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Designing Traffic Systems for Humans

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Objectives of the session

- Overview of traffic systems
- Overview of humans in the context of traffic systems
- Learn key principles of human-centered traffic design.

Introduction

- Traffic Systems
- Humans

Traffic Systems

- Refer to the complex and interconnected network of physical and operational elements designed to facilitate the safe, efficient, and orderly movement of people and goods on roadways.
- **WHAT ARE THE COMPONENTS OF TRAFFIC SYSTEMS?**

Traffic Systems Components

- Road Infrastructure



Roads and Highways



Intersections and Roundabouts



Bridges and Tunnels

Traffic Systems Components

- Traffic Control Devices



Traffic Lights and Signals



Signs & Markings



Speed Bumps and Rumble Strips

Traffic Systems Components

- Vehicles



Motor Vehicle



Non-Motorized Vehicles

Traffic Systems Components

- Pedestrian and Cyclist Infrastructure



Sidewalks and Pedestrian Paths

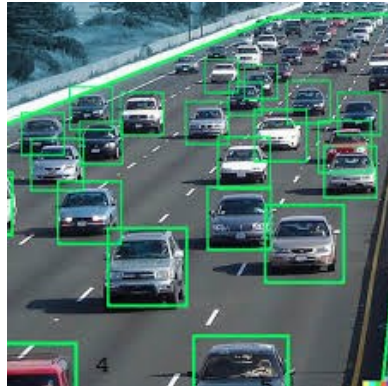


Bicycle Lanes and Paths



Traffic Systems Components

- Traffic Management Systems



Intelligent Transportation Systems (ITS)



Public Transportation Systems

Traffic Systems Components

- Policies and Regulations



Traffic Laws and Regulations



Enforcement Mechanisms

Traffic Systems Components

- Road Users (HUMANS!)



HUMANS

- Refer to all individuals who interact with and are affected by the transportation network. This includes a diverse range of users with varying needs, behaviors, and capabilities.
- WHO ARE THE HUMANS IN THE CONTEXT OF TRAFFIC SYSTEMS?

Drivers

- **Professional Drivers:** Individuals who operate vehicles as part of their occupation, such as truck drivers, bus drivers, and taxi drivers.
- **Private Vehicle Owners:** Individuals who drive their own personal vehicles for commuting, recreation, or other purposes.
- **Two & Three Wheelers Drivers :** Individuals who ride motorcycles & Bajajis, which require different safety considerations and regulations compared to other motor vehicles.

Pedestrians

- **Commuters:** Individuals who walk as part of their daily commute to work, school, or other destinations.
- **Recreational Walkers:** Individuals who walk for exercise, leisure, or social activities.
- **Vulnerable Pedestrians:** Individuals who may require special consideration in traffic system design, such as children, elderly people, and individuals with disabilities.

Cyclists

- **Commuter Cyclists:** Individuals who use bicycles as a primary mode of transportation.
- **Recreational Cyclists:** Individuals who ride bicycles for exercise, leisure, or sport.
- **Bike-Share Users:** Individuals who use public or private bike-share programs.

Public Transportation Users

- **Bus Passengers:** Individuals who rely on buses for their transportation needs.
- **Tram and Train Passengers:** Individuals who use trams, trains, or other forms of rail transit.
- **Special Needs Users:** Individuals who require accessible transportation options, such as those with mobility impairments

Traffic System Designers and Planners

- **Urban Planners:** Professionals responsible for designing and planning the layout of cities and transportation networks.
- **Civil Engineers:** Engineers who design, construct, and maintain infrastructure such as roads, bridges, and tunnels.
- **Policy Makers:** Government officials and regulators who develop and enforce policies

Humans

- ARE WE MISSING ANY HUMAN?

Traffic Systems Issues

Overview of Traffic Systems

- Lets discuss the existing traffic conditions in African cities!
- What are the common issues?

