

INTRODUCTION TO HIGHWAY DESIGN





OVERVIEW

- The role and importance of highways
- Highways authorities and governance
- Road Classification in the UK
- Highway design principles
- Key highway design standards and guidance documents



WHY ARE
HIGHWAYS
IMPORTANT?



WHY ARE HIGHWAYS IMPORTANT?

ECONOMICS



WHY ARE
HIGHWAYS
IMPORTANT?

PUBLIC SERVICES



WHY ARE
HIGHWAYS
IMPORTANT?

ACCESS TO
OPPORTUNITY



WHY ARE
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IMPORTANT?

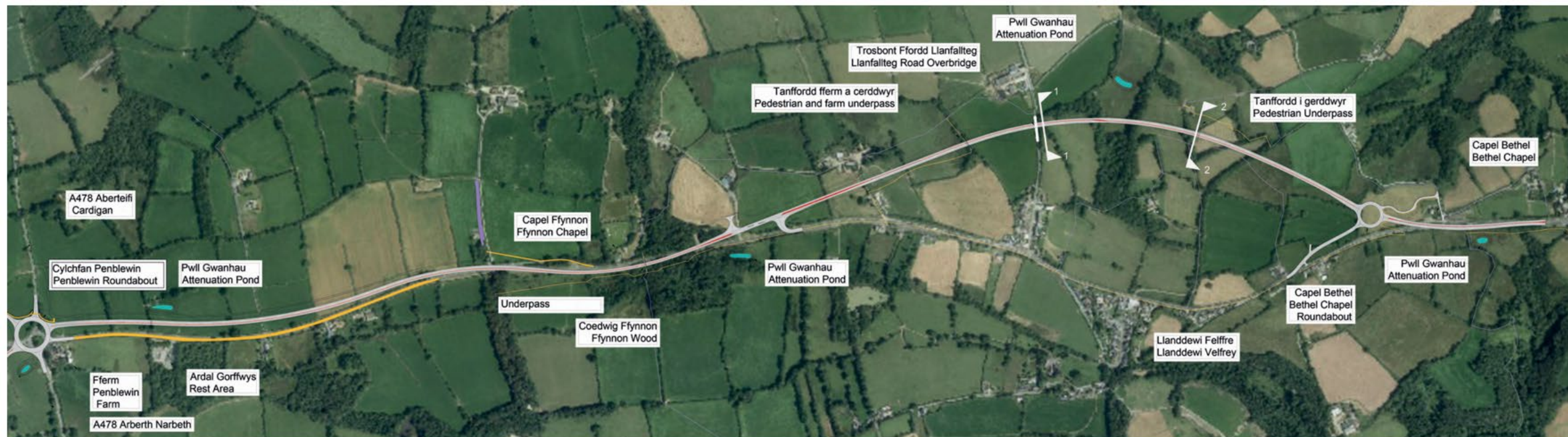
VERSATILITY



WHY DO WE
BUILD NEW
ROADS?



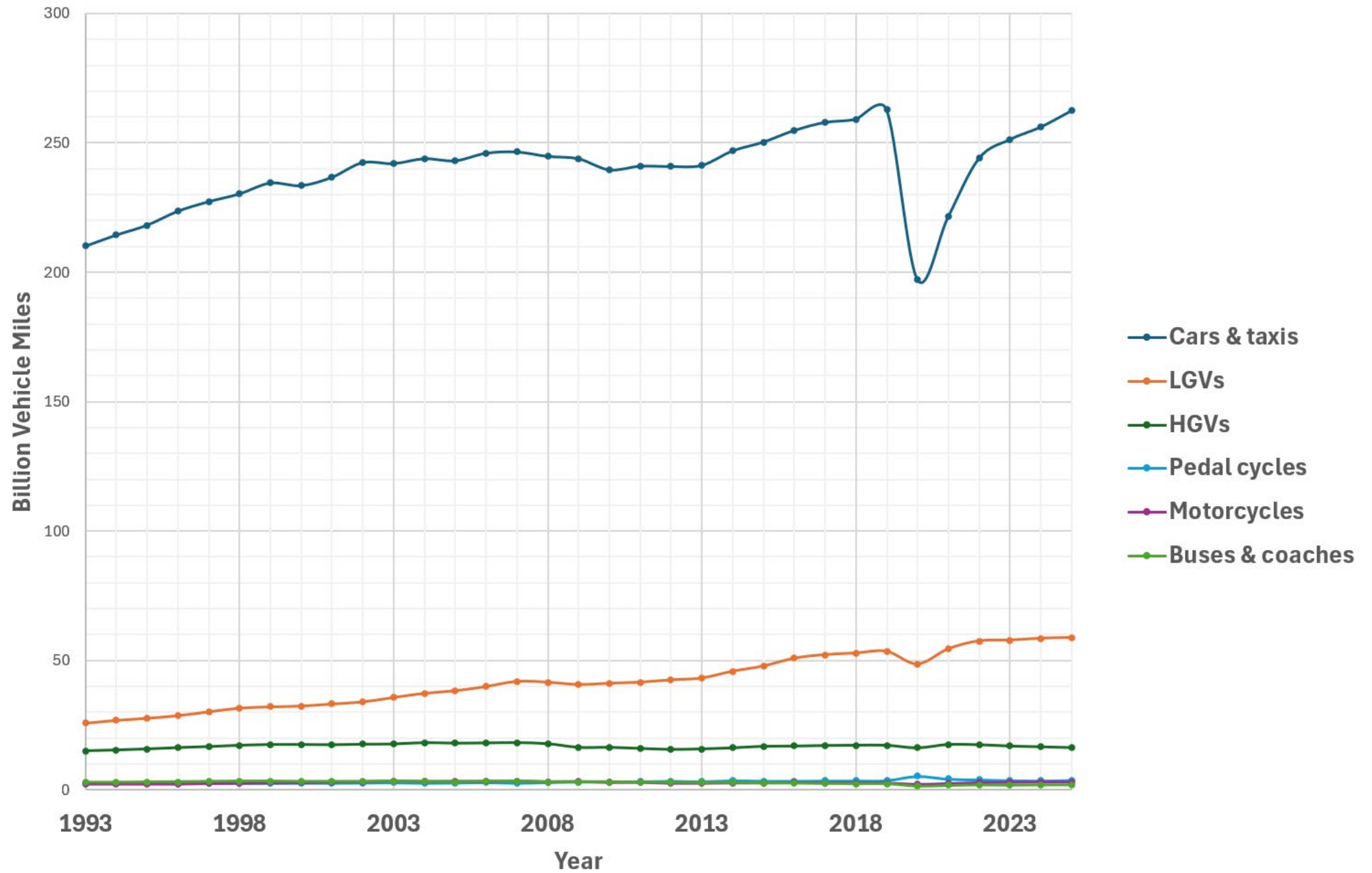




M4 congestion needs a 'roads-based solution', first minister says



The Labour Welsh government axed a project to build a relief road south of Newport in 2019



1 CARRIAGEWAY

The portion used by vehicles.



2 SHOULDERS / VERGES

Provide:

- Emergency stopping space
- Structural support
- Drainage corridor



3 FOOTWAYS AND CYCLEWAYS

Support pedestrians and cyclists.



1 CARRIAGEWAY

Main portion used by vehicles.



2 SHOULDERS / VERGES

Provide emergency stopping space, structural support and drainage corridor.



3 FOOTWAYS AND CYCLEWAYS

Support pedestrians and cyclists.



4 DRAINAGE SYSTEMS

Manage surface water and prevent flooding.



5 ROAD RESTRAINT SYSTEMS

Protect road users by reducing impact severity in the event of a crash.



4 DRAINAGE SYSTEMS

Includes:

- Gullies
- Channels
- Culverts
- Sustainable drainage systems (SuDS)



5 ROAD RESTRAINT SYSTEMS

Includes:

