IBI GROUP

Smart Transportation in the Indian Context

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IBI Group

IBI Group

MOBILIZE YOUR CITY

January 18, 2021

We are IBI Group

We are a globally integrated design and technology firm. We plan, design, build, and sustain the cities of tomorrow alongside local communities across six continents.

IBI GROUP

2,600+
Difference-makers

2,215
New projects in 2018

60+ Offices

6 Continents

We design every aspect of a truly integrated city for people to live, work, and play with expertise organized into three sectors.

IBI GROUP

Buildings

Architecture
Interior Design
Mechanical, Structural, and Electrical Engineering

Intelligence

Software
Systems Design
Systems Integration
Operations
End-user Services

Infrastructure

Civil Engineering
Landscape Architecture
Planning
Transportation
Urban Design

Our Indian Experience

- Hyderabad ITMS
- OMC ITS
- Hyderabad Signals
- Chennai ITS
- Mysore ITS
- Indore ITS
- Hubli-Dharwad ITS
- VTMS
- Bhubaneswar Smart City
- Auric Smart City
- CTU CBMP
- Jaiput CBMP
- PCMC M&E

INTRODUCTION

What is a Smart City?

A smart city is characterized by the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development

– Navigant Research

6

What is ITS?

Application of sensing, analysis, control and communications technologies to improve the safety, efficiency, and sustainability of transportation networks, to reduce traffic congestion and to enhance drivers' experiences

7

Smart Cities in India – Projects

- **Agartala**
  - Junction Improvement
  - Mobility
  - Smart Bus Operations
- **Agra**
  - Intelligent Traffic Management System
  - Mobility
  - Parking Management System
  - Smart Public Transportation
- **Ahmedabad**
  - Command and Control Centre
  - Integrated Transit Management Platform
  - Mobility
- **Aizwal**
  - Command and Control Centre
  - Mobility
- **Ajmer**
  - Integrated Traffic Management System
  - Mobility
- **Aligarh**
  - Command and Control Centre
  - Intelligent Traffic Management System
  - Mobility
  - Multi-level parking
- **Allahabad**
  - Command and Control Centre
  - Fare Collection System
  - Junction Improvement
  - Mobility
  - Smart Bus Operations
  - Traffic
  - Vehicle Tracking and Monitoring System
- **Amaravati**
  - Mobility
  - Smart Bus Operations
- **Amritsar**
  - Mobility
  - Traffic
- **Aurangabad**
  - Command and Control Centre
  - Mobility
- **Bareilly**
  - Intelligent Traffic Management System
  - Mobility
- **Belagavi**
  - Command and Control Centre
  - Mobility
- **Bengaluru**
  - B-TRIPS
  - Command and Control Centre
  - Mobility
- **Bhagalpur**
  - Command and Control Centre
  - Intelligent Traffic Management System
  - Mobility
  - Smart Bus Operations
- **Bhopal**
  - Mobility
- **Bhubaneshwar**
  - Command and Control Centre
  - Common Mobility Card
  - Mobility
  - Parking Management System
  - Smart Bus Operations
  - Traffic Management
- **Bihar Sharif**
  - Non-Motorised Transport
  - Seamless Public Transport
  - Smart Public Transportation
  - Transport Network Improvement
- **Bilaspur**
  - Intelligent Traffic Management System
  - Mobility
- **Chandigarh**
  - City Management Centre
  - City Network
  - Data Centre
  - Intelligent Transport
  - Mobility
- **Chennai**
  - ICT for Non Motorized Transport
  - Mobility
- **Coimbatore**
  - Command and Control Centre
  - Junction Improvement
  - Mobility
- **Dahod**
  - Command and Control Centre
  - Digital Transit Facilities
  - Mobility
- **Davangere**
  - Intelligent Urban Mobility System
  - Mobility
- **Dehradun**
  - City Nervous System
  - Mobility
- **Dharamshala**
  - Intelligent Traffic Management System
  - Mobility
  - Smart Public Transportation
- **Diu**
  - Command and Control Centre
  - Mobility
  - Traffic Management
  - Variable messaging system
- **Erode**
  - Command and Control Centre
  - Mobility
- **Faridabad**
  - ATCS
  - Command and Control Centre
  - E-Vehicle module
  - Fleet management System
  - Mobility
  - Parking Management System
  - Passenger Information System
  - Passive Infrastructure
  - Vehicular Monitoring System
- **Gandhinagar**
  - Mobility
- **Gangtok**
  - City Management Centre
  - Mobility
  - Smart City Platform
- **Guwahati**
  - ICT Project on Public Transport System
  - Junction Improvement
  - Mobility
  - Smart Bus Operations
- **Gwalior**
  - Command and Control Centre
  - Mobility
  - Urban Transit
- **Hubli Dharwad**
  - Mobility
- **Imphal**
  - Mobility
  - Pedestrian Pavements
  - Smart Mobility
  - Cycle Tracks
- **Indore**
  - Command and Control Centre
  - Mobility
- **Itanagar**
  - Intelligent Traffic Management System
  - Mobility
- **Jabalpur**
  - Mobility
  - Vehicle Tracking and Monitoring System
- **Jaipur**
  - Mobility
  - Smart Mobility
- **Jammu**
  - Common Mobility Card
  - Electric Buses
  - EV Charging
  - Intelligent Traffic Management System
  - Mobility
  - Smart Bus Operations
  - Smart Data centre
  - Cycle Tracks
- **Jhansi**
  - Command and Control Centre
  - Intelligent Transportation System
  - Mobility
  - Off-street Automated Multilevel car
  - Parking Management System
  - Smart Bus Operations
- **Kakinada**
  - ICT Based Urban Service
  - Mobility
- **Kalyan-Dombivali**
  - Intelligent Traffic Management System
  - Mobility
  - Parking Management System
  - Transit Mangement System
- **Kanpur**
  - Common Mobility Card
  - ICT for City Bus
  - Integrated Traffic Management System
  - Mobility
  - Smart Travel Stations
- **Karimnagar**
  - City Bus System
  - Mobility
  - Road Signages
  - Signalling
  - Solar roof tops
  - Zebra crossings and ramps
- **Karnal**
  - Mobility
  - Parking Management System
  - Smart Bus Operations
  - Traffic Violation Detection System
- **Kavaratti**
  - Mobility
- **Kochi**
  - Mobility
- **Kohima**
  - Command and Control Centre
  - Common Mobility Card
  - Mobility
- **Kota**
  - Intelligent Traffic Management System
  - Mobility
- **Lucknow**
  - Mobility
  - Smart City Platform
- **Ludhiana**
  - Command and Control Centre
  - E Rickshaw
  - Mobility
- **Madurai**
  - Command and Control Centre
  - Mobility
- **Mangaluru**
  - Command and Control Centre
  - Mobility
- **Moradabad**
  - Command and Control Centre
  - Intelligent Traffic Management System
  - Mobility
- **Muzaffarpur**
  - Intelligent Street Lighting
  - Intelligent Transportation System
  - Mobility
- **Nagpur**
  - Command and Control Centre
  - Mobility
- **Namchi**
  - Mobility
- **Nashik**
  - Intelligent Traffic Management System
  - Mobility
  - Parking Management System
- **Naya Raipur**
  - GreenSustainable Transportation
  - Last Mile Connectivity
  - Mobility
  - Smart City Identity
- **NDMC**
  - Command and Control Centre
  - Mobility
- **Newtown Kolkata**
  - Mobility
- **Panaji**
  - Smart Transportation
- **Pasighat**
  - Intelligent Traffic Management System
  - Mobility
  - Smart Data centre
  - Smart Public Transportation
- **Patna**
  - Integrated Control and Command Centre
  - Mobility
- **Pimpri-Chinchwad**
  - Bicycle Sharing
  - Command and Control Centre
  - Mobility
  - One Transit App
  - Parking Management System
  - Smart Traffic management
- **Port Blair**
  - Mobility
- **Puducherry**
  - Command and Control Centre
  - Cycle Sharing
  - Intelligent Traffic Management System
  - Mobility
  - Parking Management System
  - Smart City Platform
- **Pune**
  - Mobility
  - Transport
- **Raipur**
  - Intelligent Traffic Management System
  - Mobility
- **Rajkot**
  - Electric Buses
  - Roads
  - Cycle parking & charging station
  - Cycle Tracks
- **Ranchi**
  - Command and Control Centre
  - Corridor Management System (Traffic)
  - Fare mangement system
  - Intelligent Public Transport System
  - IPT Integration
  - Mobility
  - Parking Management System
- **Rourkela**
  - Command and Control Centre
  - Mobility
  - Traffic and Surveillience camera
  - Transport
- **Sagar**
  - Mobility
  - Transit and Traffic Infrastructure Management
- **Saharanpur**
  - Automatic Traffic Violation Deduction Camera
  - Development of Corridors and Routers
  - IPT Systems
  - Mobility
  - Smart Traffic Management Systems
  - Variable Message Sign Boards
- **Salem**
  - Integrated Traffic Management System
  - Mobility
- **Satna**
  - Command and Control Centre
  - Mobility
  - Traffic Management
- **Shillong**
  - Command and Control Centre
  - Intelligent Traffic Management System
  - Mobility
  - Parking Management System
  - Traffic Management
- **Shimla**
  - Command and Control Centre
  - Intelligent Traffic Management System
  - Mobility
- **Shivamogga**
  - Command and Control Centre
  - Mobility
- **Silvassa**
  - Automatic Number Plate Recognition
  - Command and Control Centre
  - E-Challan
  - Intelligent Traffic Management System
  - Mobility
  - Pelican signals
  - Smart Parking
  - Smart signals
- **Solapur**
  - Mobility
  - Vehicle Tracking and Monitoring System
- **Srinagar**
  - Common Mobility Card
  - Electric Buses
  - EV Charging
  - Intelligent Traffic Management System
  - Mobility
  - Smart Bus Operations
- **Surat**
  - Automatic Fare Collection
  - Intelligent Traffic Management System
  - Mobility
- **Thane**
  - Common Mobility Card
  - Intelligent Traffic Management System
  - Mobility
- **Thanjavur**
  - Command and Control Centre
  - Mobility
  - Smart tourism app
- **Thoothukudi**
  - Area Traffic Control System
  - Command and Control Centre
  - Common Mobility Card
  - Intelligent Transit System
- **Tiruchirapalli**
  - Command and Control Centre
  - Mobility
  - Transportation
- **Tirunelvali**
  - Intelligent Traffic Management System
  - Mobility
- **Tirupati**
  - City Operations Centre
  - EV Charging
  - Intelligent Traffic Management System
  - Mobility
- **Tiruppur**
  - Area Traffic Control System
  - Intelligent Traffic Management System
  - Mobility
  - Parking Management System
- **Tiruvanantapuram**
  - Command and Control Centre
  - Mobility
  - Traffic & transportation
- **Tumakuru**
  - Command and Control Centre
  - Mobility
- **Udaipur**
  - Intelligent Transport Management Systems
  - Mobility
- **Ujjain**
  - Mobility
  - Traffic Management
- **Vadodara**
  - Command and Control Centre
  - Mobility
  - Urban Mobility
- **Varanasi**
  - Command and Control Centre
  - Intelligent Traffic Management System
  - Mobility
  - Smart Parking
- **Vellore**
  - Command and Control Centre
  - Integrated Public Transport System
  - Last Mile Connectivity
  - Mobility
  - Public Information System
  - Real-time traffic modelling
- **Visakhapatnam**
  - Mobility
- **Warangal**
  - Area Traffic Control System
  - Common Mobility Card
  - Integrated City Operations Centre

