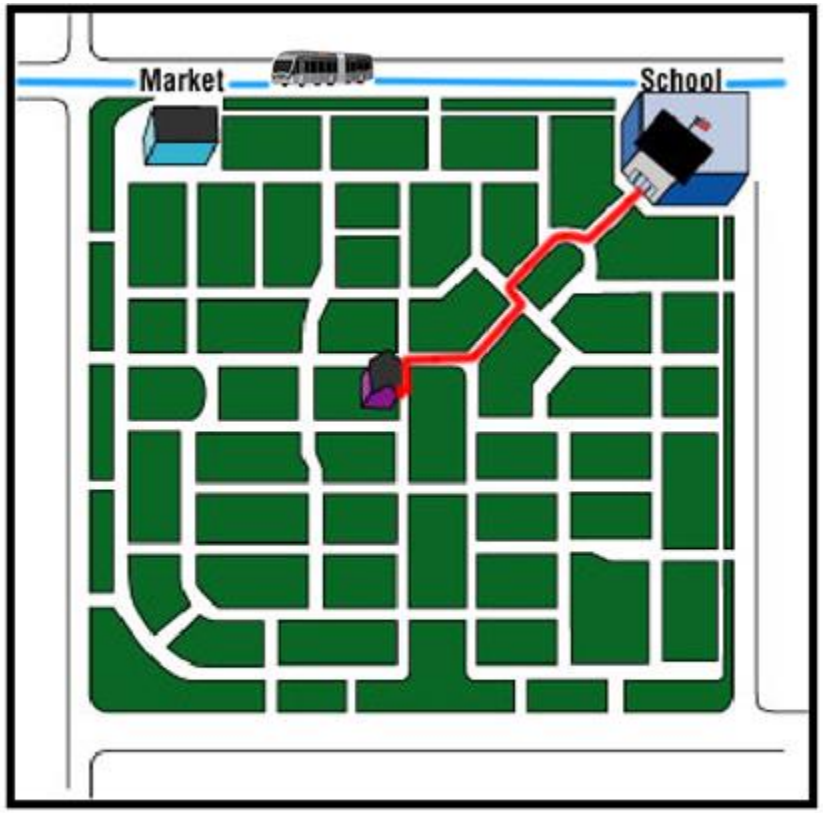

Apts.
Mall
School
Houses


Arterial


Transportation Efficient Land Use
School
Shopping
School
Home
Work
Shopping
Work
Home
Typical Suburban Land Use

Connected Streets

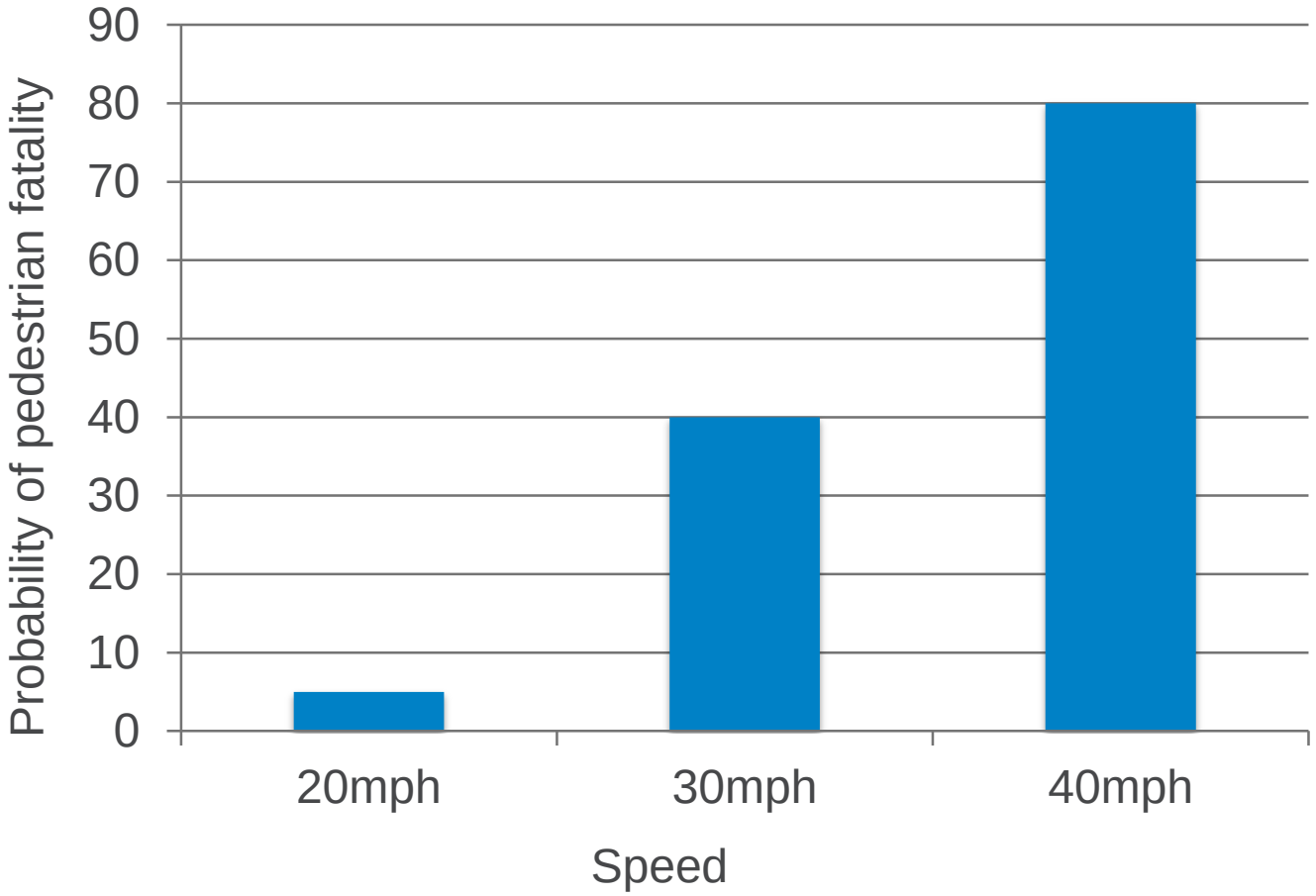
Driving-only transportation pattern



Walkable connected transporation network

Source: www.cnu.org

Slowing traffic improves safety for people walking



W.A. Leaf and D.F. Preusser, "Literature Review on Vehicle Travel Speeds and Pedestrian Injuries Among Selected Racial/Ethnic Groups," US Department of Transportation, National Highway Traffic Safety Administration (1999).

High roadway connectivity can result in:

- Reduction in travel distances for drivers
- Reduction in travel times for drivers
- Better and redundant emergency vehicle access
- More efficient public services access (mail, garbage, transit)
- Improved bicycle and pedestrian routes and accessibility
- Higher percentage mode share for transit, bicycling and walking
- Safer roads