- Guardrails
- Crash barriers
- Safety fencing



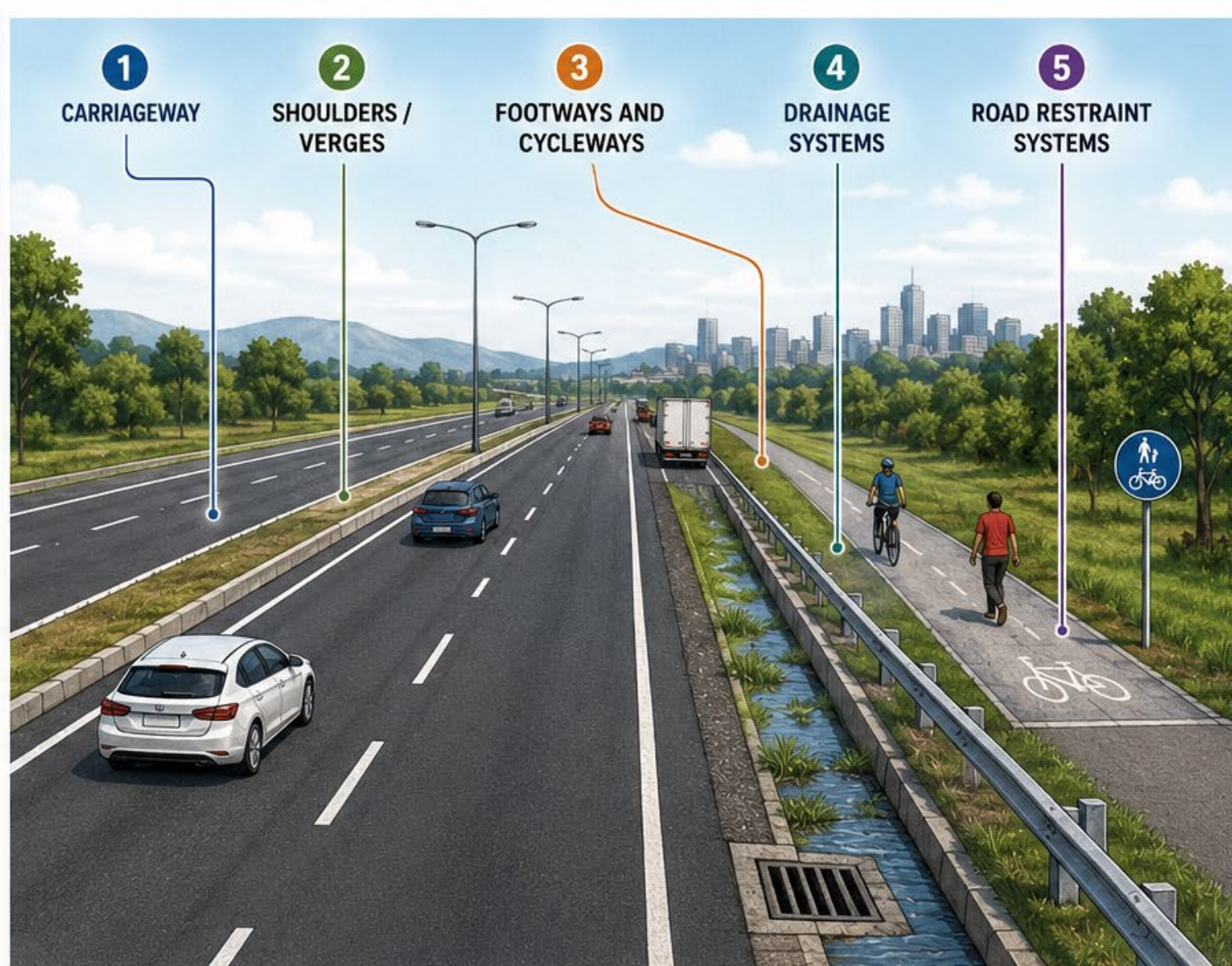
6 TRAFFIC CONTROL FEATURES

- Signs
- Markings
- Signals
- Lighting



6 TRAFFIC CONTROL FEATURES

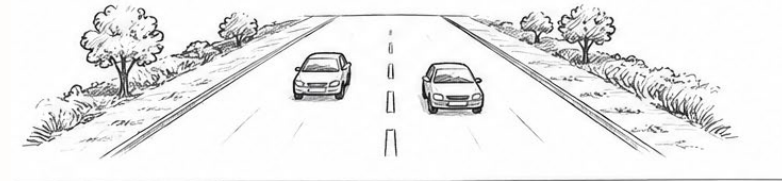
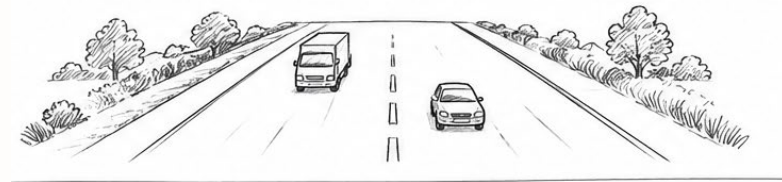
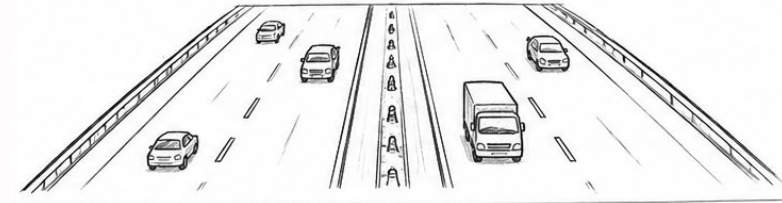
Regulate, warn and guide road users for safe and efficient travel.



ROAD HIERARCHY

Level	Typical role	Common characteristics	Design emphasis
Motorways	Long-distance strategic movement	Grade-separated junctions, controlled access, high capacity	Safety at speed, reliability, network efficiency
Trunk roads and primary A roads	National and regional connectivity	Important inter-urban links, mixed rural and urban contexts	Balance between movement, access, and freight efficiency
Non-primary A roads	Significant local and regional distribution	Connect towns and major destinations	Junction performance, local access, consistency of standard
Broads	Local distribution and access	Lower traffic volumes, variable width and alignment	Context-sensitive design and safety
Local roads and streets	Access to homes, businesses, and community services	Greater frontage access and place function	Low-speed environment, inclusivity, and placemaking

ROAD HIERARCHY



TRUNK ROADS & MOTORWAYS

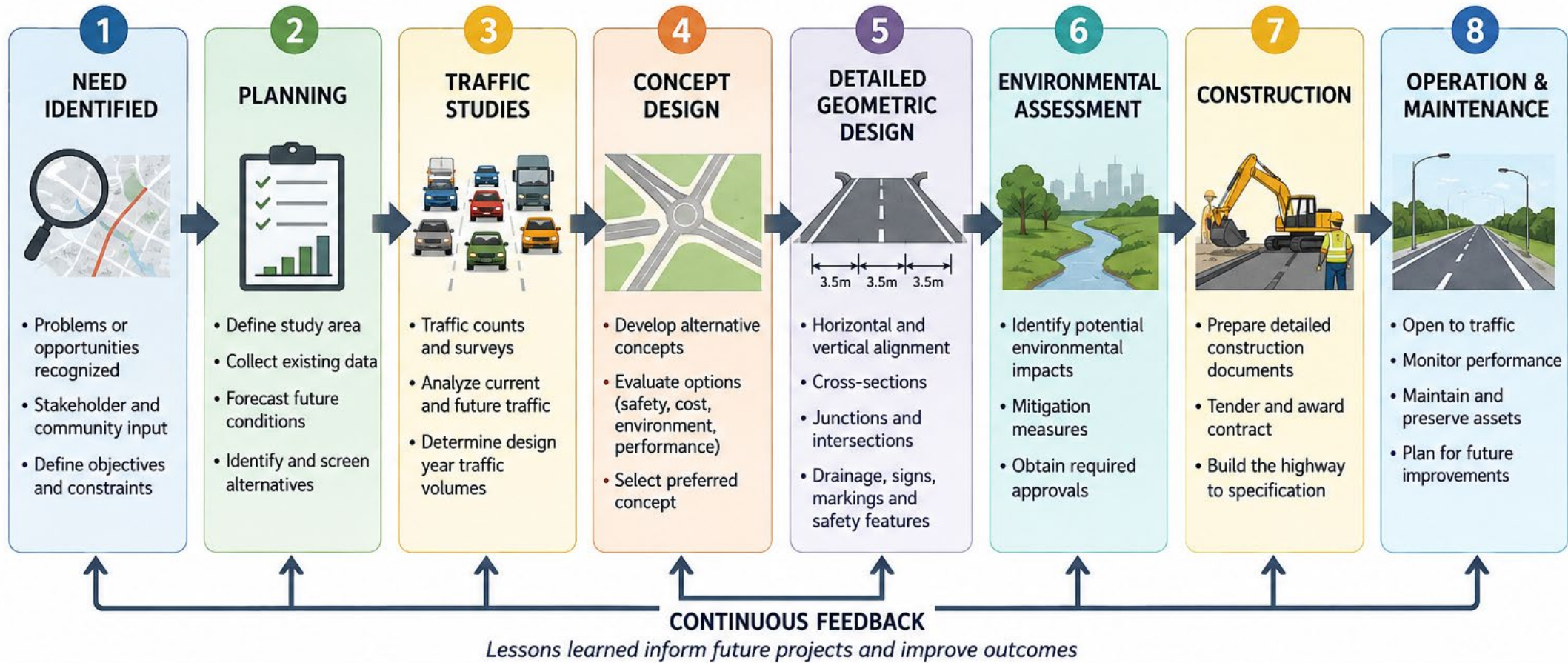
The trunk road agents
cover **1510 kilometres**
of trunk road, including
six road tunnels and
178 kilometres of
motorway.





THE HIGHWAY DESIGN PROCESS

A systematic approach to delivering safe, efficient and sustainable roads



FOCUS THROUGHOUT ALL STAGES



Stakeholder Engagement

Involve the right people, at the right time



Safety

Designing for all road users



Sustainability

Environmental and social responsibility



Cost Effectiveness

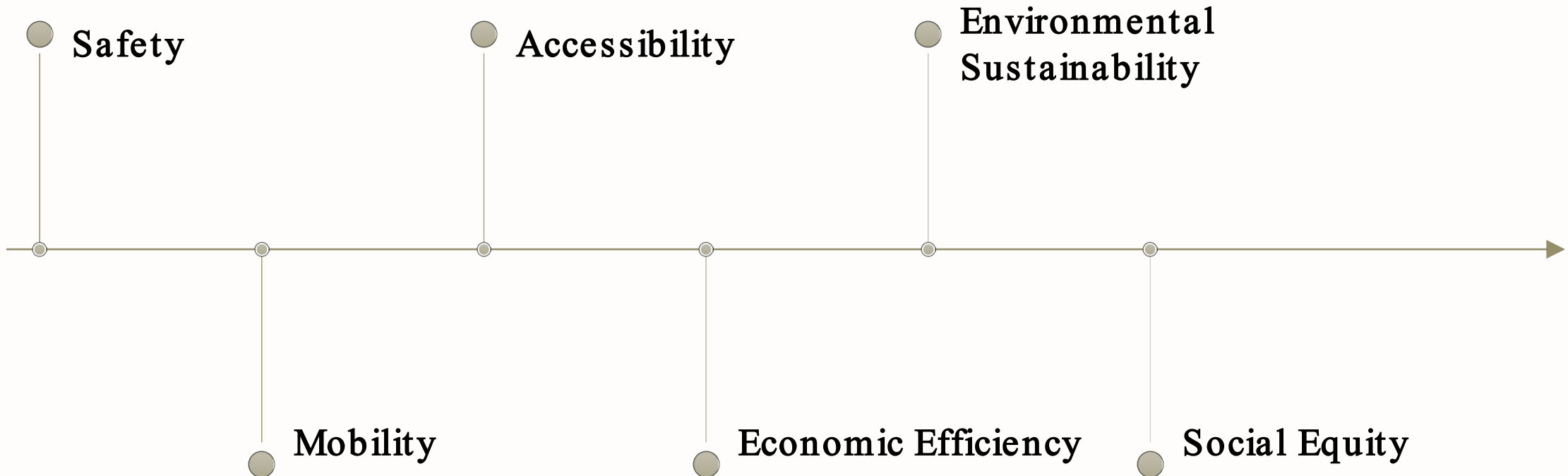
Deliver best value over the life of the asset