Outcome

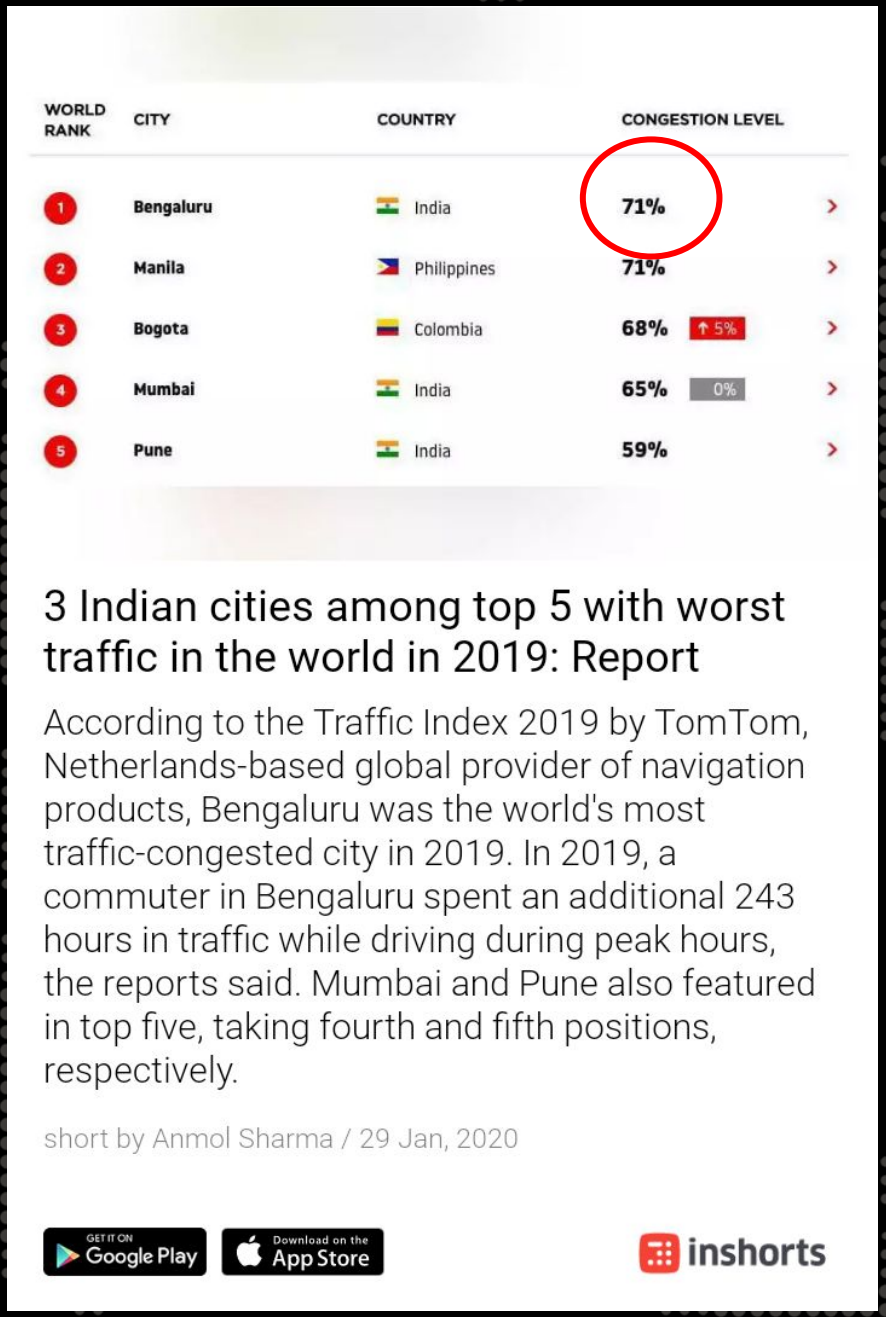
- Achieve Efficiency Through Application of Technology:
  - Livability
  - Safety
  - Governance
  - Capacity
  - Cost
  - …

SMART TRANSPORTATION

in Indian Context

Celebration???