Common Traffic Issues

- Traffic Congestion



High vehicle volume especially during peak hours

Common Traffic Issues

- **Narrow Roads and Poor Infrastructure**



Common Traffic Issues

- Inadequate Public Transport



Common Traffic Issues

- Road Accidents



Road Accidents

- Why there is a high rate of road accidents in Africa?

R O A D S A F E T Y S I T U A T I O N I N T A N Z A N I A

Category/Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	%	Cum. %
Driving error	8476	5053	2868	3624	2169	1542	1160	753	504	26149	36.72%	36.72%
Motor cycle	5118	3163	2009	1808	1135	725	492	317	176	14943	20.98%	57.70%
Speed	2039	950	691	730	489	364	288	272	282	6105	8.57%	66.27%
Car default	1623	990	502	755	375	197	105	80	70	4697	6.60%	72.87%
Pedestrian	1313	979	470	609	385	259	162	93	20	4290	6.02%	78.89%
Overtake	1475	800	474	638	262	217	236	91	45	4238	5.95%	84.84%
Cyclist	979	689	410	447	205	103	72	33	32	2970	4.17%	89.01%
Road condition	951	612	298	404	184	80	65	23	20	2637	3.70%	92.72%
Road blocks	907	489	341	533	117	120	32	9	9	2557	3.59%	96.31%
Rumination	484	285	104	123	47	31	19	14	4	1111	1.56%	97.87%
Alcohol	91	91	66	97	84	61	46	13	11	560	0.79%	98.65%
Crossing Railway	102	99	40	22	7	10	8	3	3	294	0.41%	99.07%
Fire	52	52	11	25	18	14	10	4	5	191	0.27%	99.33%
Pulling Cart	96	41	22	12	7	7	0	1	1	187	0.26%	99.60%
Livestock	94	18	20	9	13	1	3	4	4	166	0.23%	99.83%
Passenger	42	33	11	20	6	1	6	1	1	121	0.17%	100.00%
Total	23842	14344	8337	9856	5503	3732	2704	1711	1187	71216	100.00%	

Challenges

- **Infrastructure challenges:**
 - **Road conditions;**
 - Poor Maintenance
 - Limited Road Network
 - Poor quality of road constructions
 - **Signage;**
 - Inadequate signage
 - Lack of visibility

Challenges

- Infrastructure challenges:
 - Traffic Lights;
 - Malfunctioning Traffic lights
 - Inconsistent Coverage

Challenges

- **Cultural and Behavioural Aspects:**
 - **Driving Habits;**
 - Aggressive Driving
 - Lack of Adherence to Rules
 - **Pedestrian Behaviours;**
 - Unsafe Crossing Practices
 - Jaywalking

Challenges

- Cultural and Behavioural Aspects:
 - Public Transport Usage;
 - Informal Transport Systems
 - Overcrowded and Unreliable Services

Opportunities

- What are the opportunities for Improvement?

Opportunities

- Infrastructure Investment
- Technology: Smart Traffic Management
- Community Engagement
- Regulation of Informal Transport

Principles of Human-Centered Traffic Design

Understanding Human Factors & Behaviors

“Understanding human factors is crucial for gaining insights into the behavior of all road users. This knowledge helps identify their needs, ensuring consideration in the design, construction, maintenance, and enhancement of road safety”

HUMAN FACTORS

- Driving performance and limitations
- Driving errors and mistakes
- Behavioral factors

DRIVER'S PERFORMANCE AND LIMITATIONS

- Reaction time
- Vision: Sign Visibility and Legibility, Field of View Rule
- Age

DRIVING ERRORS & MISTAKES

- Failure to see an oncoming vehicle
- Failure to see a pedestrian
- Not using car indicator
- Misreading road features that are there for a long time
- Failing to put in the right gear
- Driving on a wrong lane
- Tailgating

BEHAVIORAL FACTORS

- Temporary effects or circumstances like alcohol, fear, aggression or traffic violation.
- Violation (intentional behavior such as speeding and dangerous overtaking)