Impacts of Transportation on Land Use

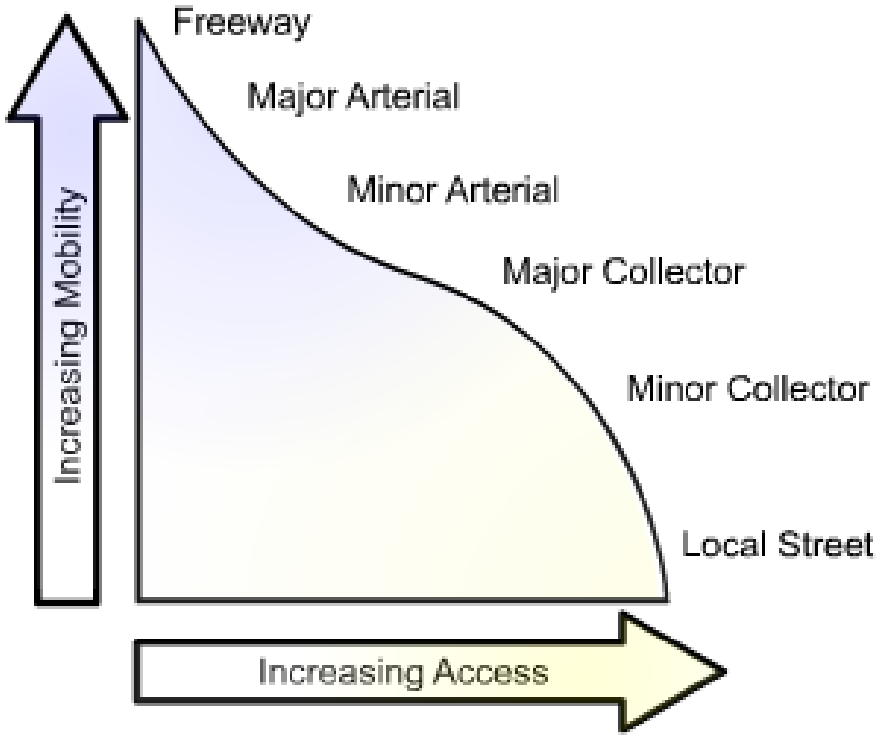
- Physical barriers
  - Fragmentation
- Noise and vibration
- Incompatible uses

How to improve Safety in Transportation and Land Use Interactions

- Integrated Planning
- Access Management
- Complete Streets
- Traffic Calming
- Road Safety Audits

Access Management

"the systematic control of the location, spacing, design and operation of driveways, median openings, interchanges, and street connections"

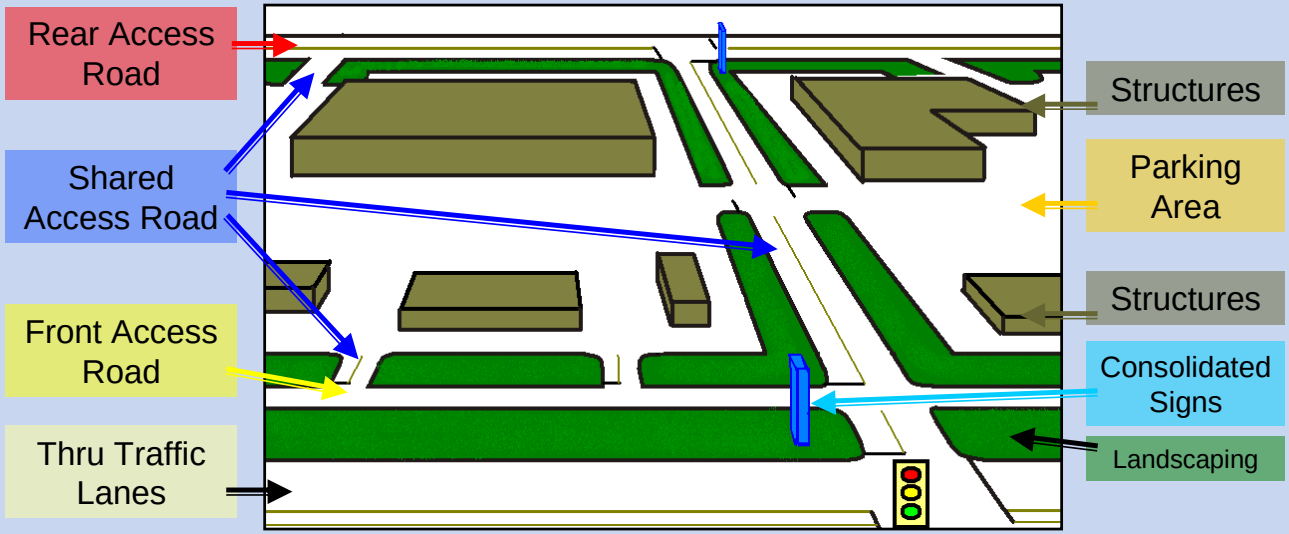


Access Management

Cost effective traffic management methods to:

- Promote the flow of traffic
- Improve safety of pedestrians & vehicles
- Improve aesthetics of roadway areas

…by managing the location, quantity, type & design of access to a roadway



Sources: Photo and Cover, MDOT Access Management Guidebook. Graphic, LSL Planning, Inc.

Mobility and Accessibility

- Mobility
  - The ability to travel
- Accessibility
  - The ability to reach desired destinations or activities

Accessibility = Mobility + Land Use

Accessibility

- Transportation System Performance
  - Quicker, more reliable, and/or lower-cost transportation alternatives provide greater accessibility
- Land Use Development Patterns
  - A more dense arrangement of land uses means greater accessibility
  - Mix of land uses, for example jobs/housing balance or proximity to retail, also influences accessibility.
- Market sheds
  - Different land use, different market area

Balancing Access and Mobility

- Different agencies may control the roadway and the parcels that it serves

- Both use and intensity of land development affect traffic generation

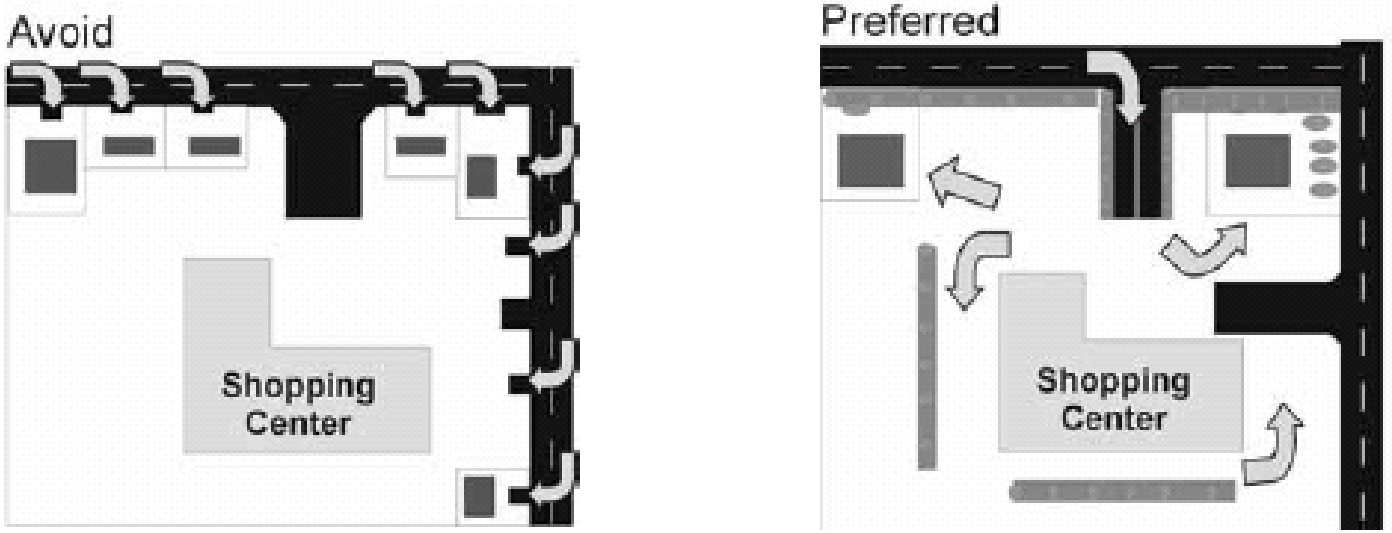
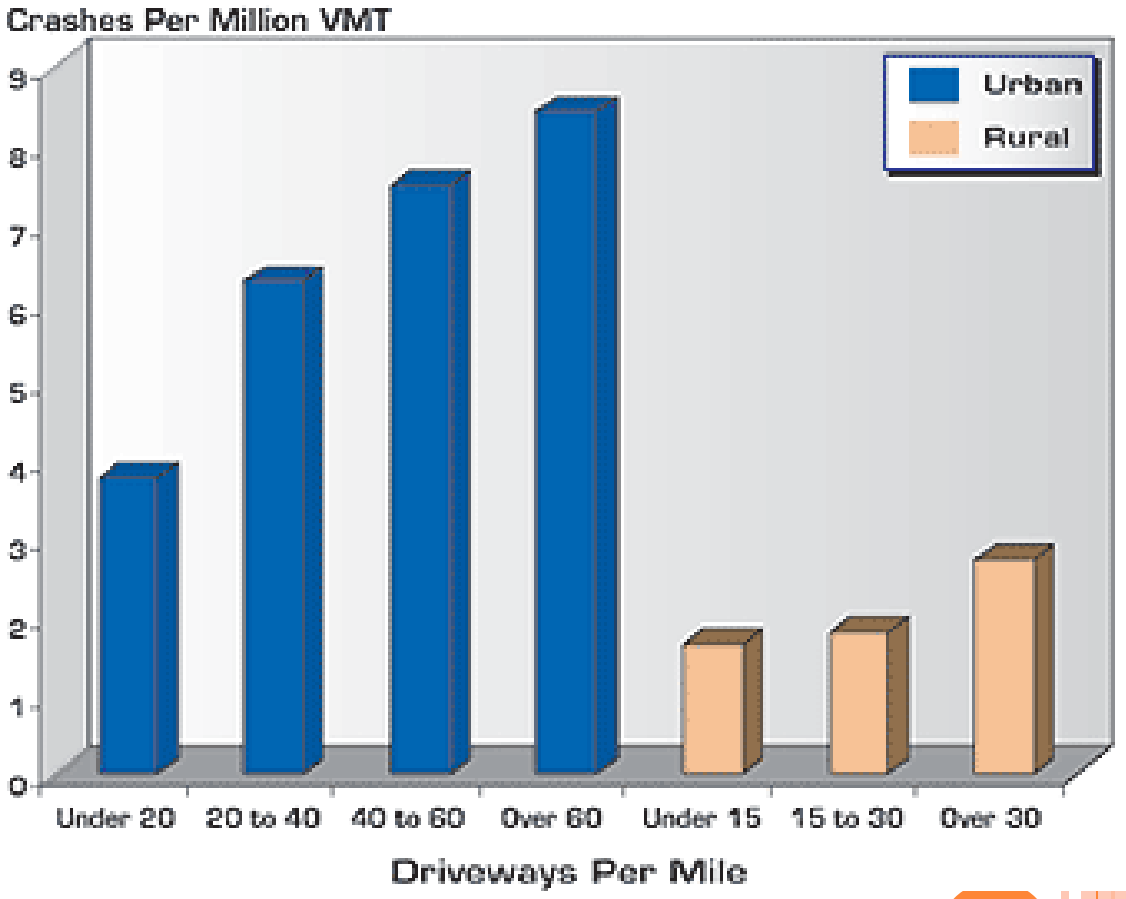