Indian city of Bengaluru crowned ‘World’s Most Traffic Congested City’



WORLD RANK	CITY	COUNTRY	CONGESTION LEVEL
1	Bengaluru	India	71%
2	Manila	Philippines	71%
3	Bogota	Colombia	68% ↑5%
4	Mumbai	India	65% 0%
5	Pune	India	59%

3 Indian cities among top 5 with worst traffic in the world in 2019: Report

According to the Traffic Index 2019 by TomTom, Netherlands-based global provider of navigation products, Bengaluru was the world's most traffic-congested city in 2019. In 2019, a commuter in Bengaluru spent an additional 243 hours in traffic while driving during peak hours, the reports said. Mumbai and Pune also featured in top five, taking fourth and fifth positions, respectively.

short by Anmol Sharma / 29 Jan, 2020

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Most Quoted Reason...

Bengaluru has worst infra among Indian cities

BENGALURU, March 15, 2017, DHNS/PTI:, MAR 15 2017, 01:31AM IST | UPDATED: MAR 15 2017, 01:31AM IST

Transport Infra Expectation...

The Mobility Conundrum

"If you build it, they will come."

- Field of Dreams

https://www.quora.com/Why-does-Bengaluru-have-the-worst-infrastructure-among-Indian-cities

Smart solution for…

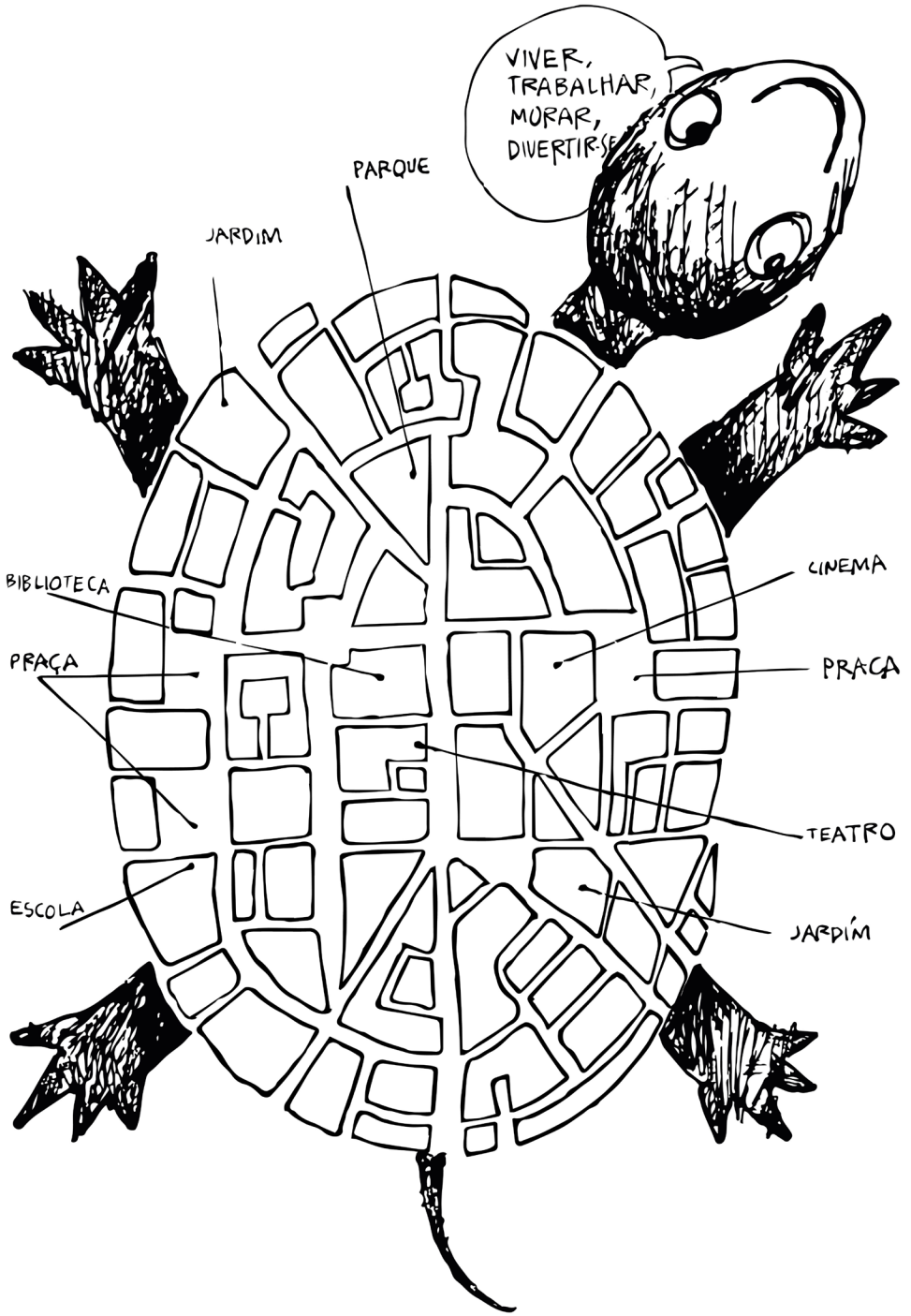
IBI GROUP

Source: http://bengaluru.citizenmatters.in/

is not ...

What we need..