KEY BEHAVIORAL FACTORS

- Speeding
- Drink-driving: 5%-35% of road deaths are reported as alcohol-related
- Seat-belt use: reduces the risk of death and serious injuries by 45%-50% for drivers and front seat occupants and by 25% among rear seat occupants
- Helmet use: head injuries are the leading cause of death and major trauma for 2 and 3-wheeled motor vehicles users
- Child-restraints: lead to 60% reduction in deaths
- Driver fatigue
- Distracted driving

Design Principles

- **Safety:** Designing roads to reduce accidents.
- **Efficiency:** Ensuring smooth flow of traffic.
- **Accessibility:** Making roads usable for all, including pedestrians, cyclists, and people with disabilities.
- **Sustainability:** Incorporating eco-friendly practices.

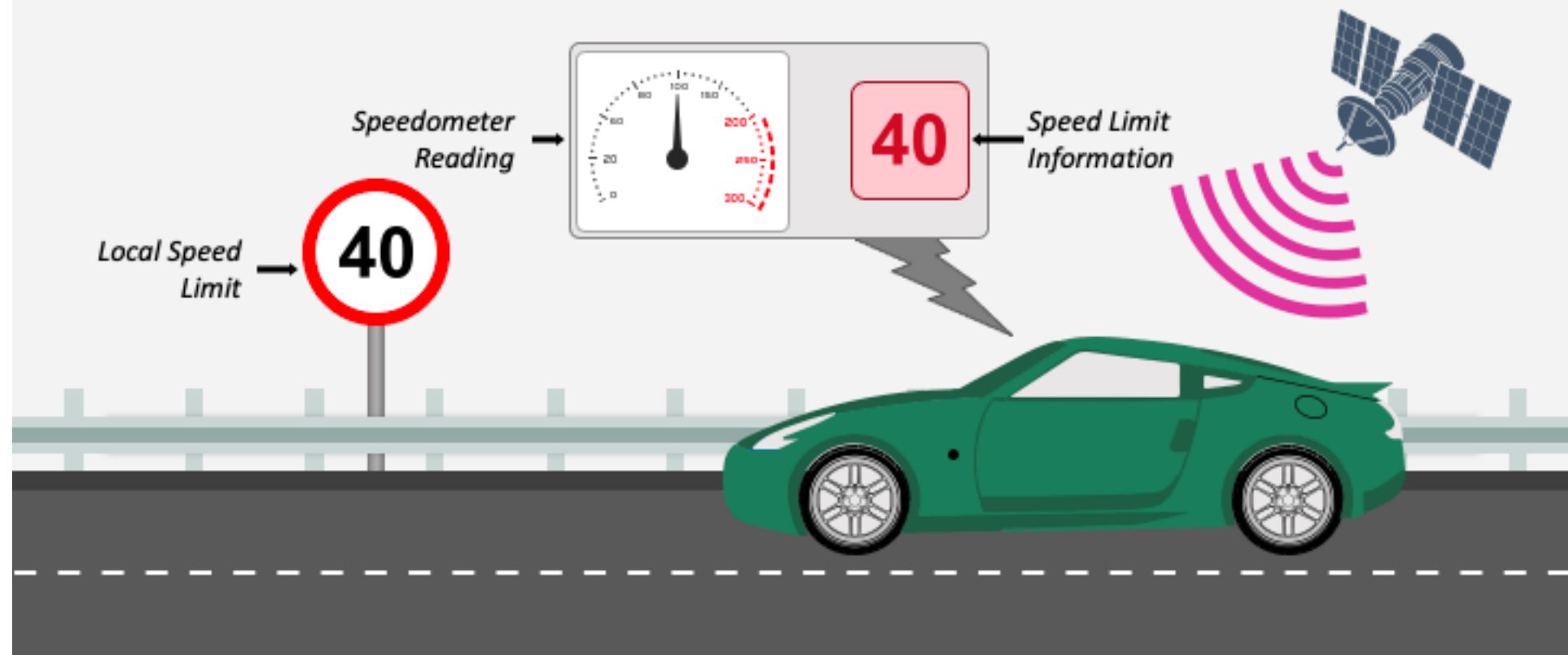
Safety: Designing Roads to Reduce Accidents (Best Practices)