Figure 3: Promote internal access to shopping center outparcels (*6*).

Access Management

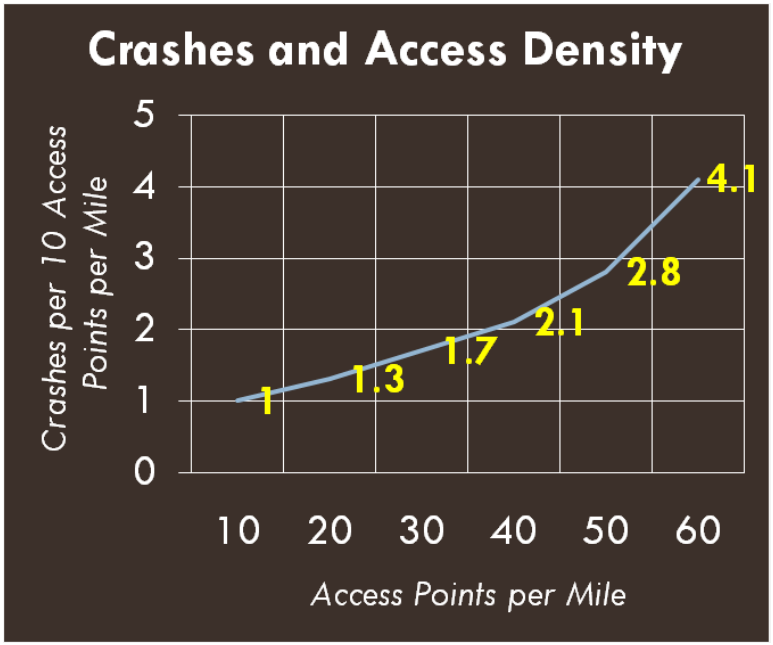
Signals Per Mile	Increase in Travel Time (%)
2	–
3	9
4	16
5	23
6	29
7	34
8	39

Signals Per Mile	Crashes Per Million VMT
Under 2	3.53
2 to 4	6.89
4 to 6	7.49
6 +	9.11



Source: FHWA Office of Operations

Benefit: Safety



Source: FHWA, MDOT Access Management Guidebook

- Access management can help reduce injuries and property damage due to crashes
- Doubling of access density from 10-20 access points per mile often results in about a 40% increase in expected crash rates*

*according to the Michigan Department of Transportation

What are Complete Streets?

Complete Streets are streets for everyone, no matter who they are or how they travel.

Complete Streets policies

Ensure that the entire right-of-way is planned, designed, constructed, operated, and maintained to provide safe access for all users

Complete Streets

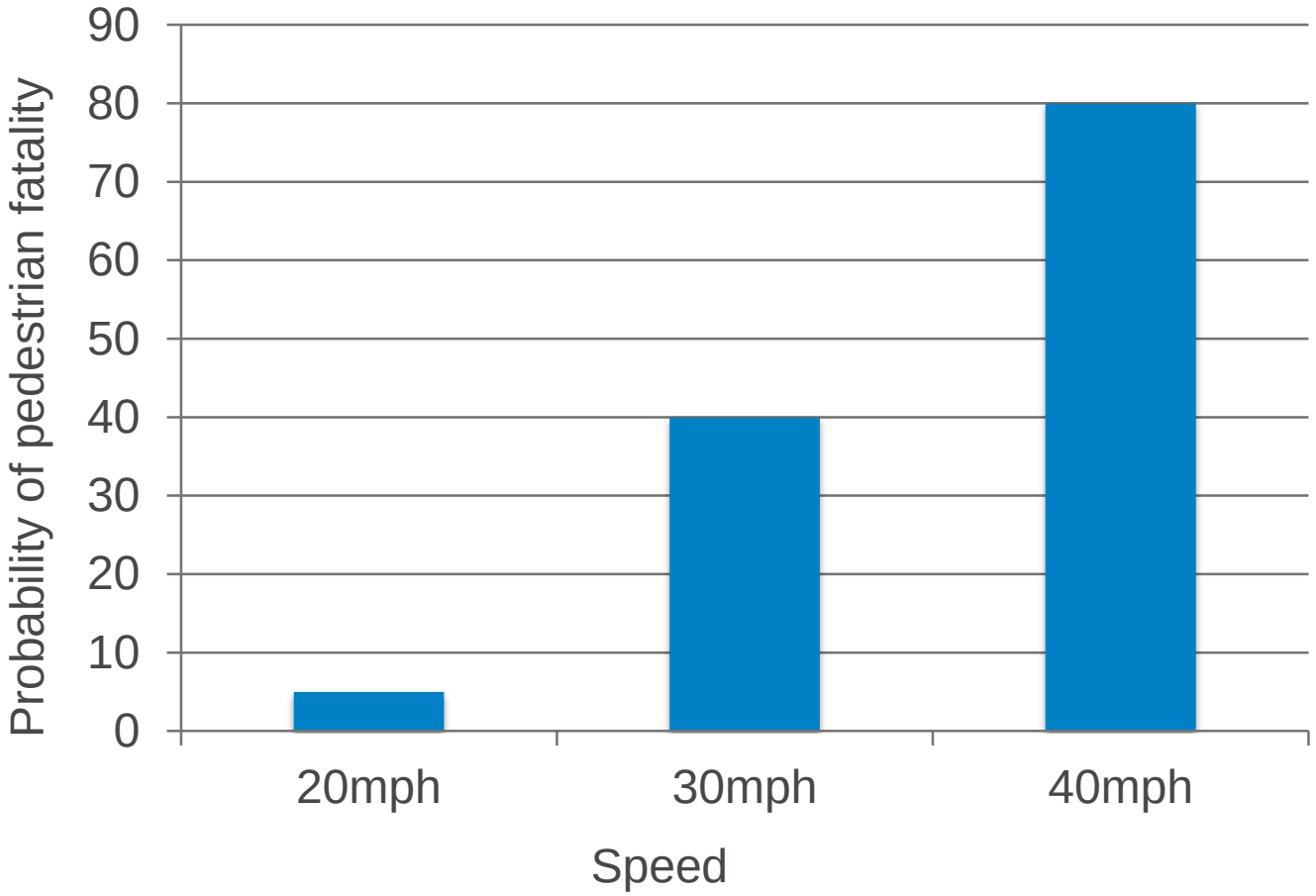
- Roadways that serve all users—vehicle drivers, pedestrians, bicyclists, transit riders and freight
- Interconnected, multimodal networks
- Safe for all ages and abilities
- Vary by context (e.g., urban/rural)
- Based on community desires
- Outcome of good planning and design