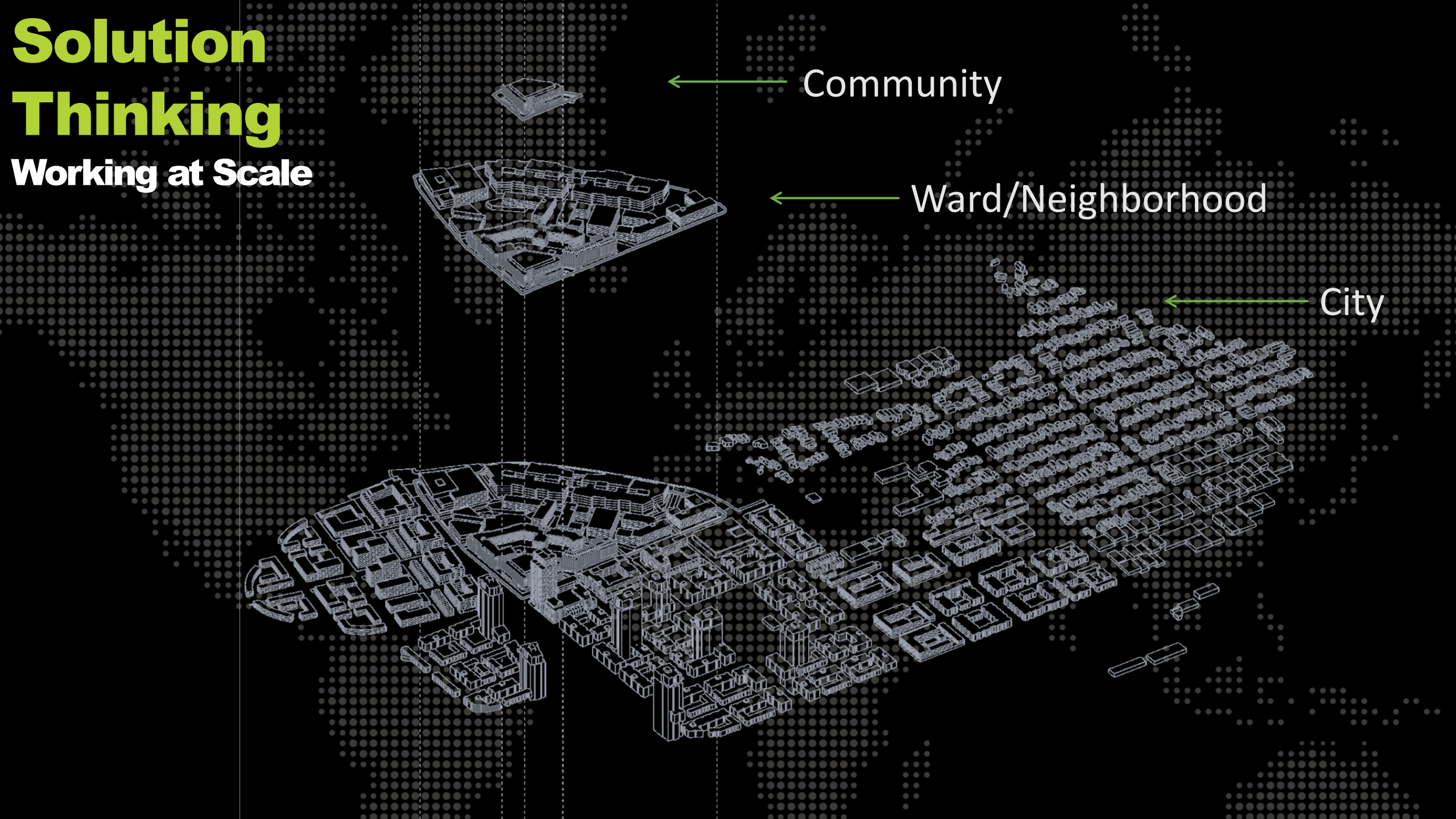
Human Sized, Living, Breathing Cities



Source: JaimeLerner.com

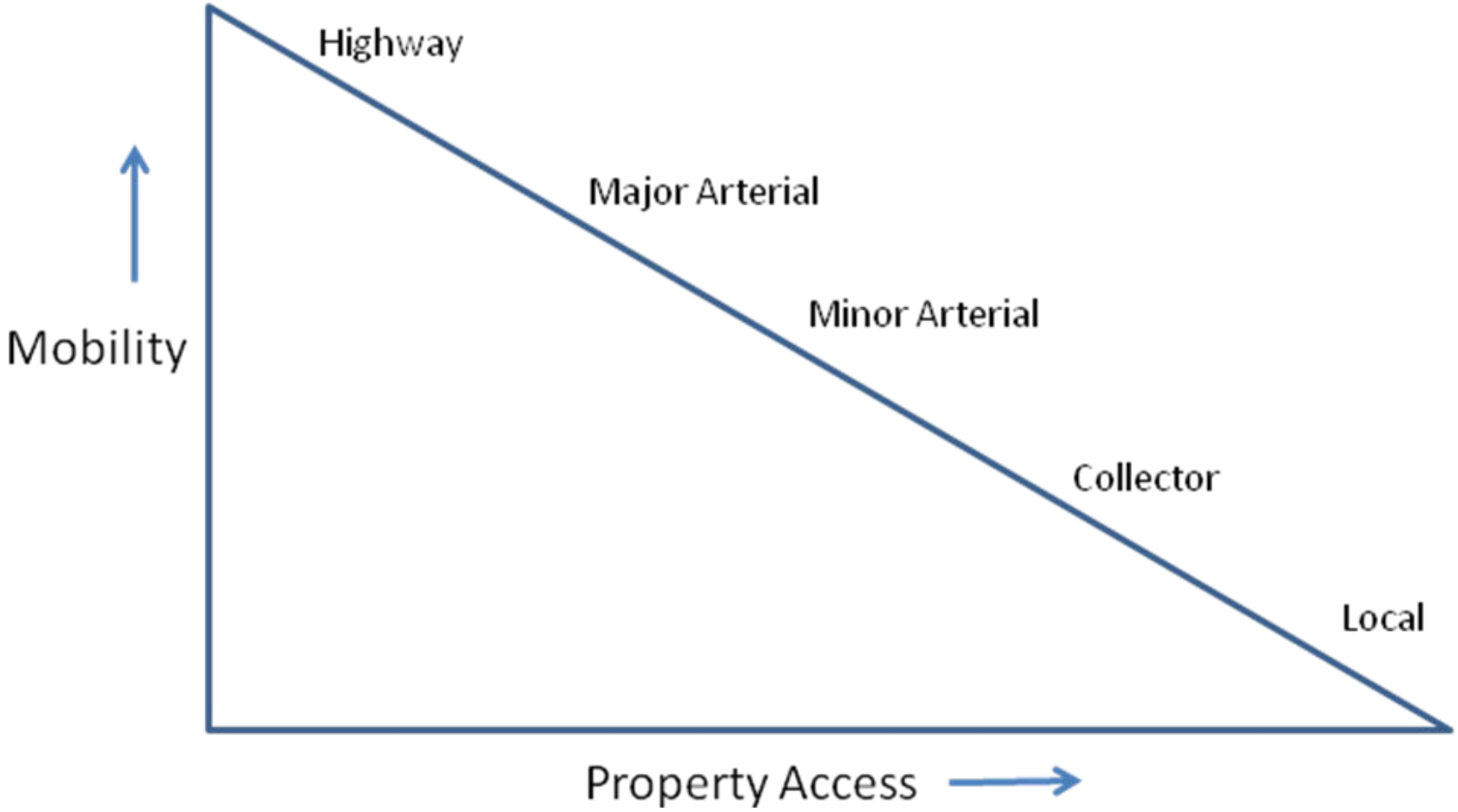
Solution Thinking

Working at Scale



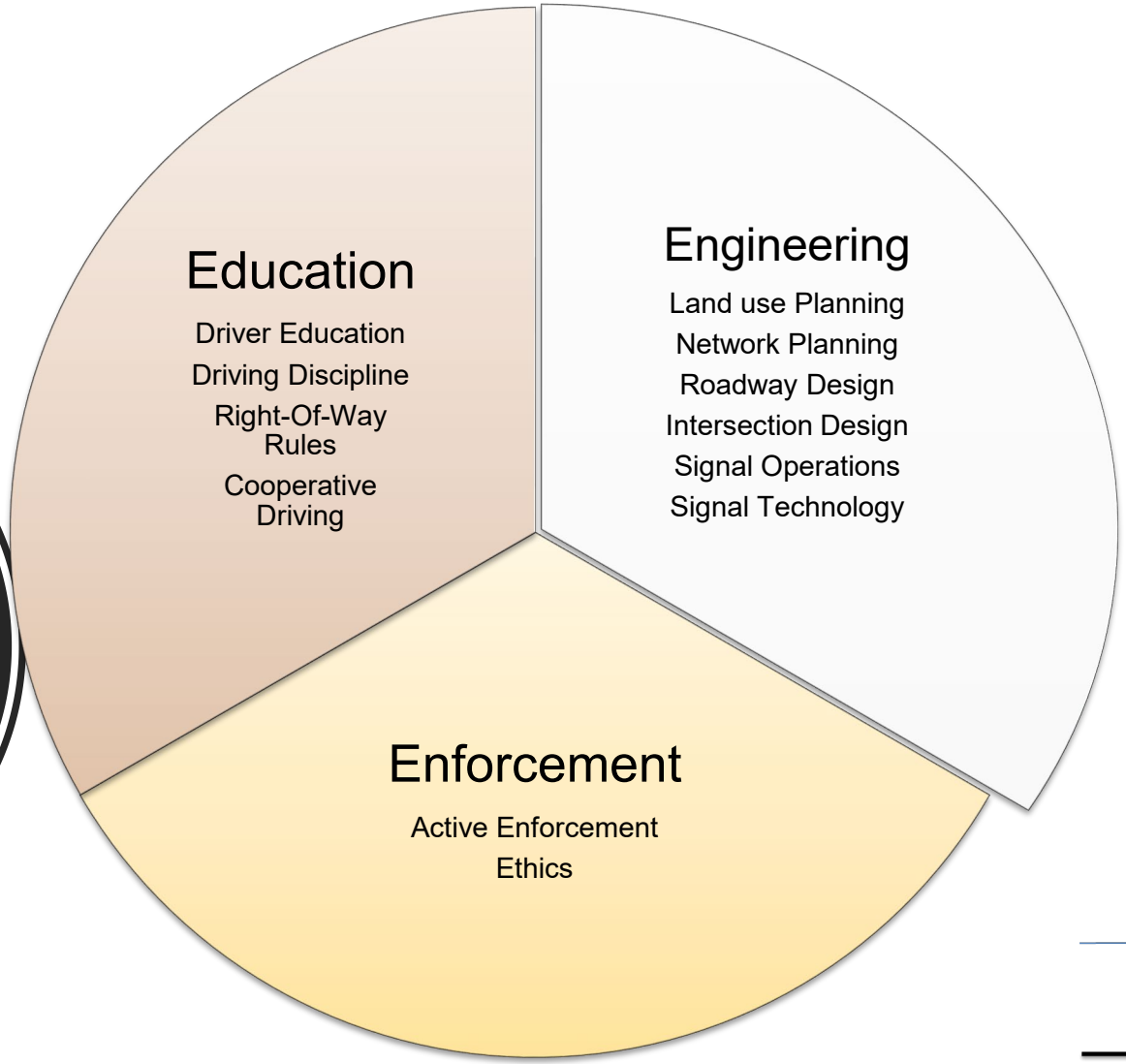