Performance

Achieve mobility, accessibility and reliability

OBJECTIVES OF HIGHWAY DESIGN

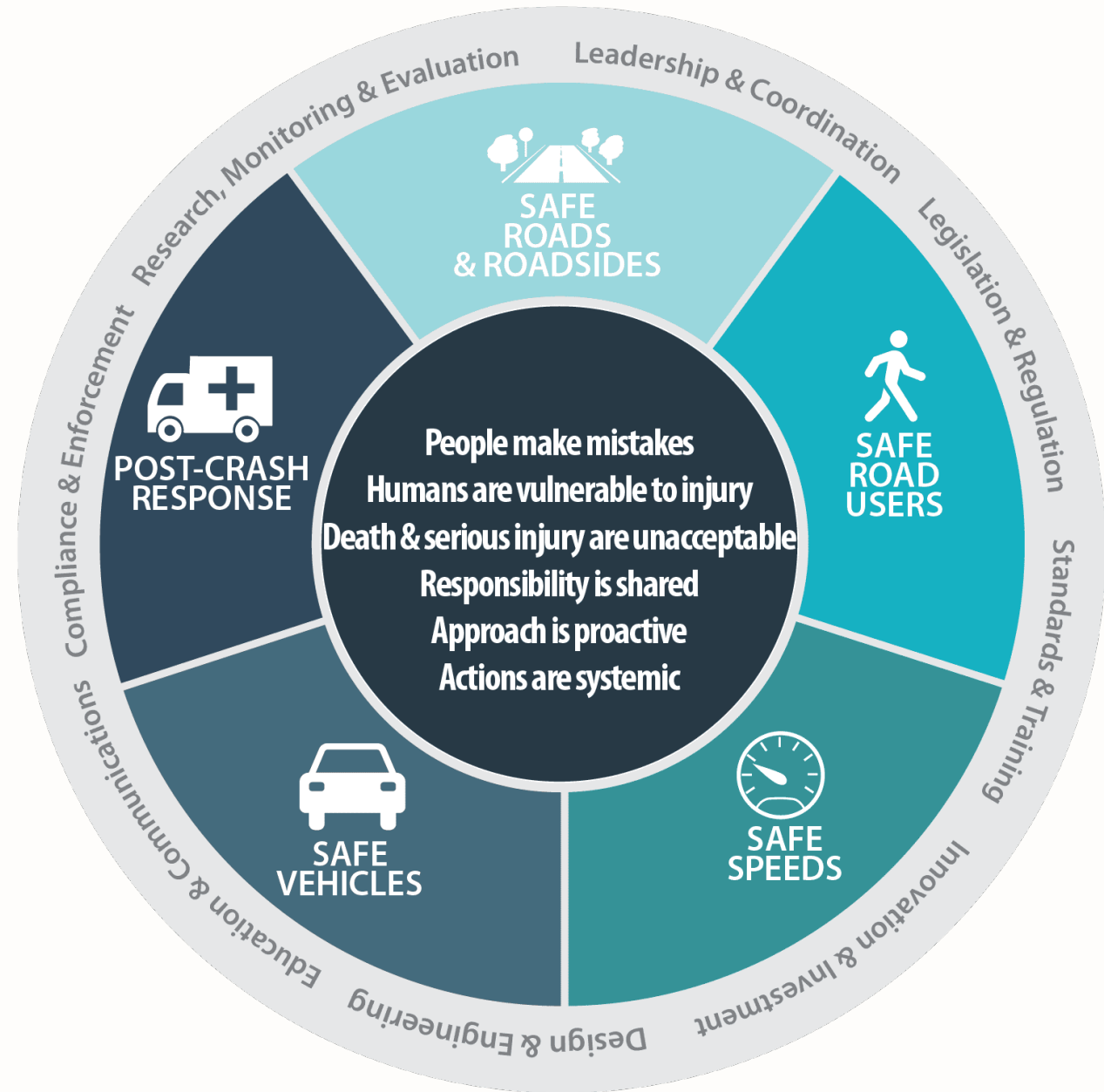


SAFETY

What questions should designers ask?

SAFETY

Humans make mistakes.
Roads should be
forgiving enough that
mistakes do not result in
death or serious injury.



MOBILITY



Motorways

Prioritises long-distance movement.



City Centres

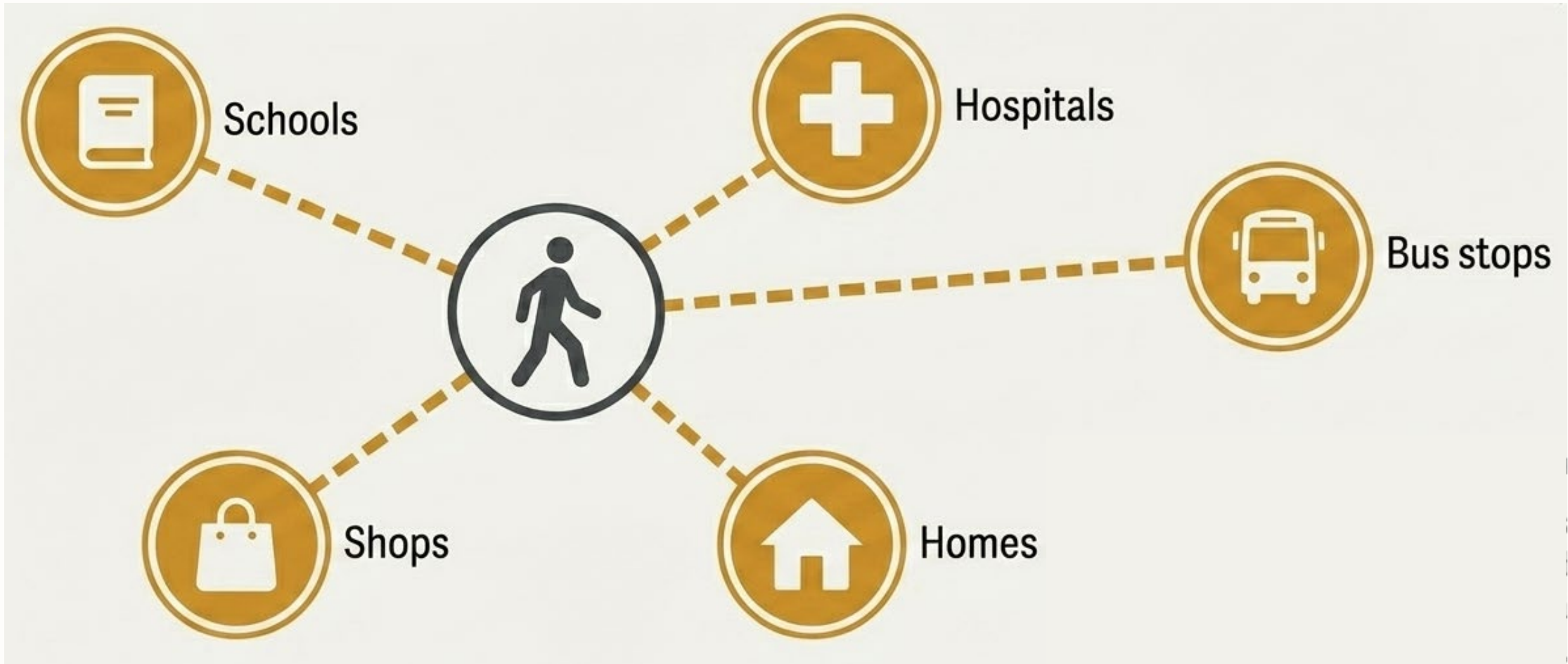
Prioritises access over speed.



Freight Routes

Prioritises reliability.

