Which option is more desirable?

1. High mobility and high accessibility
2. Low mobility and high accessibility
3. High mobility and low accessibility
4. Low mobility and low accessibility
- **Density** (development density, employment density, and population density)
- **Diversity** (dwelling type, jobs-housing/population ratio, land-use mix)
- **Design** (block size or type, intersection and street density, street pattern (connectivity, direct routes, ...), intersection and street size or type, facilities for different travel modes)
- **Destination accessibility** (location (distance or travel time to home, CBD or job) and accessibility by mode)
- **Distance to public transport**
- **Demand management** (e.g., TOD or other land use policies for encouraging alternative travel modes)
- **Demographics characteristics**
  - Availability and quality of green and natural spaces
• **Density** (development density, employment density, and population density)

• **Diversity** (dwelling type, jobs-housing/population ratio, land-use mix)

• **Design** (block size or type, intersection and street density, street pattern (connectivity, direct routes, ...), intersection and street size or type, facilities for different travel modes)

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• **Demand management** (e.g., TOD or other land use policies for encouraging alternative travel modes)

• **Demographics** characteristics

• Availability and quality of **green and natural spaces**

---

**Smart Growth**

• **Density**
  Higher-density

• **Growth pattern**
  Compact

• **Scale**
  Human scale

• **Transport**
  Multi-modal transportation

• **Connectivity**
  Highly connected roads, sidewalks and paths

• **Street design**
  Accommodate a variety of activities

• **Planning process**
  Various stakeholders

• **Public services**
  Local and smaller

• **Public space**
  streetscapes, pedestrian areas, public parks and facilities
Walking
Traffic calming

- Safety
- Reduce speed
- Livability

Depend on road hierarchy

Chicane: Vancouver, Canada
(Credit: Richard Drdul)
Slower traffic speed

Roundabout
  • Safety
  • Improve traffic flow
  • Landscape

• Connector and local
• School and shopping
Curb radii

- Less than 8 m
- Minimum 3-4.5m
- One way 1.5m

- High visibility
Driveway

- Min width 3.6m
- Min distance from intersections 9m

*Typical Detail of Raised Driveway at Building Entries*
Street crossing
Curb extension
(shorter crossing)

• Where there is on-street parking
• Free obstacle
• No bike lane obstruction
• Consider large vehicles
Street crossing

- High pedestrian volume
- Near schools
- Safe and comfortable
- Connected pedestrian network
**Street crossing**
- Midblock crossing
- Median
- Corner island

- Safety
- Reduce conflicts
- Visibility

**Median**
- Max crossing 18m
- Min width 1.8m and 3m with landscape
Curb ramp
Buffer and barrier
Buffer and barrier
Social spaces
Landscape and trees

- Shade
- Buffer
- Reduce runoff

- A clear width of 1800 x 1800 mm is needed to be left free of concrete, in order to allow access of nutrients to the roots of trees.
- Tree gratings need to be finished at the same level as surrounding pavement – allowing people to walk over them, while still allowing water, air and nutrients to access the roots
- Trees should be at least 6m far from intersections
Pavement
Marking
Marking
Signing

- Orientation – way finding (street signs)
- Availability of public transit nearby (transit signs)
- Guiding street flow (traffic signs)
- Announcing about city’s specific features or attractions (information signs)
- Conveniences (toilet, dustbin, hawker signs)
Minimum width for wheelchair
Accessible surface without vibration

The following conditions were observed to cause changes in level:

• Buckled bricks
• Cracks
• Curbs without ramps
• Drainage grates
• Grooves in concrete
• Icy path due to frost
• Lips at curb ramp frames
• Railroad tracks
• Roots
• Small steps
• Tree grates
• Uneven transitions between streets, gutters, and ramps
Slope

5% counter slope (gutter)

8% slope (curb ramp)

2 percent cross slope
915 mm (36 in) minimum

2 percent cross slope maximum
Location of furniture
Visible walk
Elderly

- Attractive trees and plants
- Clean and well-maintained surface
- Good space for chatting
- No obstacle
- Enough seats
- Enough social space like cafe
- Toilets
- Ramp with handrail
- Weather protection
- Wide footways and easy transition at level change
Children

• Space for playing
• Transit stops near schools
• Double curb line for pedestrian and emergency service near schools
• Bicycle paths and racks near school entry
Complete street

SUSTAINABLE STREETS for CHICAGOLAND

multi-modal, multi-functional and totally fabulous
Complete street
Complete street

- Improved Access Management
- Remove Visual Clutter
Complete street
Complete street
Complete street
Complete street
Complete street
Complete street
Complete street
Complete street
Complete street
Walkable cities use ..................to maximize walking.