Complete Streets May Include:

- Wider sidewalks
- Narrower travel lanes, traffic calming features
- Crosswalks, curb ramps, accessible pedestrian signals
- Median islands
- Universal design features
- Bike lanes
- Wide paved shoulder
- Bus stops, shelters, bus pull outs
- Curb extensions

BENEFITS: SAFETY

SLOWING TRAFFIC IMPROVES SAFETY FOR PEOPLE WALKING



W.A. Leaf and D.F. Preusser, "Literature Review on Vehicle Travel Speeds and Pedestrian Injuries Among Selected Racial/Ethnic Groups," US Department of Transportation, National Highway Traffic Safety Administration (1999).

Pedestrian crashes

- **88%** with sidewalks
- **69%** with hybrid beacon
- **39%** with medians
- **29%** with road conversions

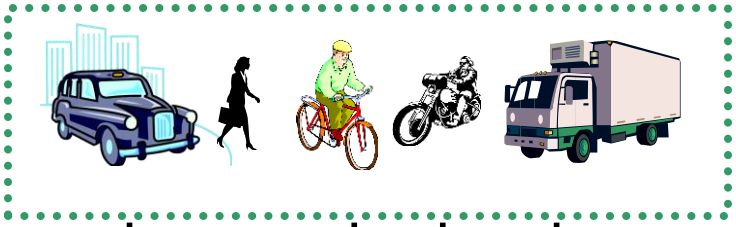
Road Safety Audits

- An examination of a future or existing roadway, in which an independent, qualified auditor(s) reports on potential safety issues

- Usually done by an interdisciplinary team

A ROAD SAFETY AUDIT…

- considers the safety of all road users



- considers interactions at the borders or limits of the project
- examines the interaction of project elements
- may proactively consider mitigation measures

Traditional Road Safety Review versus Road Safety Audit

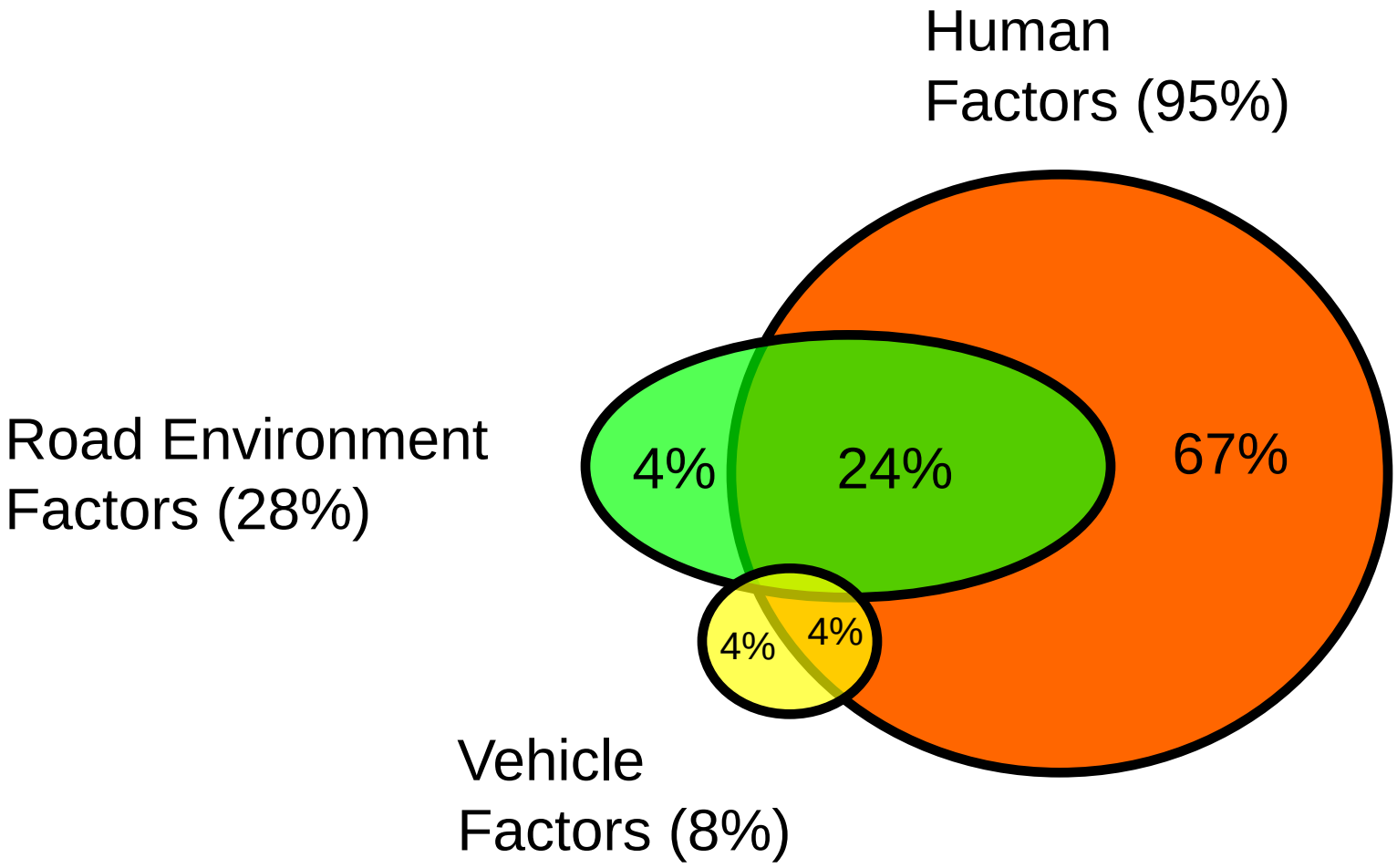
Traditional Road Safety Review

- reactive
- in-house team
- standards compliance

Road Safety Audit

- proactive
- independent team
- field reviews
- comprehensive, with human factors

WHY DO WE NEED RSAS?