Solution Thinking

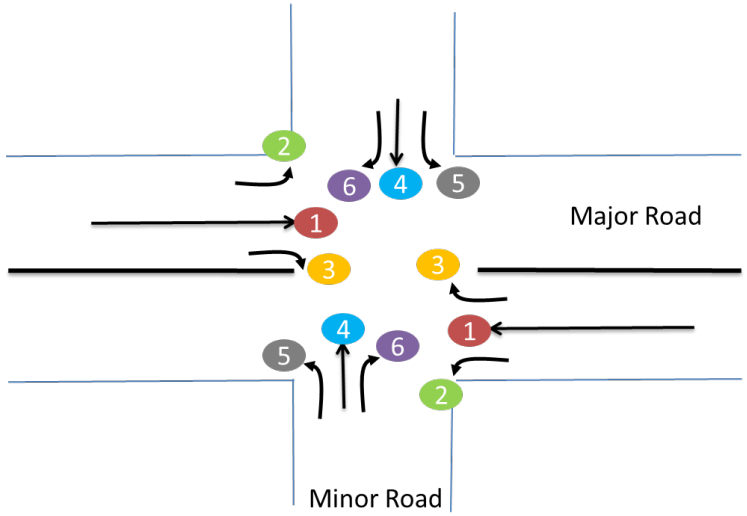
Mobility vs. Access



Solution Thinking

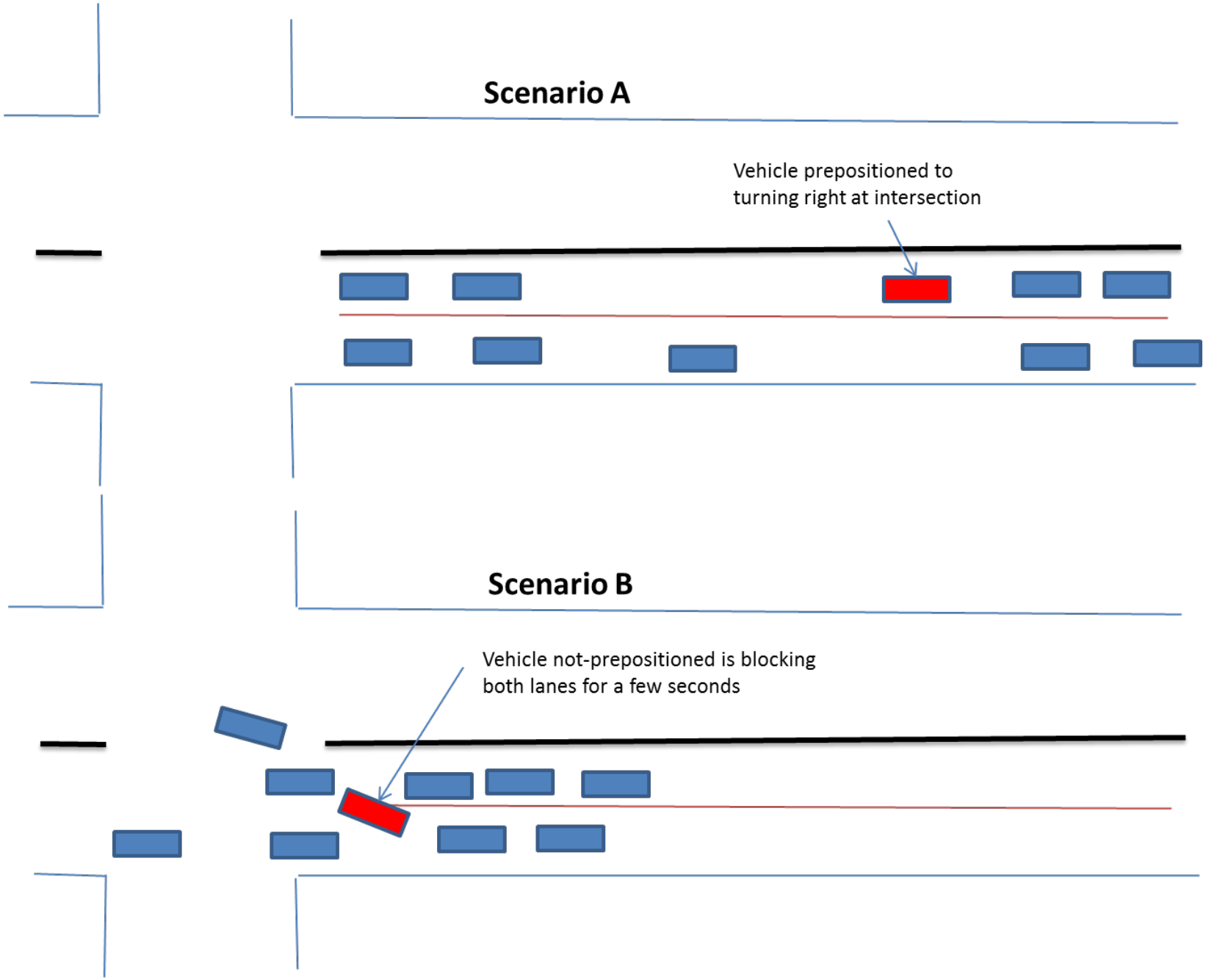
3Es





Solution Thinking

Role of Education

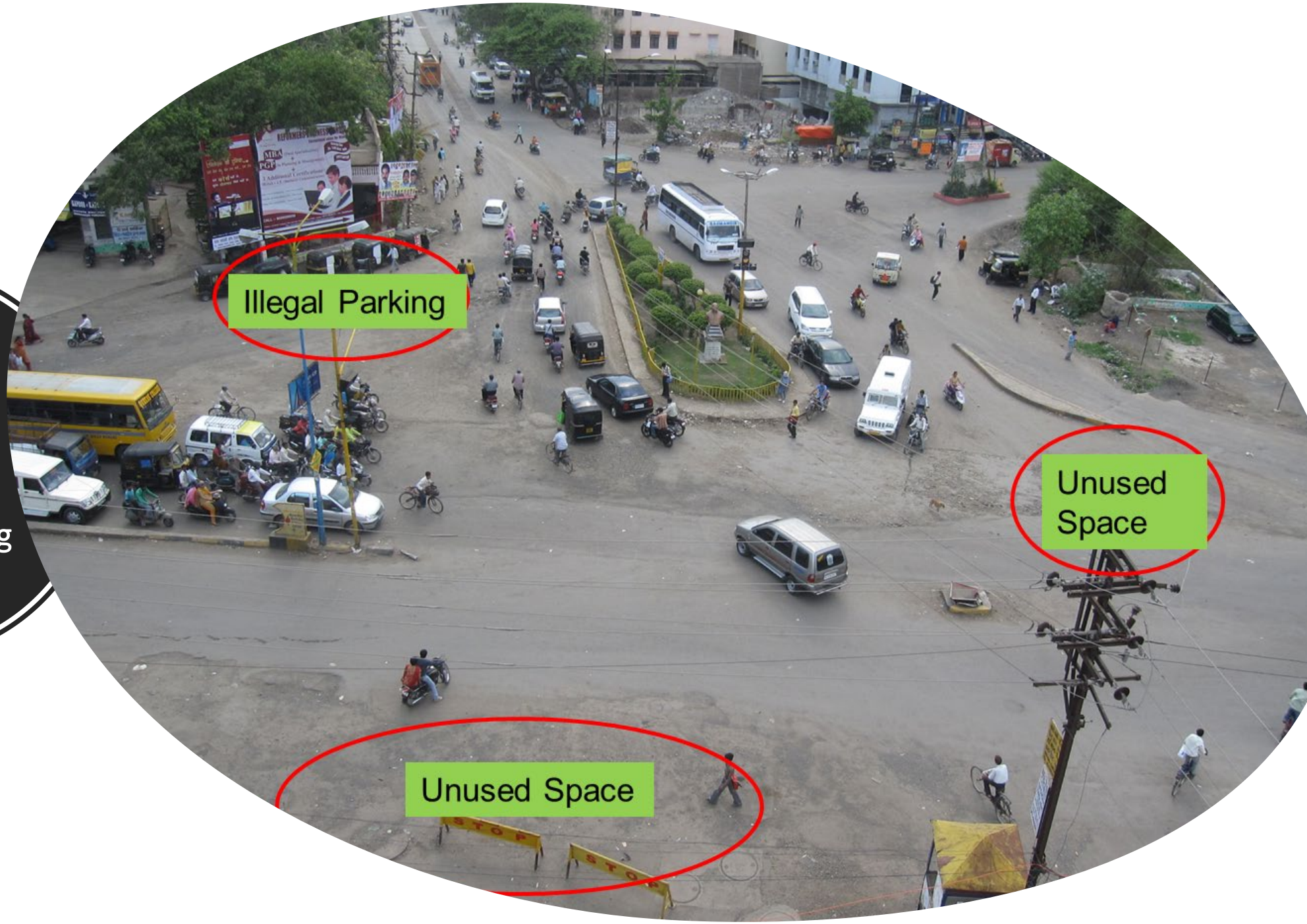