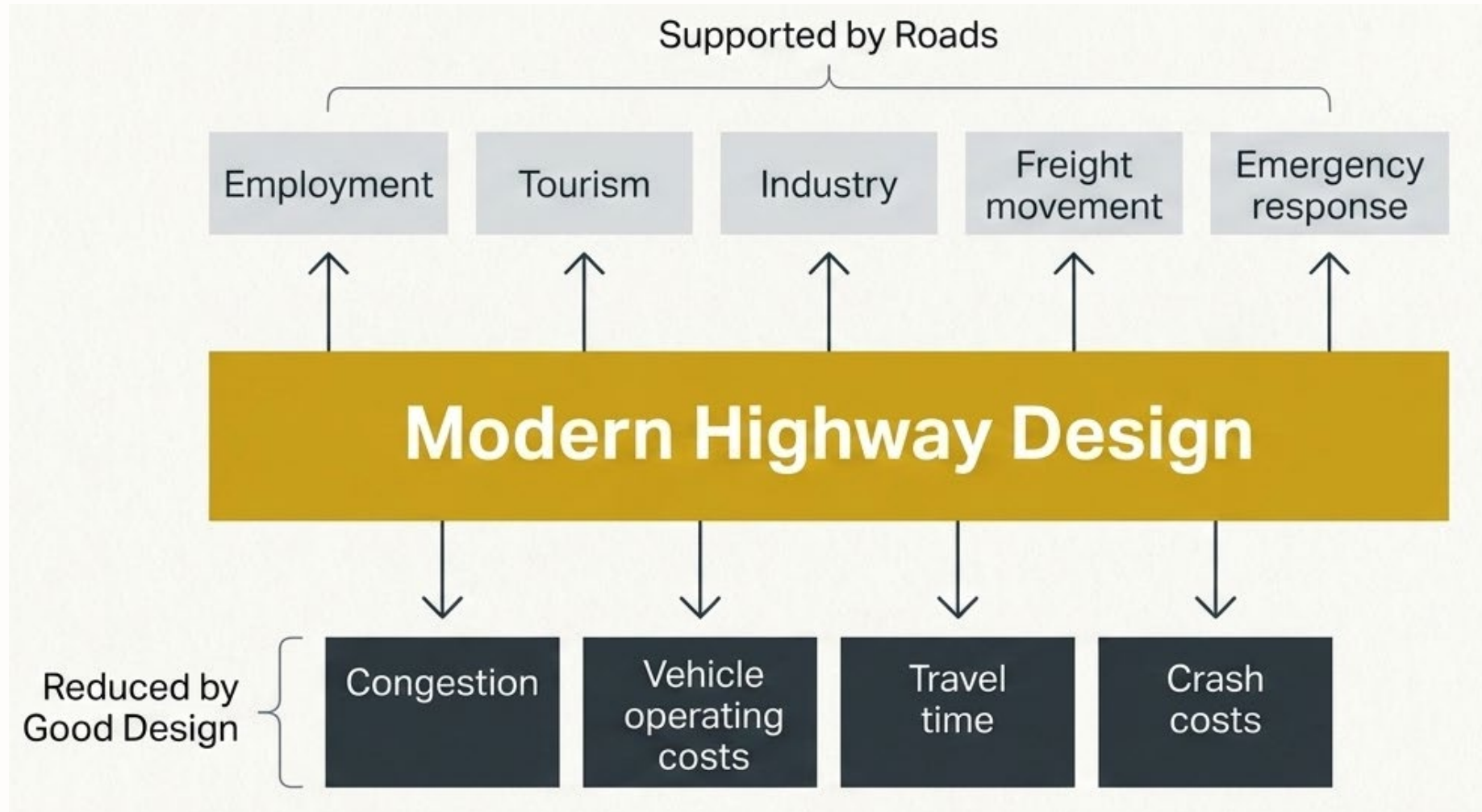
ACCESSIBILITY

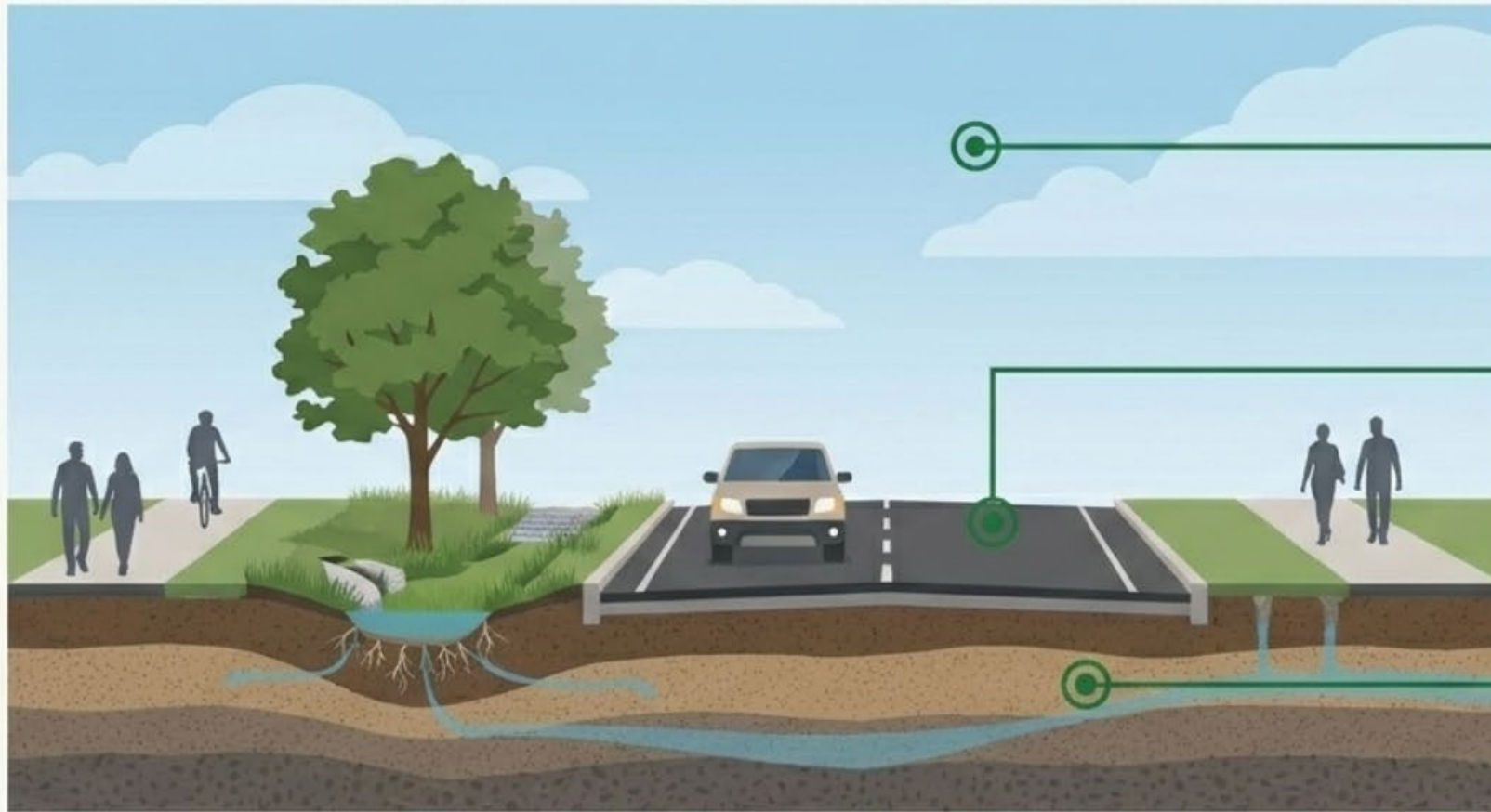


MOBILITY VS ACCESSIBILITY

Dimension	 Motorway	 City Centre
Target Speed	High (Maximized for distance)	Low (Calmed for safety)
Primary User	Long-distance drivers & freight	Pedestrians, cyclists, local transit
Junction Frequency	Few (Minimizing interruption)	Frequent (Maximizing crossing opportunities)
Core Priority	Vehicle Movement (Mobility)	Human Access (Accessibility)

ECONOMIC EFFICIENCY



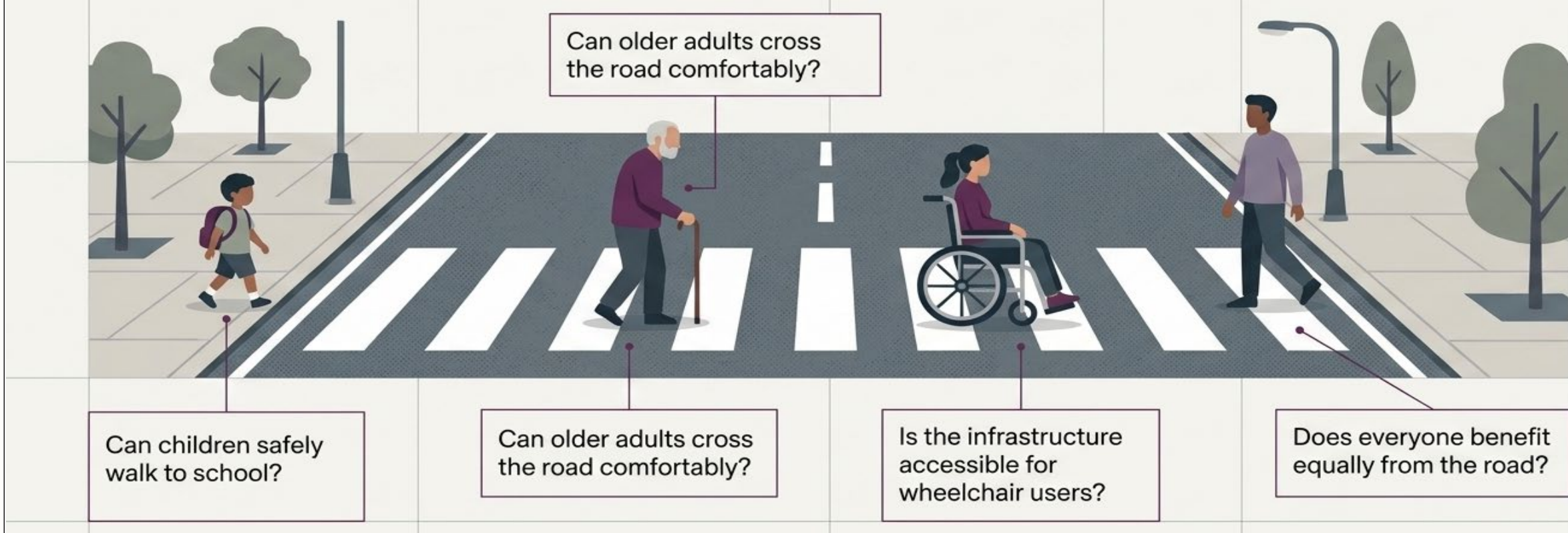


Above the road:
Air quality & Carbon emissions

At the road surface:
Urban heat & Noise

Below/Beside the road:
Water quality & Wildlife habitats

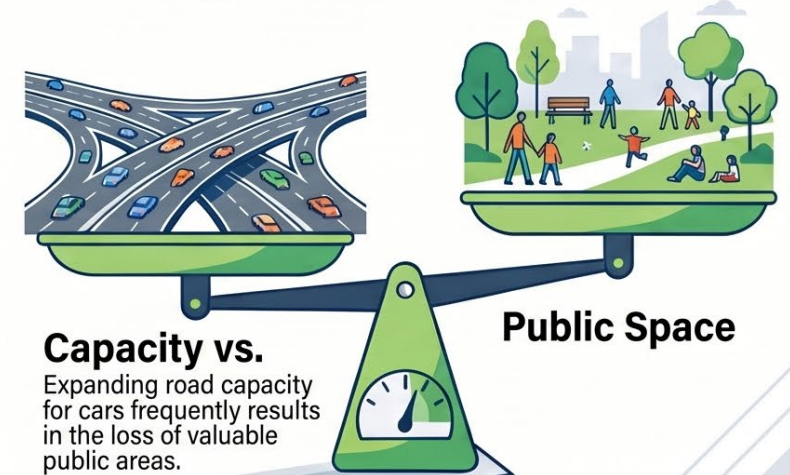
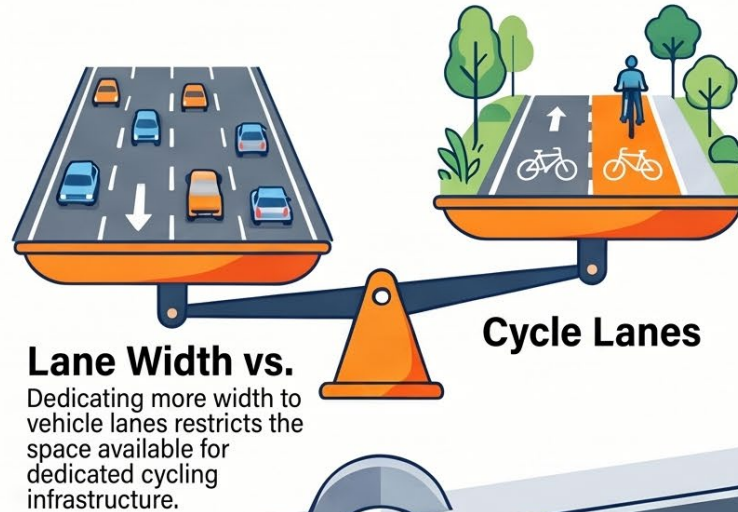
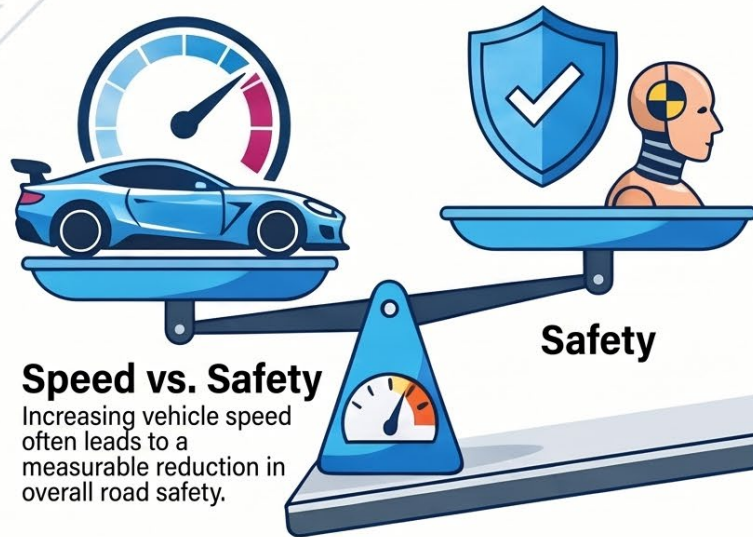
ENVIRONMENTAL
SUSTAINABILITY



SOCIAL EQUITY

The Highway Design Balancing Act

The Trade-off Matrix



Inverse Relationships

If we increase...