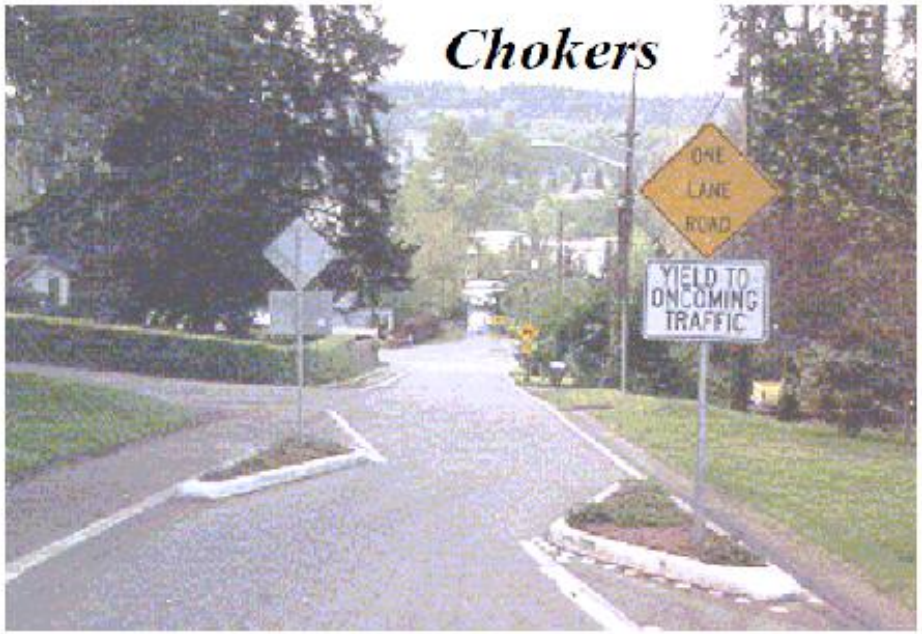
TYPICAL REPORTED CRASH CAUSES

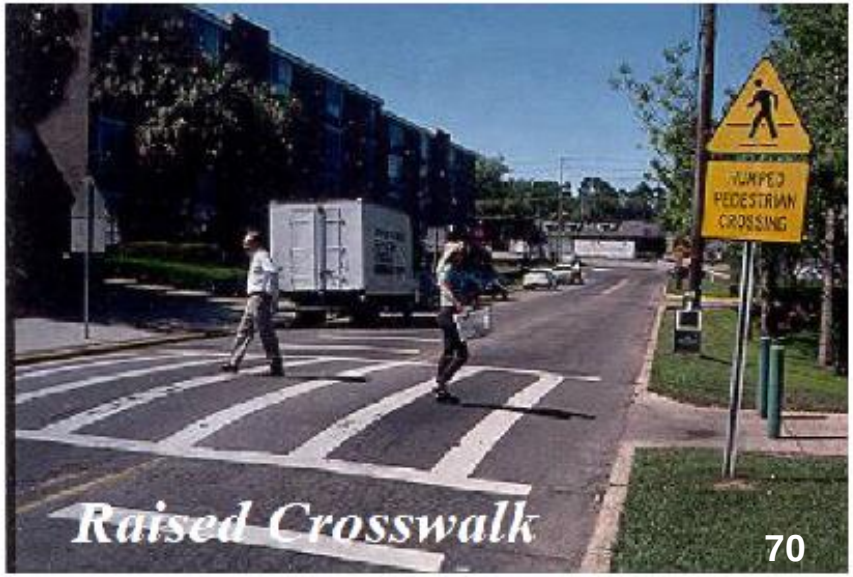
RSA Benefits

- Reduce the number and severity of crashes
- Promote awareness of safe practices
- Process to identify and address problems
- Considers human factors and multimodal issues
- Low cost

Traffic Calming

- "Traffic calming" — generally self-enforcing, physical design measures designed to force the driver to slow down — is increasingly being used to alter driver behavior and improve safety conditions.





Pucher: Cycling for Everyone

Pucher: Cycling for Everyone

Other Traffic Calming Tools

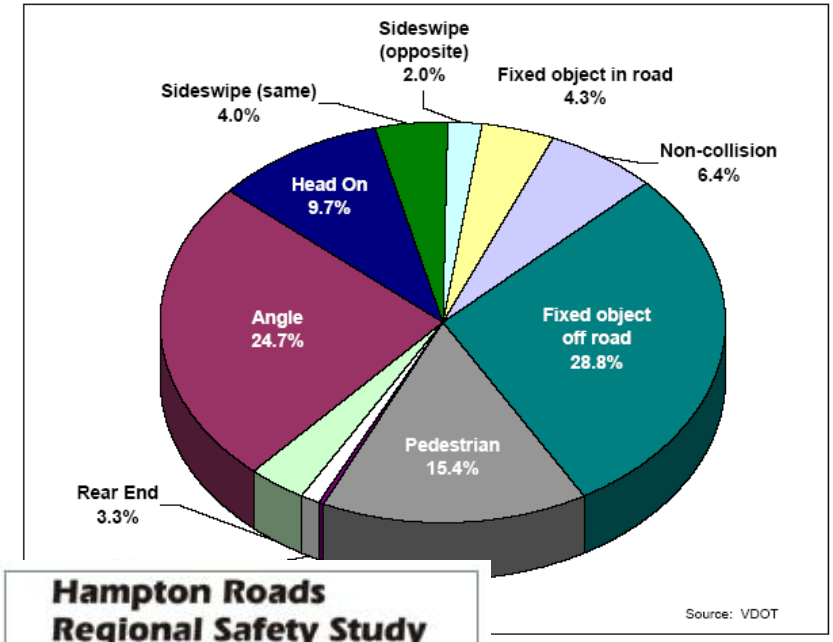
- Diagonal Parking
- Changing One-Way Streets to Two-Way
- Widening Sidewalks/Narrowing Streets and Traffic Lanes
- Roundabouts
- Tight Corner Curbs
- Diverters
- Rumble Strips and Other Surface Treatments
- Landscaping
- Bus turnouts

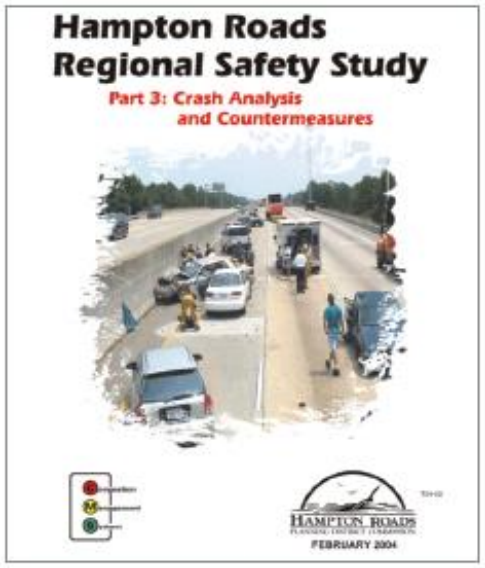
Case Studies

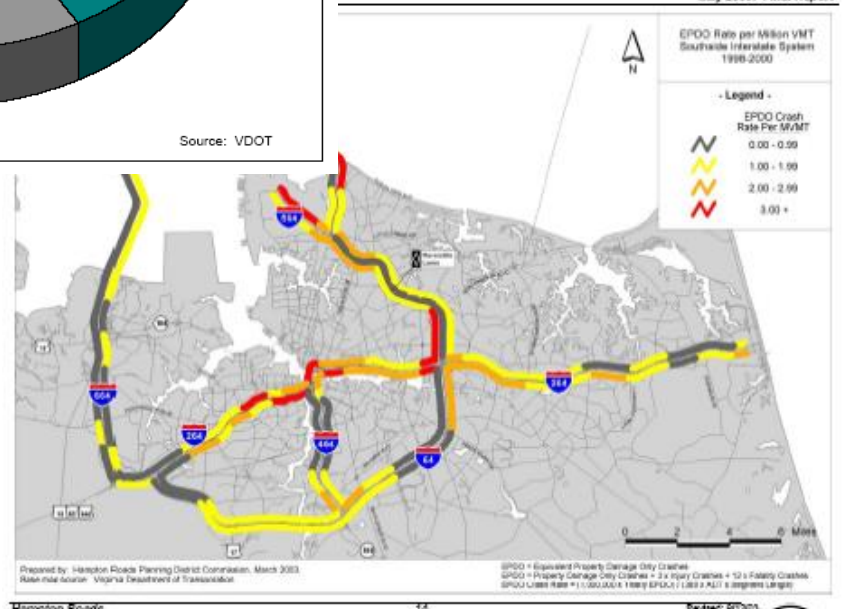
- Norfolk, VA or Charlottesville, VA
- Poughkeepsie, NY
- Tampa, FL