Solution Thinking

Role of Enforcement

Solution Thinking

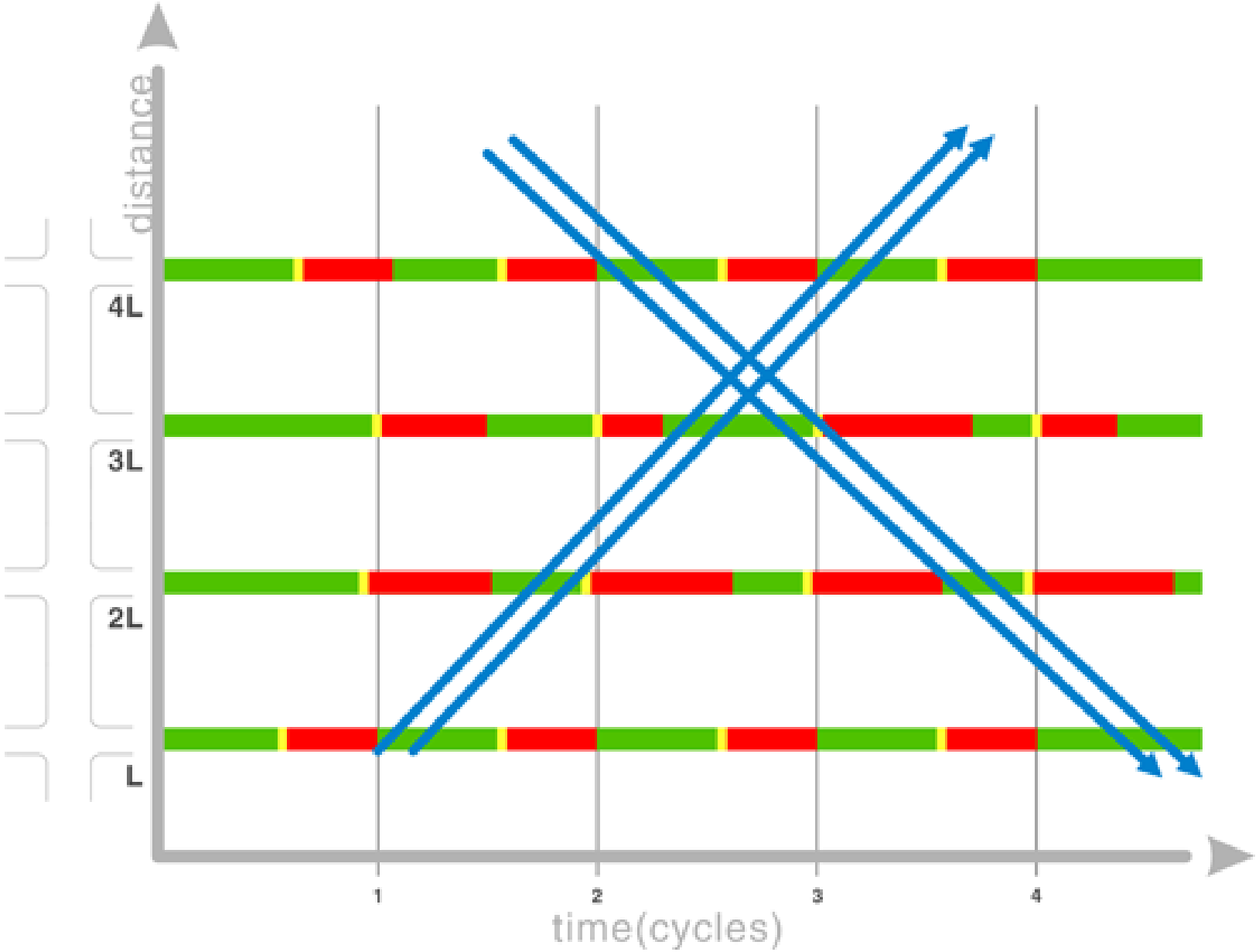
Role of Engineering



Progression Bandwidth Optimization Or Signal Synchronization

Solution Thinking

Signals & Metering