- Parking
- Vehicle priority
- Speed

We may reduce...

- Visibility
- Pedestrian comfort
- Safety

If we increase...

- Parking
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- Pedestrian comfort
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The Goal of Engineering

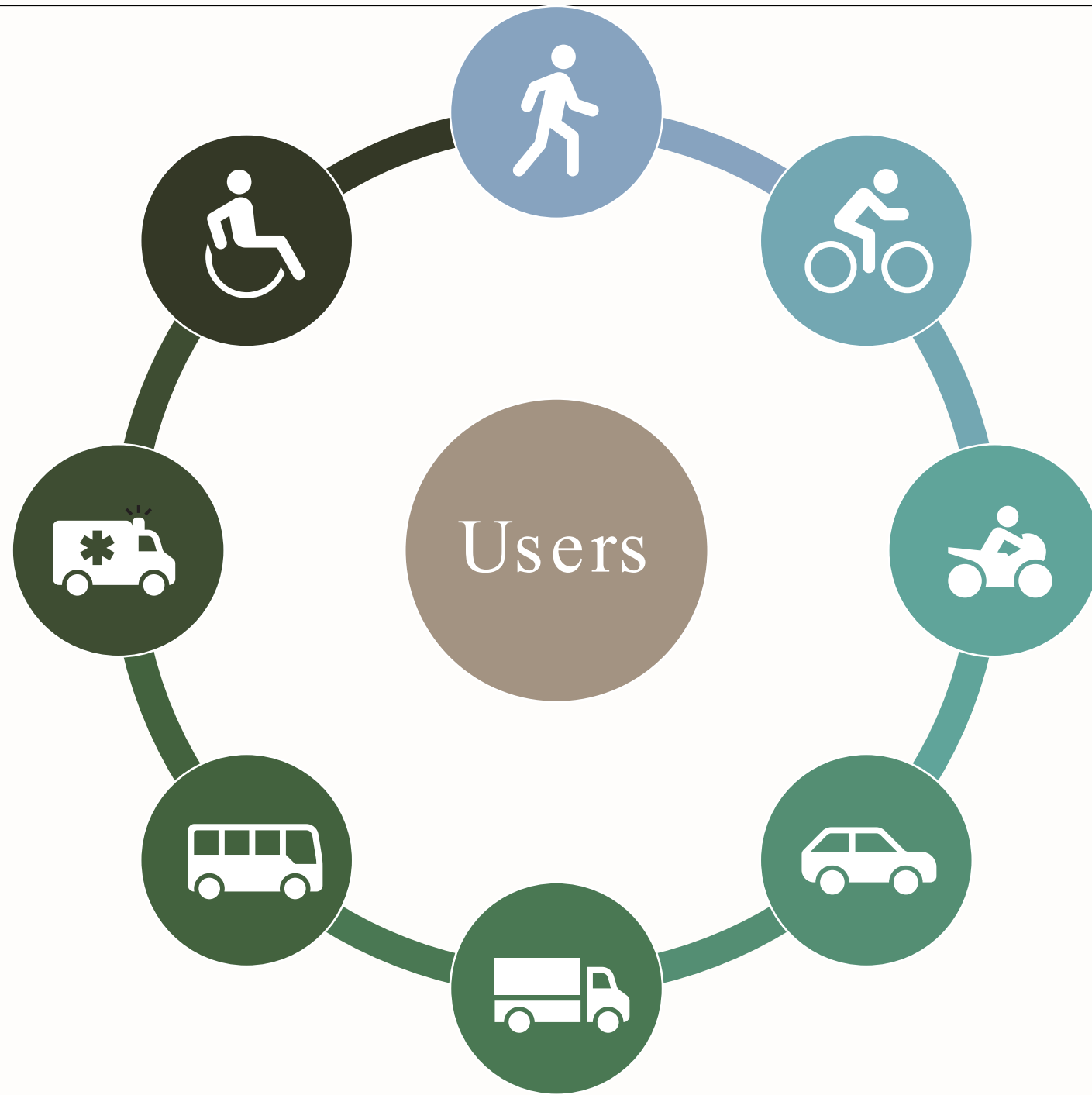


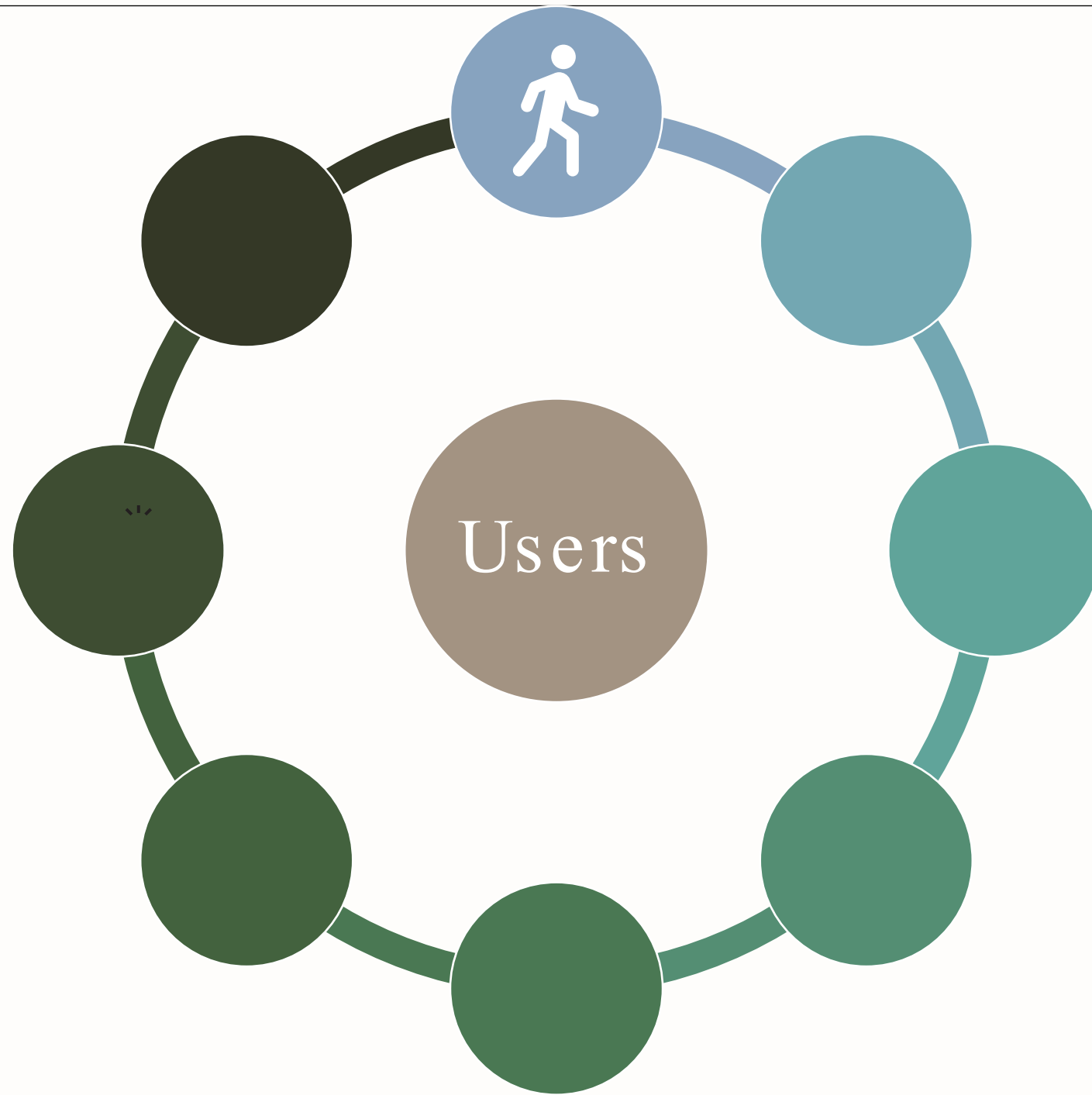
No "Perfect" Solution
Design is about seeking the optimal balance rather than a single flawless outcome.