- Traffic Calming Measures: roundabout, humps, lane narrowing, chicanes, etc



INTELLIGENT SPEED ADAPTATION (ISA)

What is Intelligent Speed Adaptation (ISA)?



SPEED ADAPTATION

ISA is a system that informs, warns, and discourages the driver from exceeding the statutory local speed limit. The in-vehicle speed limit is set automatically as a function of the speed limits indicated on the road. GPS allied to digital speed limit maps allows ISA technology to continuously update the vehicle speed limit to the road speed limit.

Safety: Designing Roads to Reduce Accidents (Best Practices)

Improved Signage and Markings:

- **Clear Signage:** Ensure all traffic signs are clear, visible, and properly maintained. Use reflective materials for better visibility at night.
- **Road Markings:** Maintain clear road markings for lanes, pedestrian crossings, and bike lanes to guide road users effectively.

Safety: Designing Roads to Reduce Accidents (Best Practices)

Pedestrian and Cyclist Safety:

- **Sidewalks and Crosswalks:** Construct wide, well-lit sidewalks and marked crosswalks with pedestrian signals.
- **Bike Lanes:** Develop dedicated bike lanes separated from vehicular traffic to protect cyclists.

Safety: Designing Roads to Reduce Accidents (Best Practices)

Vehicle Safety Regulations:

- **Helmet and Safety-Belt Usage Laws:** Enforce mandatory helmet and safety-belt use.
- **Vehicle Inspections:** Implement regular vehicle inspections to ensure roadworthiness and safety compliance.

Efficiency: Ensuring Smooth Flow of Traffic (Best Practices)

Traffic Signal Coordination:

- **Adaptive Traffic Signals:** Use adaptive traffic signal systems that adjust based on real-time traffic conditions to minimize wait times and reduce congestion.
- **Signal Timing Optimization:** Regularly review and optimize traffic signal timings to improve flow at intersections.

Efficiency: Ensuring Smooth Flow of Traffic (Best Practices)

Public Transportation Integration:

- **Bus Rapid Transit (BRT):** Develop dedicated lanes for buses to ensure they can travel quickly and reliably, encouraging public transport use.
- **Multi-Modal Transport Hubs:** Create hubs where different modes of transport (buses, trains, bikes) connect seamlessly to promote efficient movement across the city.