Join: vevox.app ID: 195-774-858
Cycling
### CORE DESIGN PRINCIPLES

<table>
<thead>
<tr>
<th>Accessibility for all</th>
<th>Coherent</th>
<th>Direct</th>
<th>Safe</th>
<th>Comfortable</th>
<th>Attractive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DO</strong> Cycle networks should be planned and designed to allow people to reach their day to day destinations easily, along routes that connect, are simple to navigate and are of a consistently high quality.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DO</strong> Cycle routes should be at least as direct - and preferably more direct - than those available for private motor vehicles.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DO</strong> Not only must cycle infrastructure be safe, it should also be perceived to be safe so that more people feel able to cycle.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DO</strong> Comfortable conditions for cycling require routes with good quality, well-maintained smooth surfaces, adequate width for the volume of users, minimal stopping and starting and avoiding steep gradients.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DO</strong> Cycle infrastructure should help to deliver public spaces that are well designed and finished in attractive materials and be places that people want to spend time using.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **DON'T** Neither cyclists or pedestrians benefit from unintuitive arrangements that put cyclists in unexpected places away from the carriageway. |
| **DON'T** This track requires cyclists to give way at each side road. Routes involving extra distance or lots of stopping and starting will result in some cyclists choosing to ride on the main carriageway instead because it is faster and more direct, even if less safe. |
| **DON'T** Space for cycling is important but a narrow advisory cycle lane next to a narrow general traffic lane and guard rail at a busy junction is not an acceptable offer for cyclists. |
| **DON'T** Uncomfortable transitions between on- and off carriageway facilities are best avoided, particularly at locations where conflict with other road users is more likely. |
| **DON'T** Sometimes well-intentioned signs and markings for cycling are not only difficult and uncomfortable to use, but are also unattractive additions to the street scene. |

---

The UK Department for Transport: Cycle Infrastructure Design
### TYPES OF FACILITIES

#### USER DIMENSIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>Width (mm)</th>
<th>Length (mm)</th>
<th>Min. turning circle (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Outer radius</td>
</tr>
<tr>
<td>Conventional bicycle</td>
<td>700</td>
<td>1800</td>
<td>1650</td>
</tr>
<tr>
<td>Tandem</td>
<td>700</td>
<td>2400</td>
<td>3150</td>
</tr>
<tr>
<td>Bicycle and trailer</td>
<td>800</td>
<td>2700</td>
<td>2650</td>
</tr>
<tr>
<td>Cargo trike</td>
<td>1200</td>
<td>2600</td>
<td>2300</td>
</tr>
</tbody>
</table>
TYPES OF FACILITIES

Bike Lanes

- Fully kerbed cycle tracks
- Stepped cycle tracks
TYPES OF FACILITIES

Bike Lanes

Bus Stops
**Two-way cycle tracks**

**Opportunities**
Where buildings, active uses and side roads are entirely or largely on only one side

Where side road access may be reconfigured to take place largely on one side

Arterial roads such as wide dual carriageways with infrequent crossings

**Challenges**
Can be unintuitive and generate risks associated with motorists and pedestrians

Potential safety concerns at side roads and accesses

Complex transitions from one way, with-flow to two-way cycle provision

Connectivity for cyclists to and from the track can be difficult to manage

---

**Bike Lanes**

Fully kerbed cycle tracks
Stepped cycle tracks
Which option is better to encourage walking and cycling?

1. Permanent improvements to have complete streets

2. Temporary improvements to enhance safety, accessibility, and equity

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TYPES OF FACILITIES

**Bike Lanes**

- Light segregation
- Pop-up bike lane
- Quick-build street design
TYPES OF FACILITIES

Bike Lanes

Cycle lanes
TYPES OF FACILITIES

Bike Lanes

Mixed traffic streets
TYPES OF FACILITIES

Bike Lanes

cycling and pedestrians
TYPES OF FACILITIES

Bike Lanes

Cycle lanes between other traffic lanes
TYPES OF FACILITIES

Bike Lanes

Off road cycle paths
TYPES OF FACILITIES

Intersections

Protected Signalised intersection
TYPES OF FACILITIES

Intersections

Signal prioritised
TYPES OF FACILITIES

Intersections

Unsignalized intersections
TYPES OF FACILITIES

Intersections

Roundabouts
TYPES OF FACILITIES

Cycle parking

Short stay parking
TYPES OF FACILITIES

Cycle parking

Long stay parking
TYPES OF FACILITIES

Signs and markings
TYPES OF FACILITIES

Micro-mobility

Public transport integration
Public Transport

➢ Reasons and benefits

• To reduce
  Congestion
  Energy consumption
• To improve
  Health and safety

• To save
  Time
  Fuel
• To reduce
  Air and noise pollution
Public Transport

Key Points

Operations
- Reliability
- Frequency and timetabling
- Network/routing
- Coordination and integration / connectivity
- Customer / user interface
- Capacity management
- Information

Accessibility
- Disabled
- Underage / Children
- Senior Citizens / Elderly / Parents with prams
- Accessibility to urban / commercial / industrial land use
- Accessibility to remote areas
Public Transport