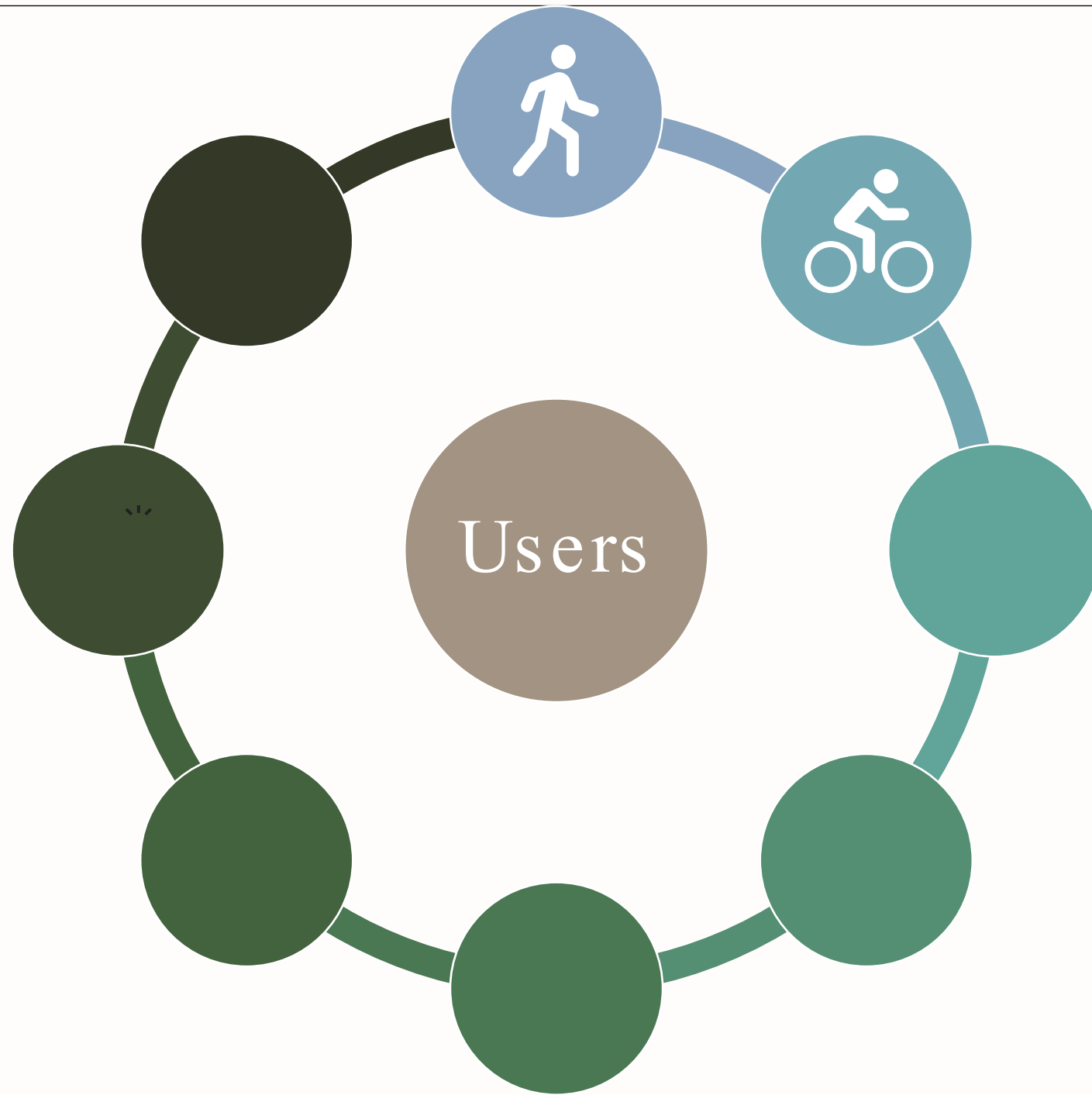


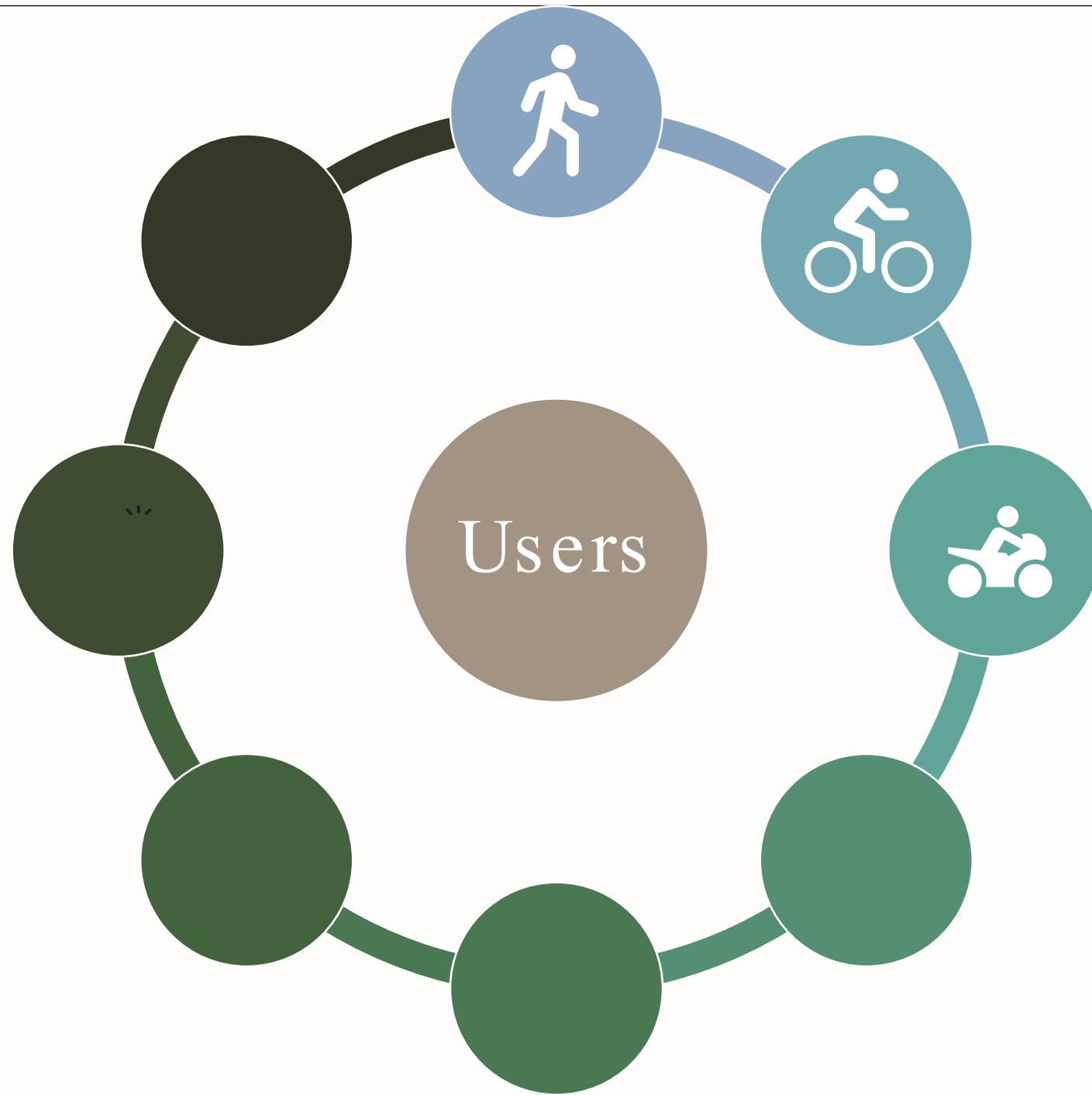
Context-Based Design
Decisions are driven by the specific location and the diverse people using the road.