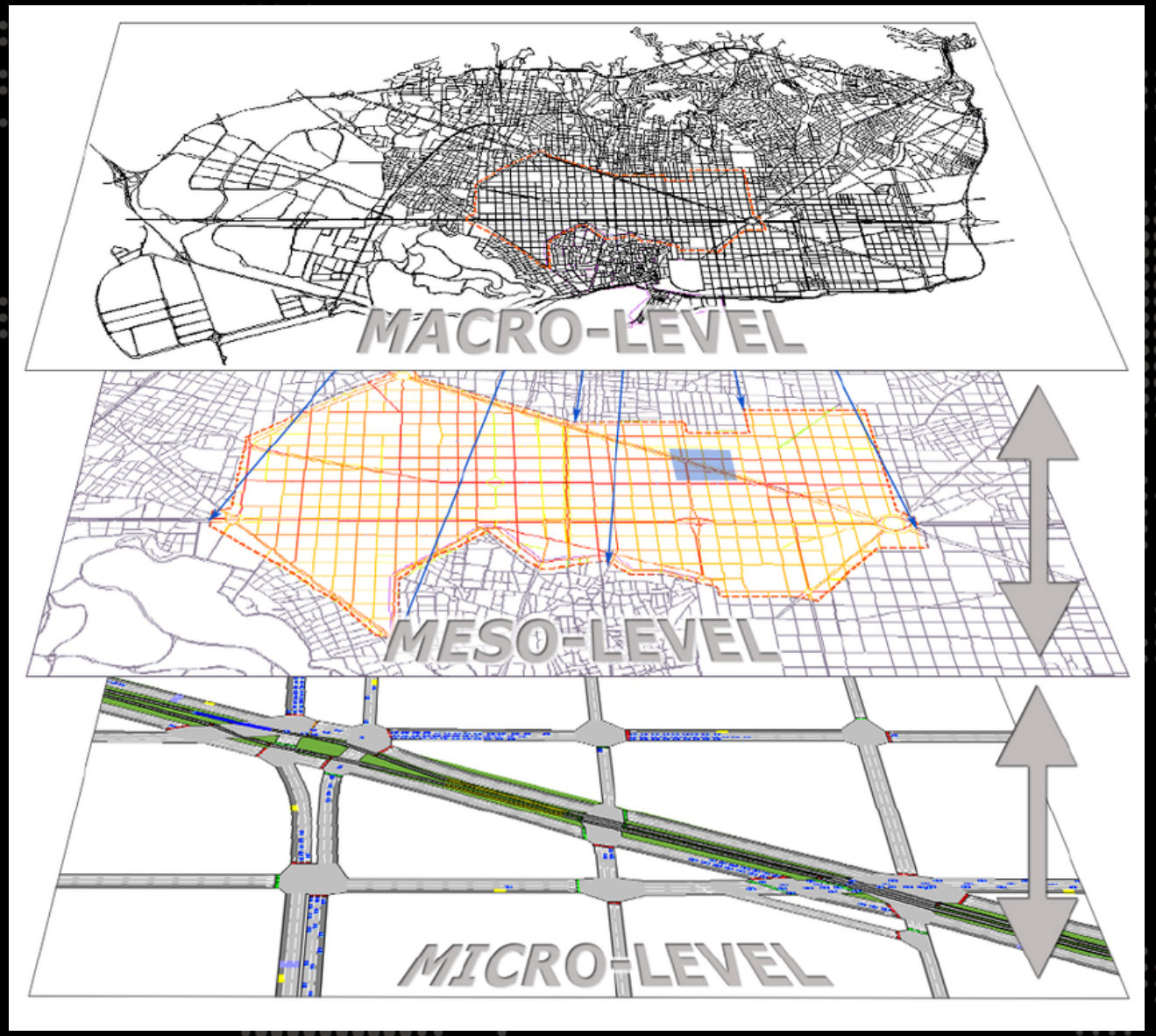
Solution Thinking – Beyond Vehicles

Solution Thinking – All Road Users

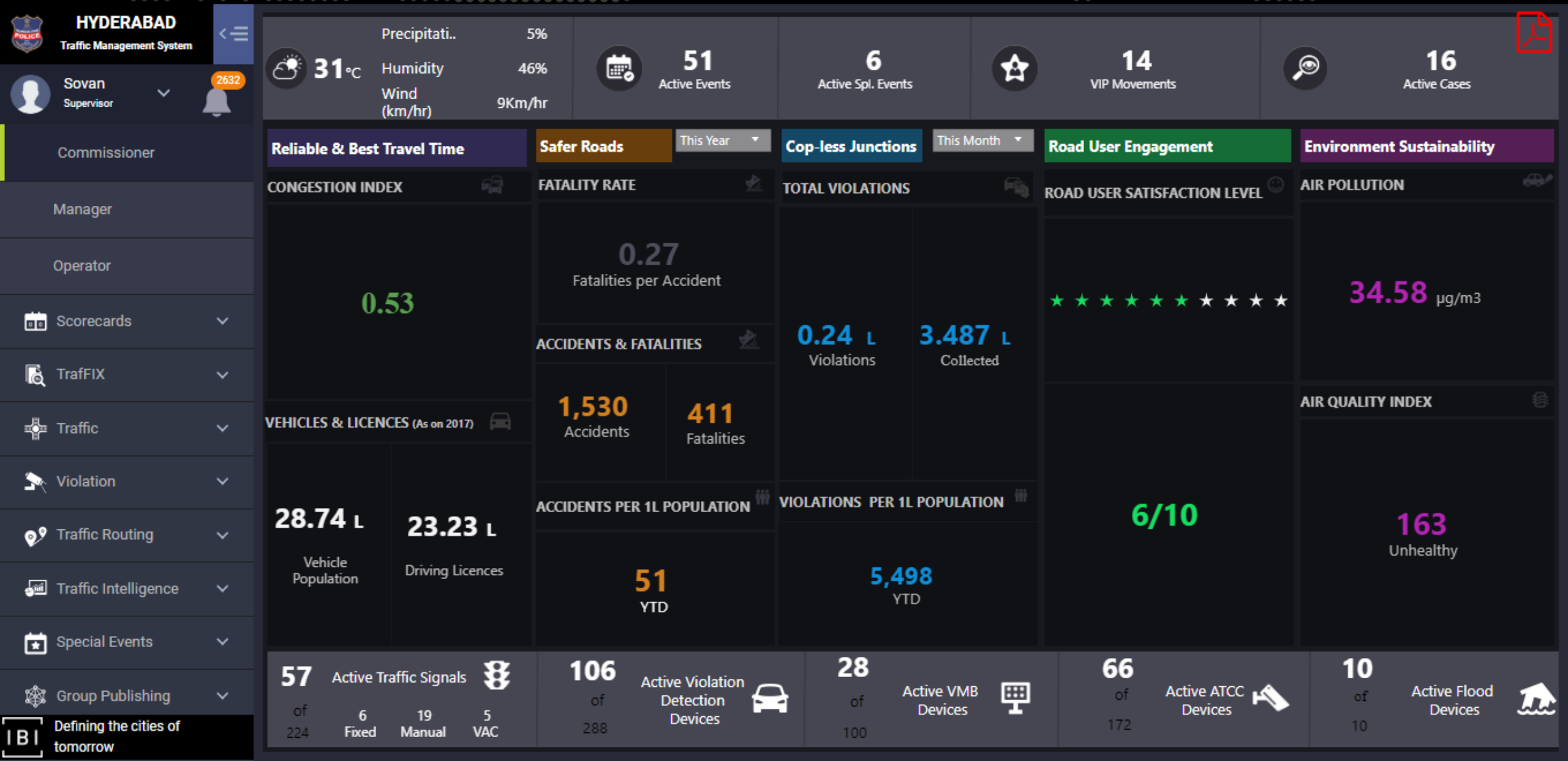
Winner of “Justicia Urbana”
http://unhabitat.org/the-2015-urban-october-design-competi…/