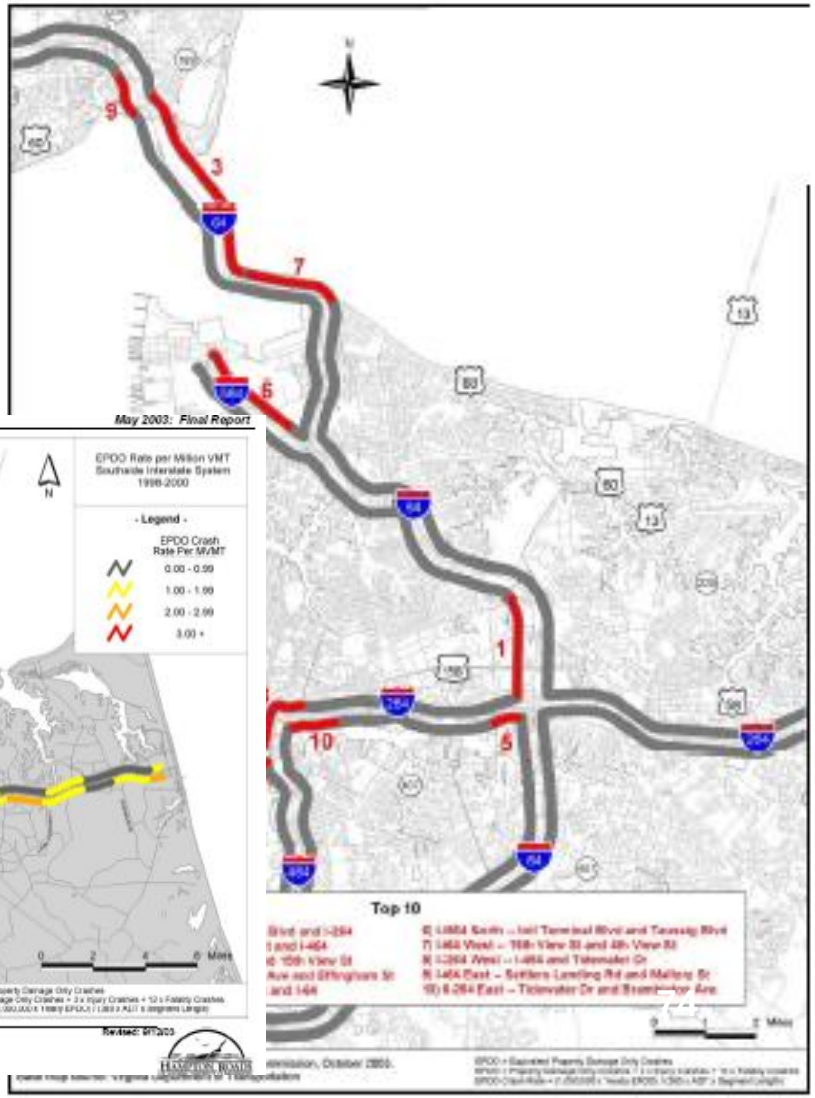
Regional Safety Study – Norfolk, VA

FIGURE 21 – Hampton Roads Traffic Crash Fatalities by Crash Type, 1998-2000



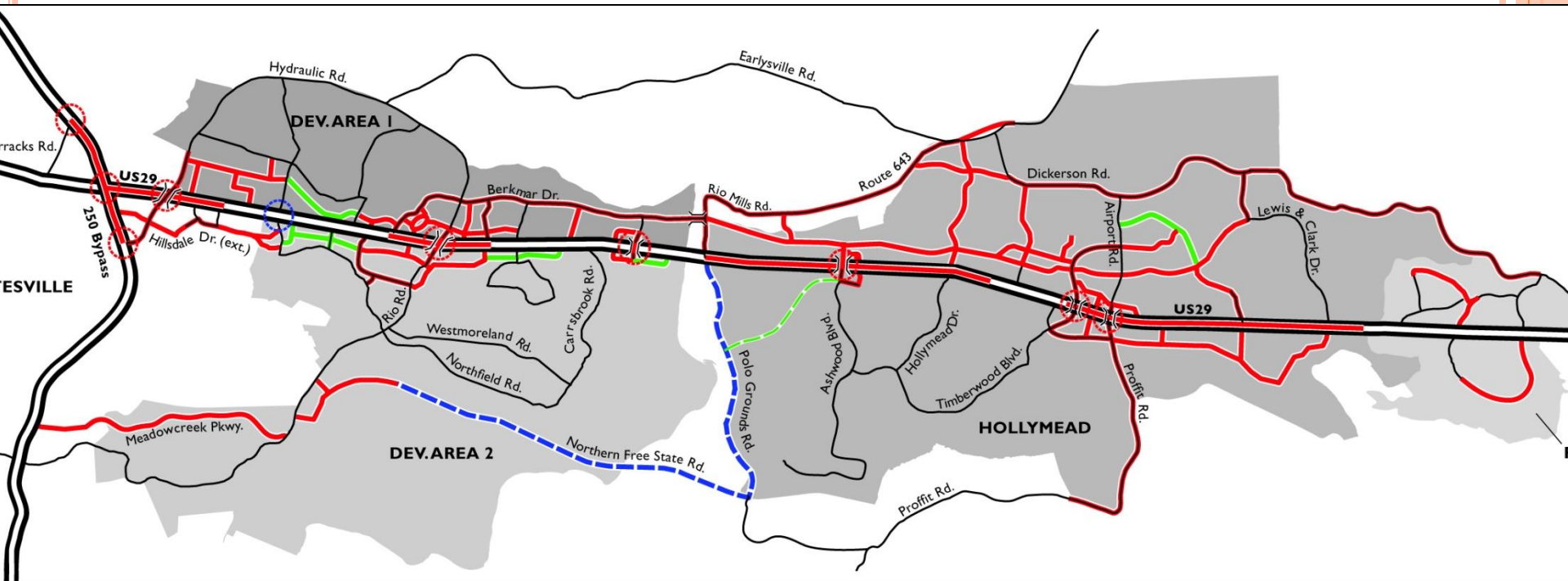






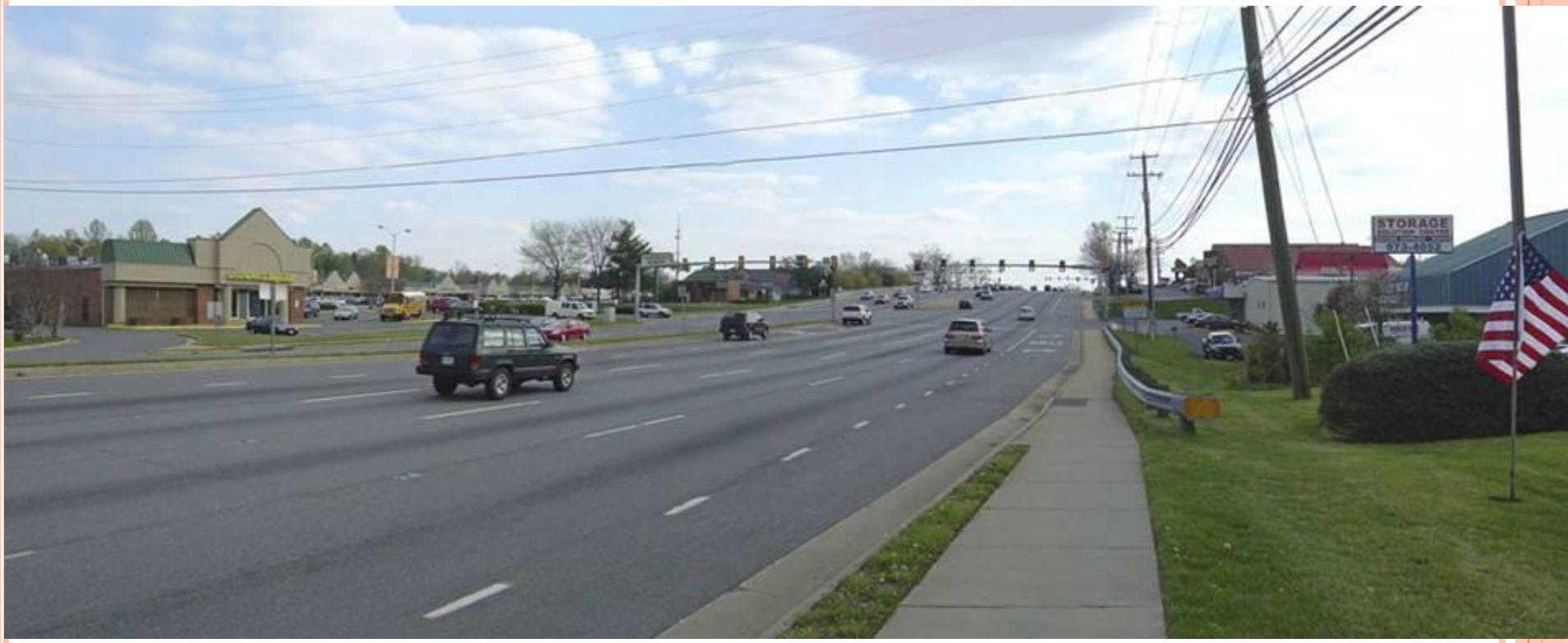
Charlottesville, Virginia

- Multimodal corridor plan integrated with place-based county comprehensive master plan
- Parallel network connections built as development occurs, help remove local traffic from through corridor
- Connectivity across US 29 with urban grade separations