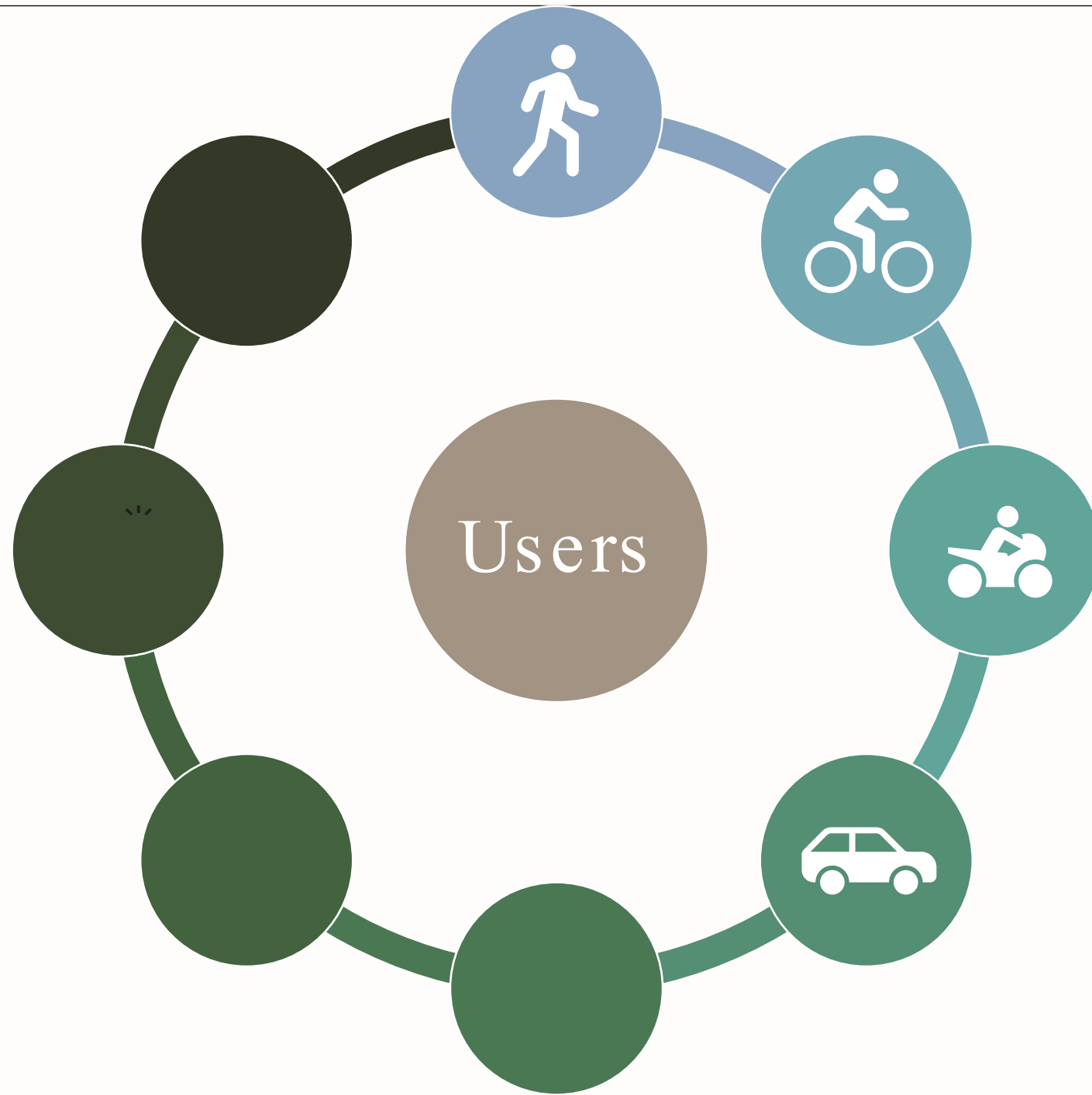


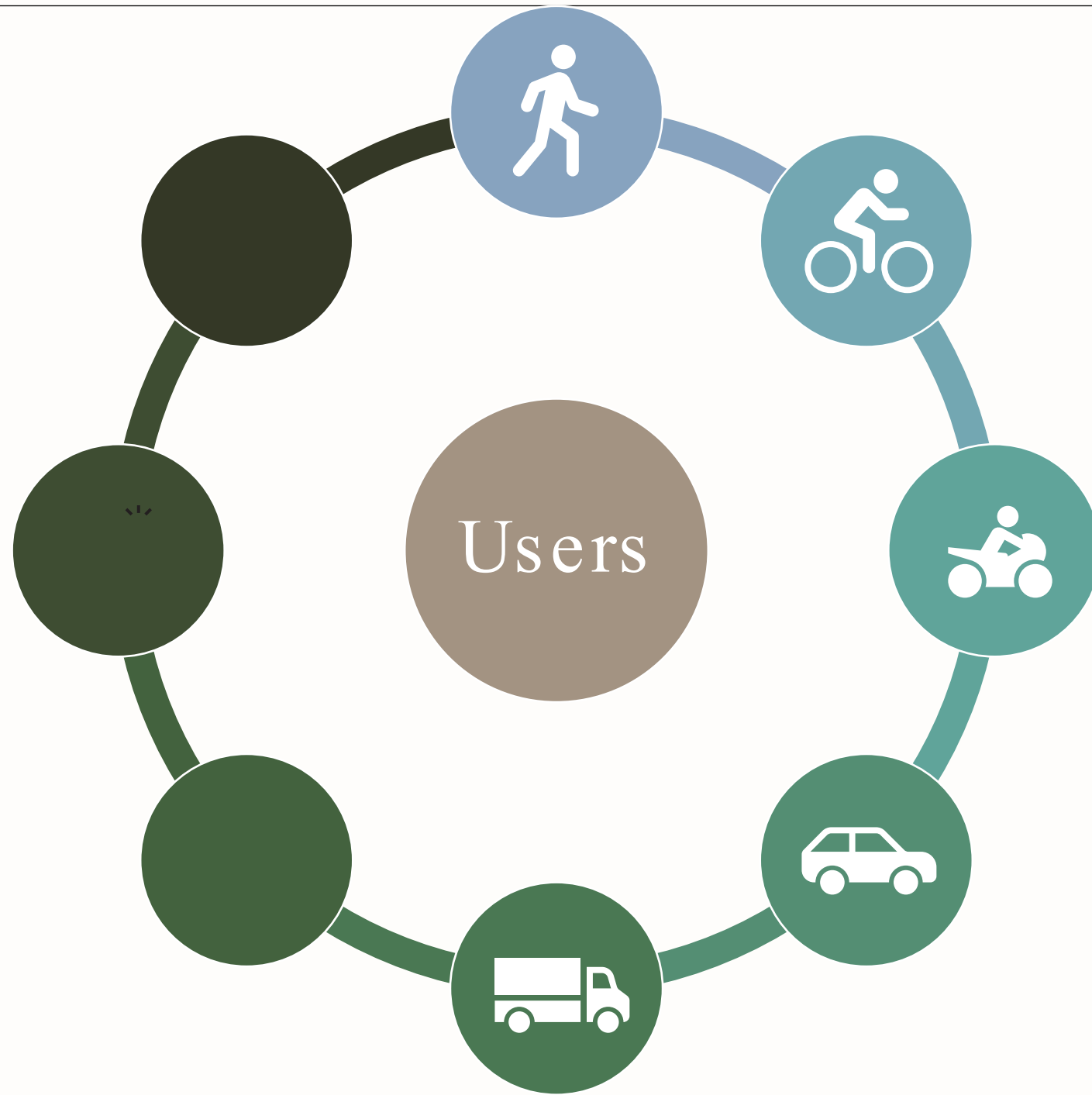


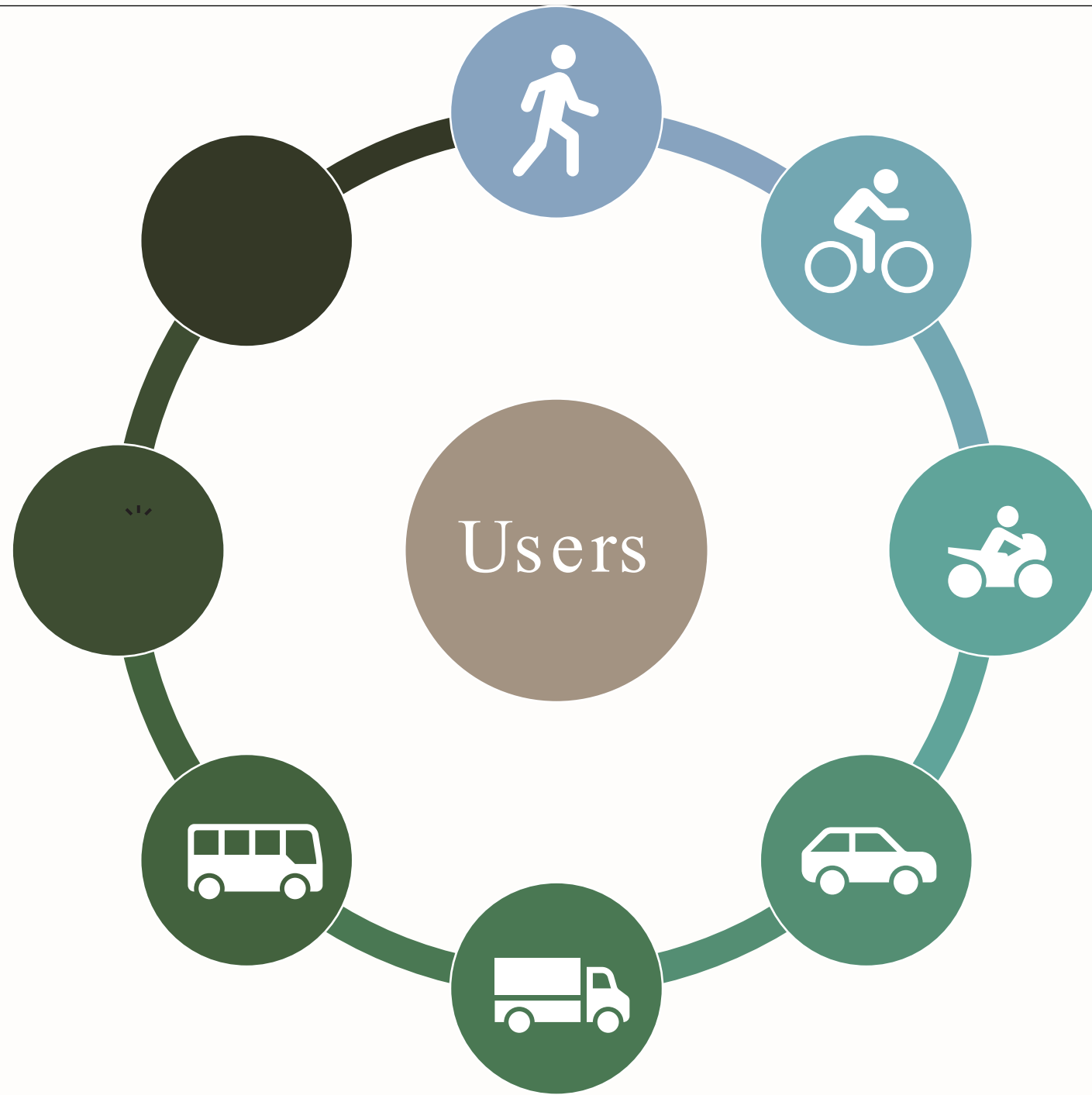


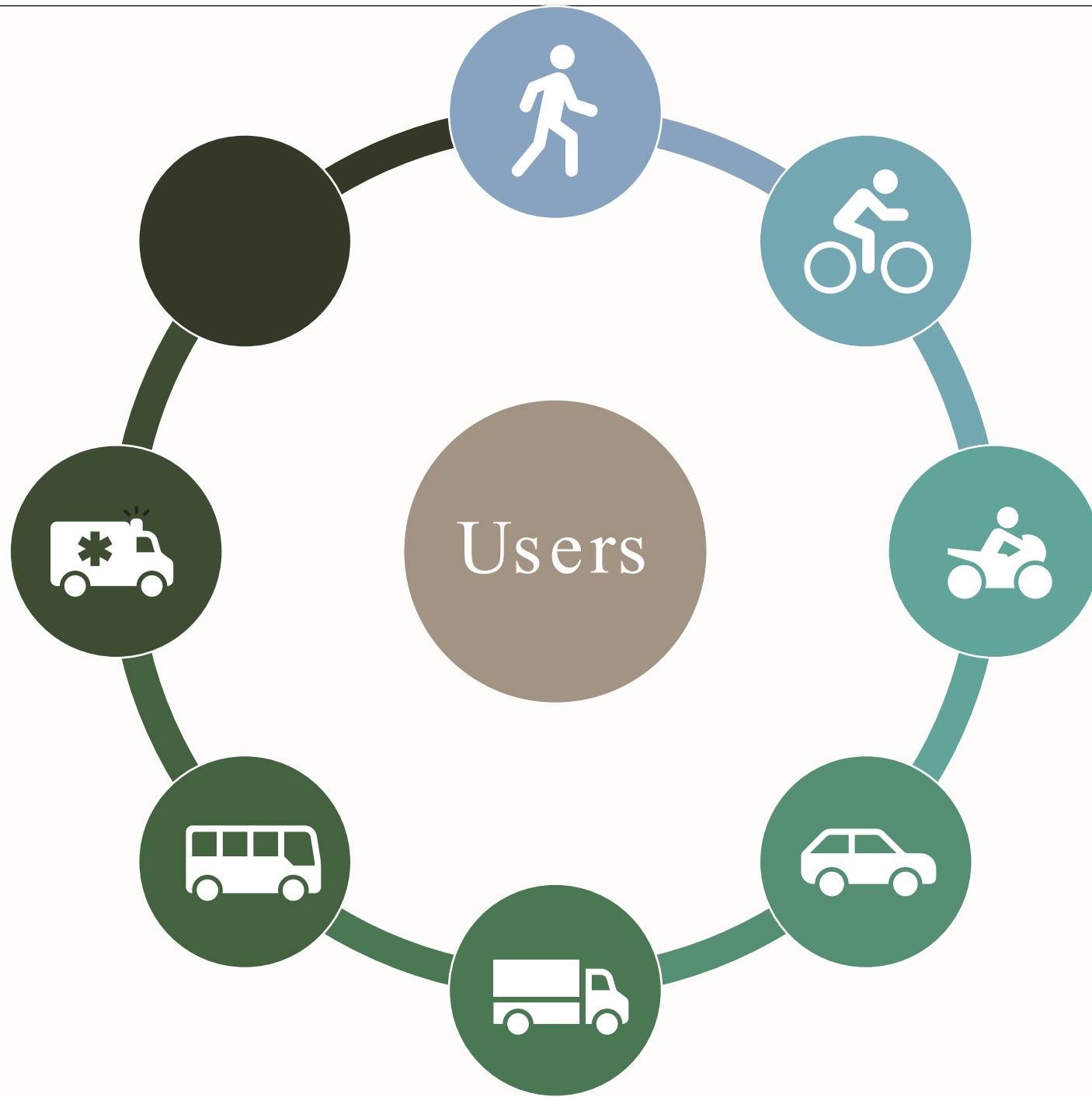


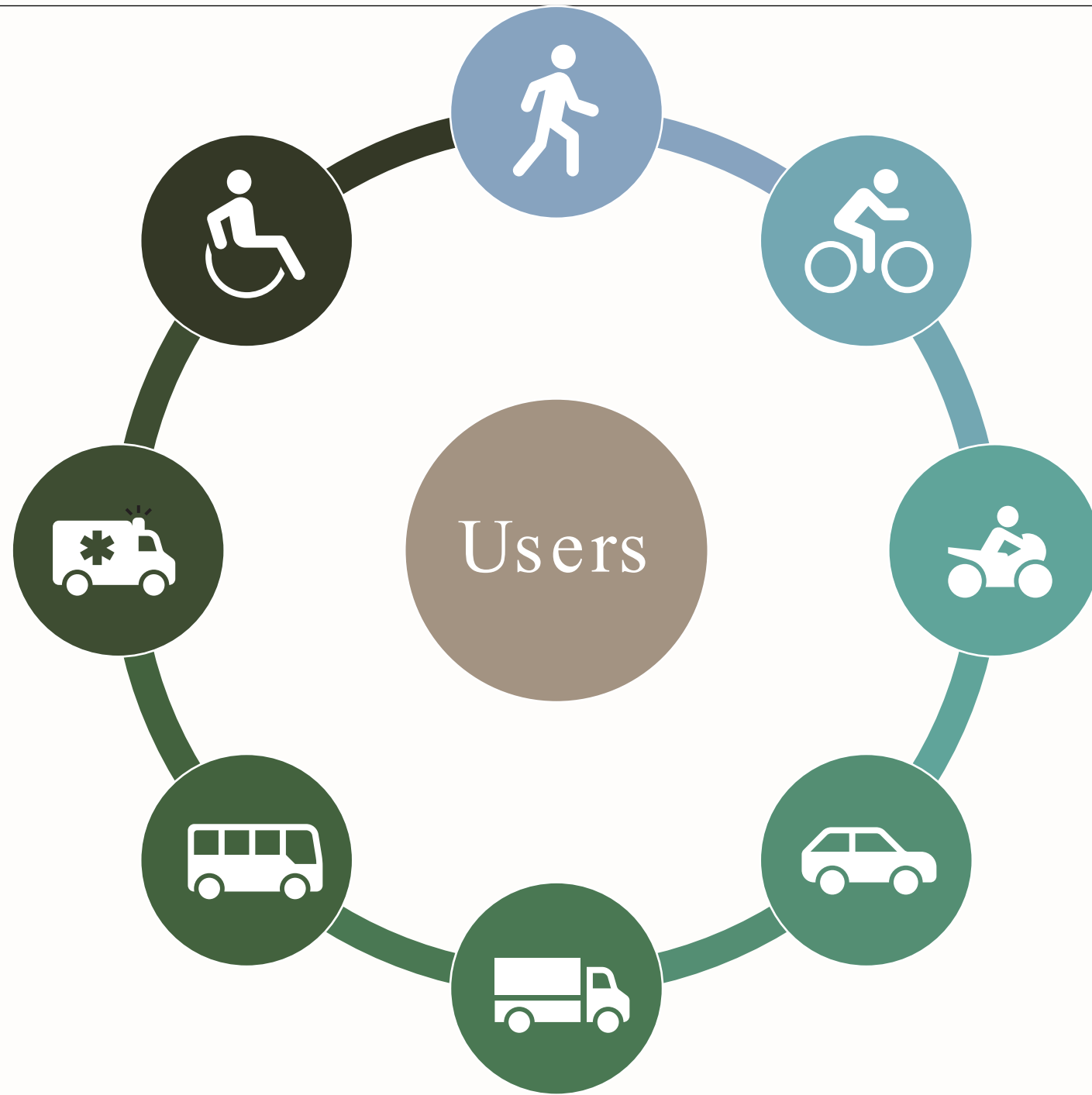








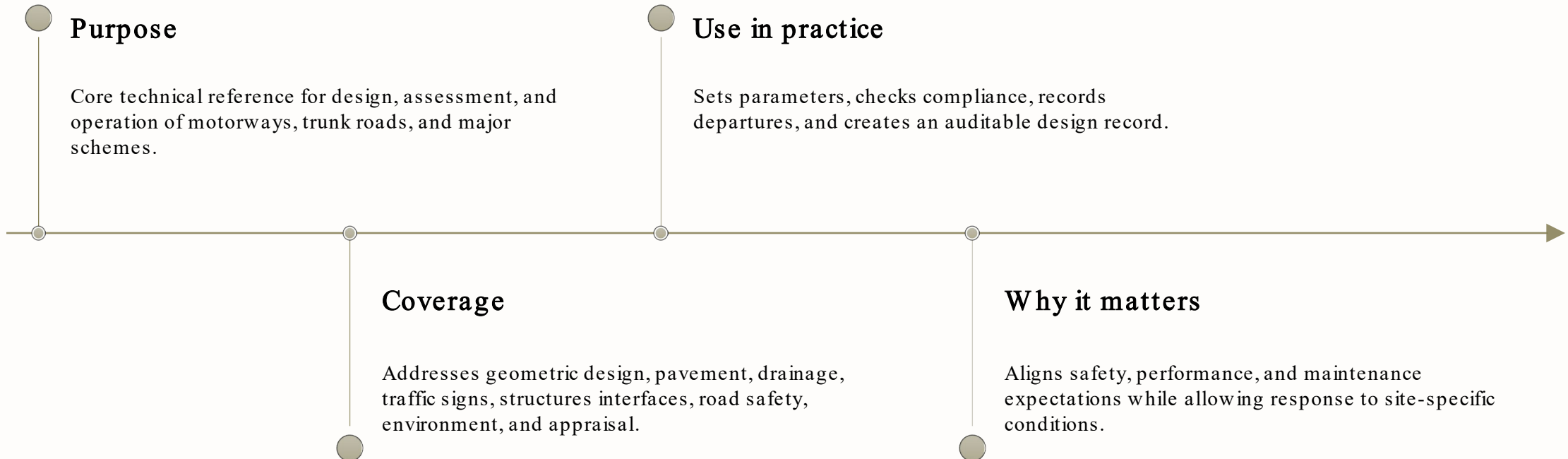