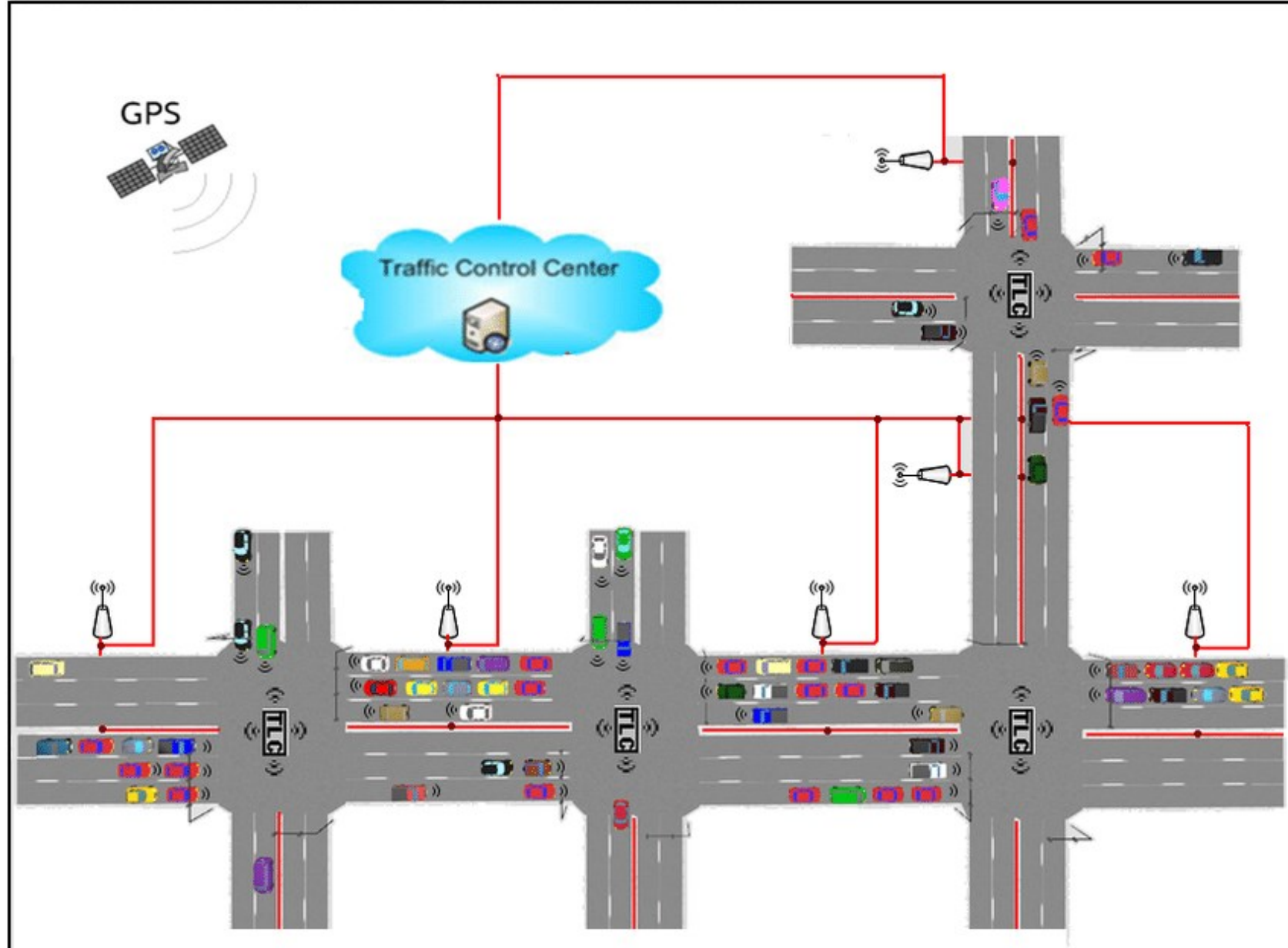
Efficiency: Ensuring Smooth Flow of Traffic (Best Practices)

Traffic Management Systems:

- **Real-Time Monitoring:** Use cameras and sensors to monitor traffic conditions and manage incidents promptly.

- **Traffic Information Systems:** Provide real-time traffic information to drivers via apps and electronic signs to help them choose the best routes

Efficiency: Ensuring Smooth Flow of Traffic (Best Practices)



Accessibility: Making Roads Usable for All (Best Practices)

- Accessible Crosswalks
- Inclusive Public Transport
- Safe Pedestrian & Cyclist Facilities

Accessibility: Making Roads Usable for All (Best Practices)

- New vision of urban space (woonerfs) – ‘shared speed’, ‘shared space’



Sustainability: Incorporating Eco-Friendly Best Practices

- Sustainable Materials
- Energy-Efficient Lighting
- Promoting Non-Motorized Transport

Conclusion

- By incorporating these design principles—**safety, efficiency, accessibility, and sustainability**—into **traffic systems**, cities can create a **more humane, functional, and environmentally friendly transportation network.**

Q&A

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