Key Points

**Infrastructure**
- Park-n-Ride
- Terminals / shelters / bus stops / waiting areas
- Priority lane
- Fare / ticket machine
- On-board priority seating

**Policy and Regulations**
- Fare structure
- Network design
- Budgetary support
- Sustainable transportation
- Master plan
- Role of local government
Public Transport

Components of an Urban Transport System
# Public Transport

➢ **Mass Transit System**

<table>
<thead>
<tr>
<th>Transit Mode</th>
<th>Commuter Rail</th>
<th>Metro</th>
<th>Monorail</th>
<th>LRT</th>
<th>BRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seated Capacity</td>
<td>90-185 per car</td>
<td>60-80 Per Car</td>
<td>25 - 45 Per Car</td>
<td>65-85 Per Car</td>
<td>40 Standard; 75 Articulated; 125 double articulated</td>
</tr>
<tr>
<td>Total Capacity</td>
<td>-</td>
<td>100 – 250 per car</td>
<td>50 - 100 per car</td>
<td>75 – 225 per car</td>
<td>50 – 100 Standard</td>
</tr>
<tr>
<td>Average Speed</td>
<td>40-70 kmph</td>
<td>25-55 kmph</td>
<td>25-40 kmph</td>
<td>25-50 kmph</td>
<td>25-50 kmph</td>
</tr>
<tr>
<td>Headways</td>
<td>-</td>
<td>3 min</td>
<td>2 min</td>
<td>2 min</td>
<td>1 min</td>
</tr>
<tr>
<td>Passenger Throughput PPHPD</td>
<td>Up to 75,000</td>
<td>40,000 - 60,000</td>
<td>Up to 20,000</td>
<td>20,000 (At grade)</td>
<td>5,000 – 8,000 (with articulated buses and overtaking facilities)</td>
</tr>
<tr>
<td>Min. Curve Radius</td>
<td>50 m</td>
<td>150 m</td>
<td>Elevated -50 m</td>
<td>At Grade - 25 m Elevated LRT – 100m</td>
<td>25 m</td>
</tr>
<tr>
<td>Implemented Cities (International)</td>
<td>Moskow, Jakarta, Johannesburg, Buenos Aires</td>
<td>Bangkok, Kuala Lampur, Mexico City, Cairo</td>
<td>Tokyo, Kuala Lampur, Sydney, Seattle</td>
<td>Hong Kong, Shanghai, Kuala Lumpur</td>
<td>Istanbul, Taipei, Bogota, Curitiba, Pitts Adelaide</td>
</tr>
</tbody>
</table>
Public Transport

BRT

Curitiba, Brazil
Public Transport ➢ Multi-Modal Integration

Walking, bicycling – bus (feeder mode) – rail system

- Maximizing the public transport usage
- Increase the public transport attraction
- Reducing the time of transfers
- Reducing the costs
- Increase the public transport coverage
- Reduce the energy consumption
- Reduce emissions
Public Transport

Level of Integration

➢ Multi-Modal Integration

• Operational
  The coordination of routes and frequencies

• Physical
  The creation of facilities to streamline the transfers

• Information
  The integration of information such as routes and vehicle tracking information

• Fare
  The integration of pavement and provision of discounts or free transfers

• Institutional
  The integration of involved related agencies to increase efficiency
Of the following technologies, which one is the most effective technological approach to shift existing mobility patterns?

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1. Vehicle automation
2. Sharing
3. Electrification
4. Sensing and connectivity
5. Tailored vehicles
RESPONSES TO THE TECHNOLOGICAL SHIFT

STREET DESIGN

PARKING DESIGN

DESIGN OF INTERSECTIONS

NETWORK STRUCTURE
Reclaiming street space

STREET DESIGN

Present situation

Reducing lane width

Reducing number of lanes

San Francisco’s entry to Smart City Challenge (SFMTA)
STREET DESIGN

Segregating street space

Singapore's AV Vision

Maheshwari (2020)
STREET DESIGN

Proposal for a shared street by BIG Architects for the Audi Urban Future Award 2010 Source: archdaily.com
Responsive street design

Maheshwari (2020)
PARKING DESIGN

Reclaiming parking space

Maheshwari (2020)
PARKING DESIGN

Redefining on-street parking

San Francisco’s entry to Smart City Challenge (SFMTA)
INTERSECTION DESIGN

AV Priority Intersection

Pedestrian Priority Intersection

Pedestrian crossing offset from the intersection (SEH Inc)
NETWORK STRUCTURE

Flexible grid design (NACTO, 2017)
Responses in Practice

Small Scale Bottom-Up Transformations

The Interplay Between Transport and Land Use

Strategies in Conflict with One Another

Intuitive conjectures not enough to understand complex systems

Quantitative modelling is not reliable in high uncertainty

Combining quantitative analysis in urban design workflows
Does autonomous driving result in better urban mobility automatically?

1. Yes
2. No

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Questions