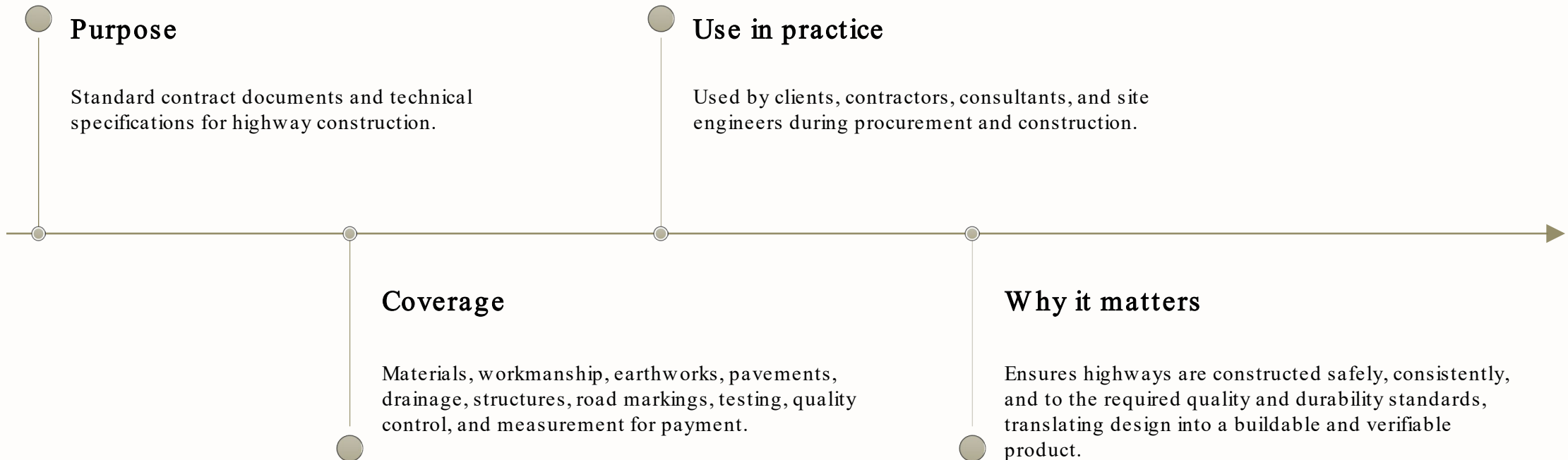
Purpose, scope, practical use, and value

THE DESIGN MANUAL FOR ROADS AND BRIDGES (DMRB)



Purpose, scope, practical use, and value

THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS (MCHW)



Purpose, scope, practical use, and value

MANUAL FOR STREETS