- Framework for bicycle and trails network, supports transit



Charlottesville, Virginia

US29 facing south toward Rio Road



Typical suburban roadway with auto-oriented shopping

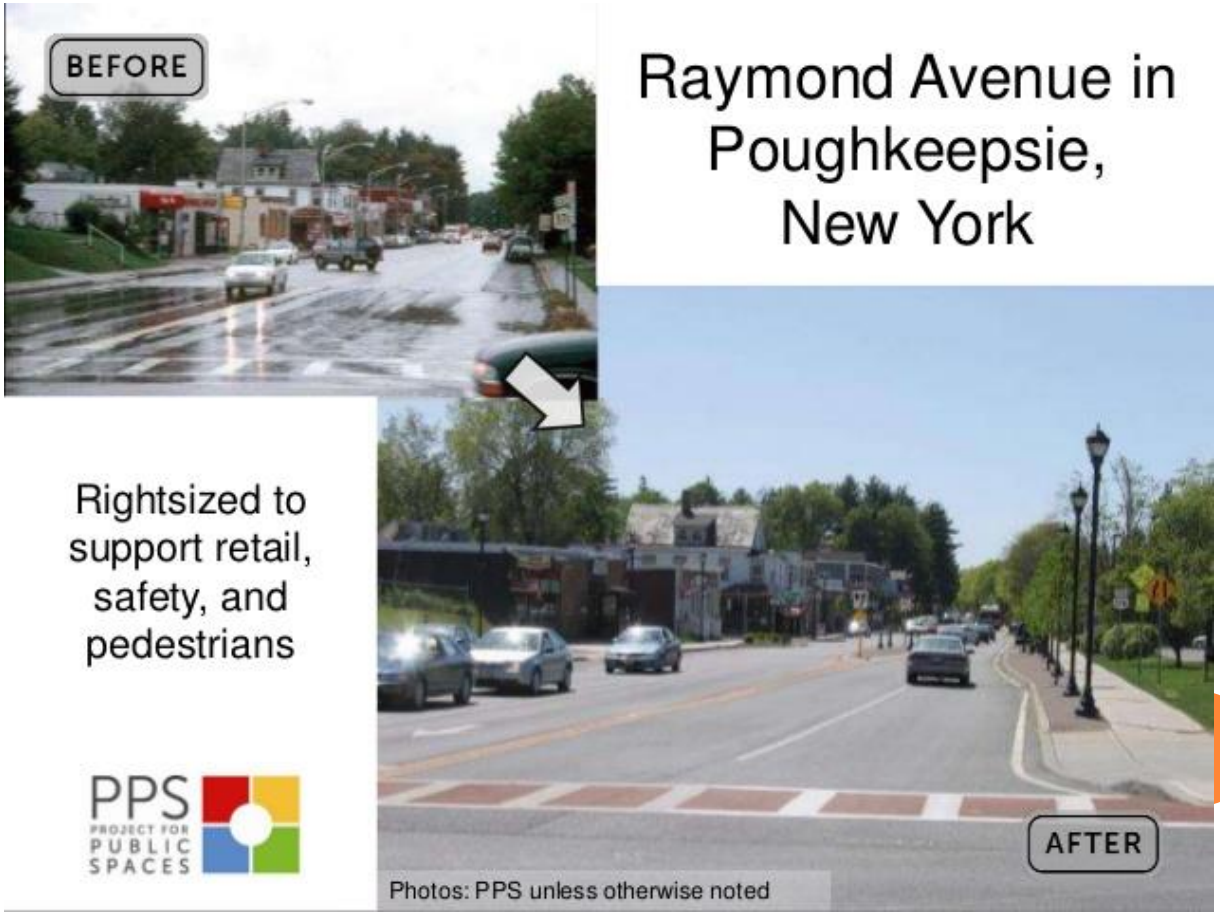
Charlottesville, Virginia

US29 facing south toward Rio Road

Urban grade separation (in distance) and multimodal boulevard
Mixed-use infill development on existing aging shopping centers

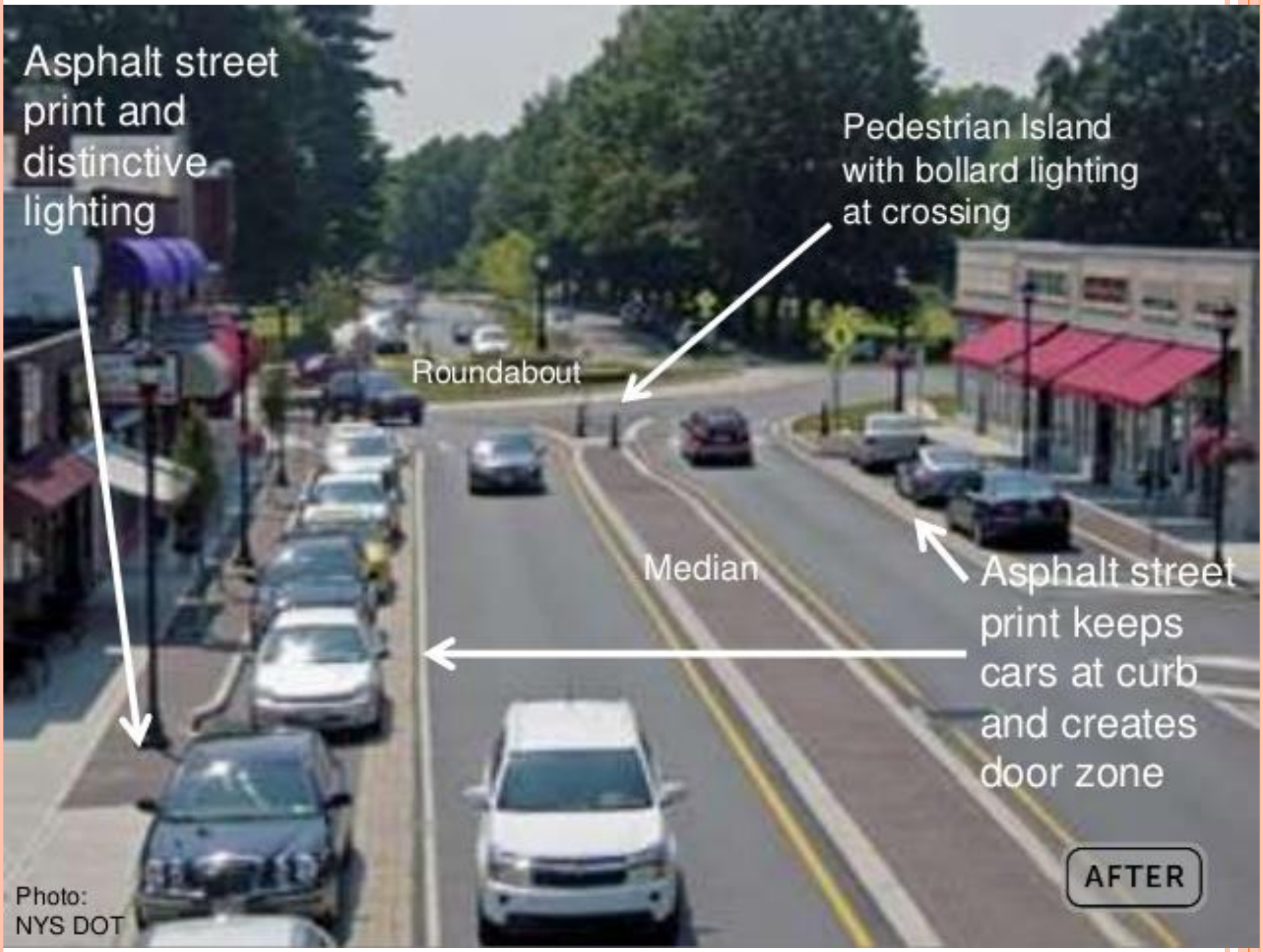
Raymond Avenue: Rightsizing Improved Safety and Pedestrian Experience

- Poughkeepsie, NY
- 4 → 2 Lane Configuration + Roundabouts and Pedestrian Infrastructure



Raymond Avenue: Rightsizing Improved Safety and Pedestrian Experience

- One lane removed in each direction, such that the street was reduced from four to two lanes.
- Two roundabouts constructed. Each replaced a traffic signal.
- Sidewalks and parking were made more consistent along the corridor.
- Neckdowns were added at pedestrian crossings.
- A center median with plantings and trees, with pedestrian refuges
- Mid-block crosswalk changed.
- Colored asphalt prints installed.


Asphalt street print and distinctive lighting
Pedestrian Island with bollard lighting at crossing
Roundabout
Median
Asphalt street print keeps cars at curb and creates door zone
AFTER
Photo: NYS DOT

Raymond Avenue: Rightsizing Improved Safety and Pedestrian Experience

- Accidents decreased more than 50%
- Vehicle speeds declined by about 24%
- Corridor travel time increased by about 7%.
- Traffic delays decreased 56% at the roundabouts.
- Vehicle traffic decreased 8.8%. Some parallel streets saw increases in traffic, while others saw a reduction or no change.

Improving Safety for All Users: Rightsizing Nebraska Avenue

- Tampa, FL
  4 Lane → 3 Lane Conversion + Bike Lanes

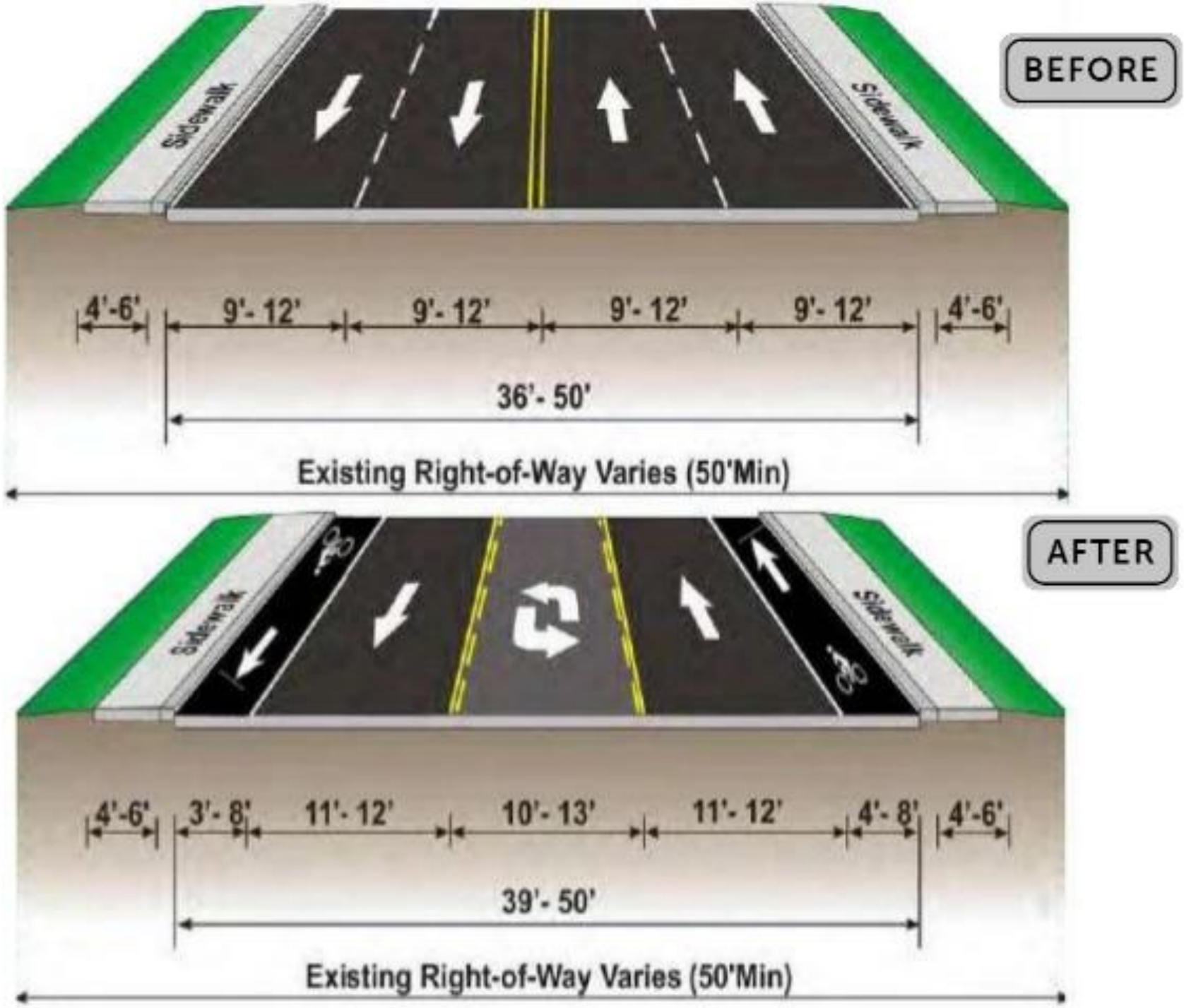
Nebraska Avenue in Tampa, FL

Photos Credit: Florida DOT

PPS PROJECT FOR PUBLIC SPACES

Improving Safety for All Users: Rightsizing Nebraska Avenue in Tampa, Fl

- Road converted from 4 to 3 lanes
  - Center lane median and two-way left turn lane
- Bike lanes added to increase bicyclists' safety.
- Bus bays added to improve bus loading and unloading.
- Midblock crossing added
- Traffic and pedestrian signals upgraded



Graphic Credit: Florida DOT

Improving Safety for All Users: Rightsizing Nebraska Avenue in Tampa, Fl

- Frequency, rates, and severity of crashes on the corridor have decreased from above average to below average for its road type.
- Crash rate decreased from 8.5 to 3.3 crashes per MVMT
- 45% reduction in fatal/incapacitating crashes per year
- Sideswipe crash rate was reduced 90 % from 0.78 crashes per MMVT to 0.08
- Bike crashes were reduced from 5.0 a year to 2.7 a year.
- Pedestrian crashes were reduced from 7.0 to 2.7 per year.
- Traffic volumes decreased

Discussion