Solution Thinking

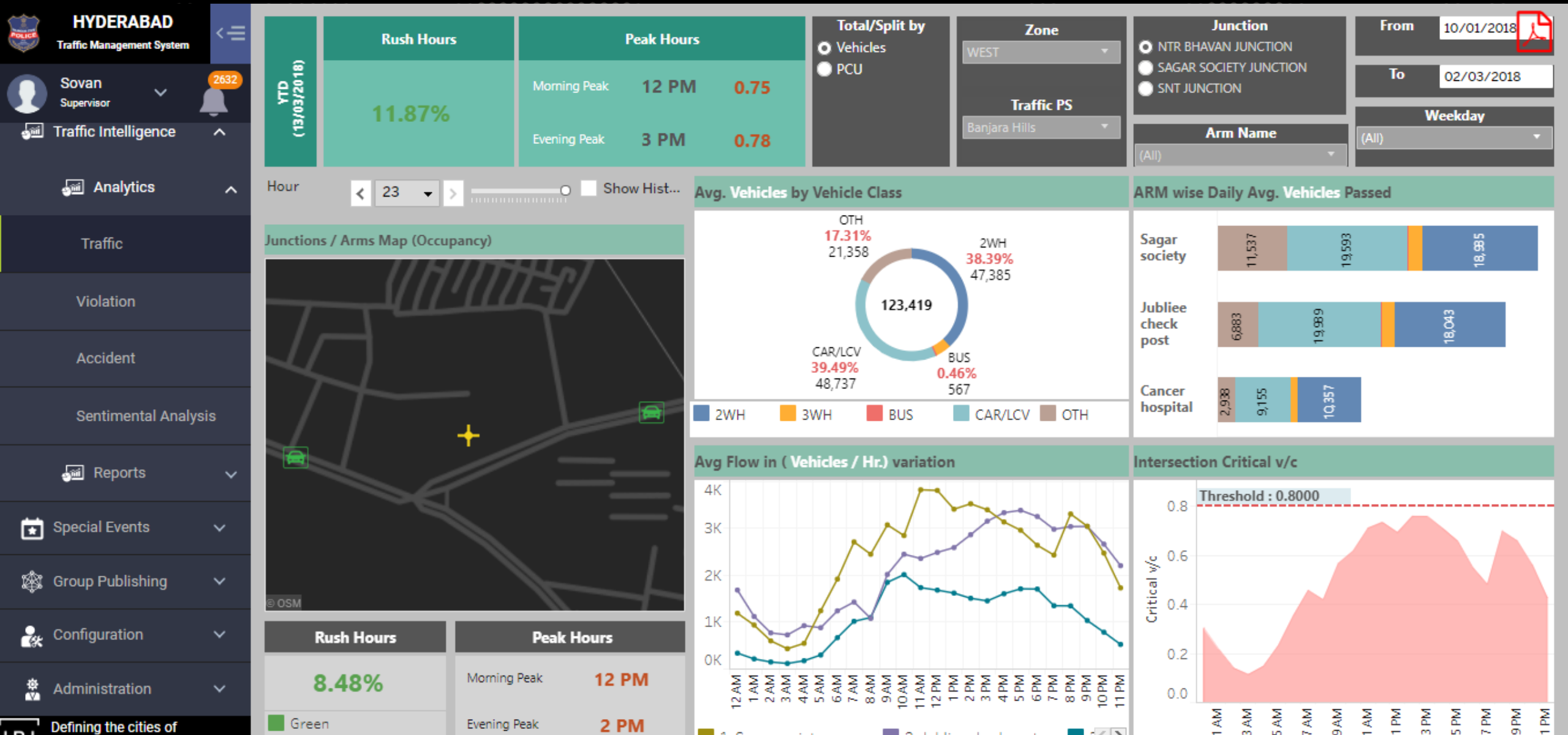
Modeling



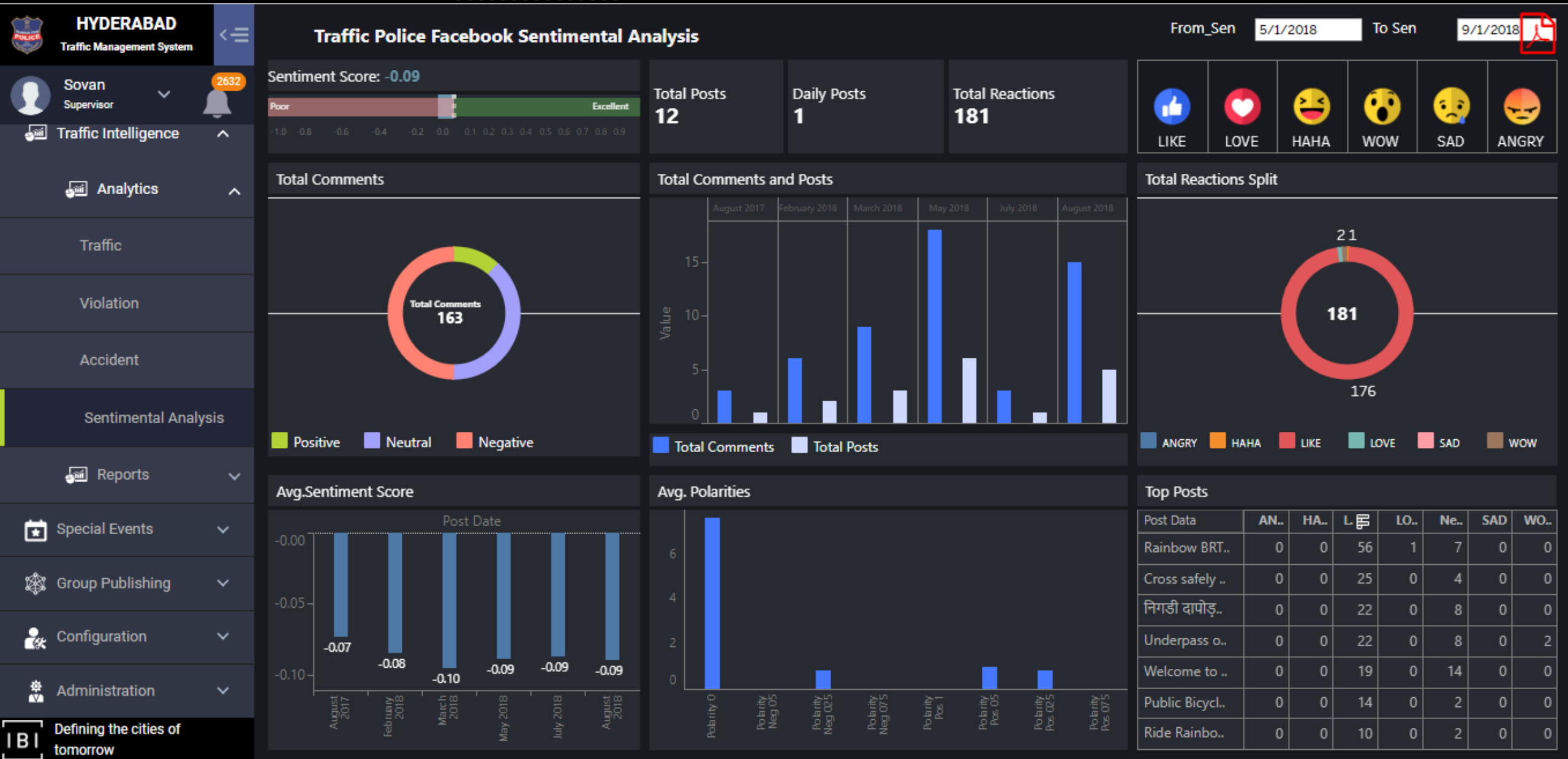
Solution Thinking – Systems & KPIs



Solution Thinking – Data & Analytics

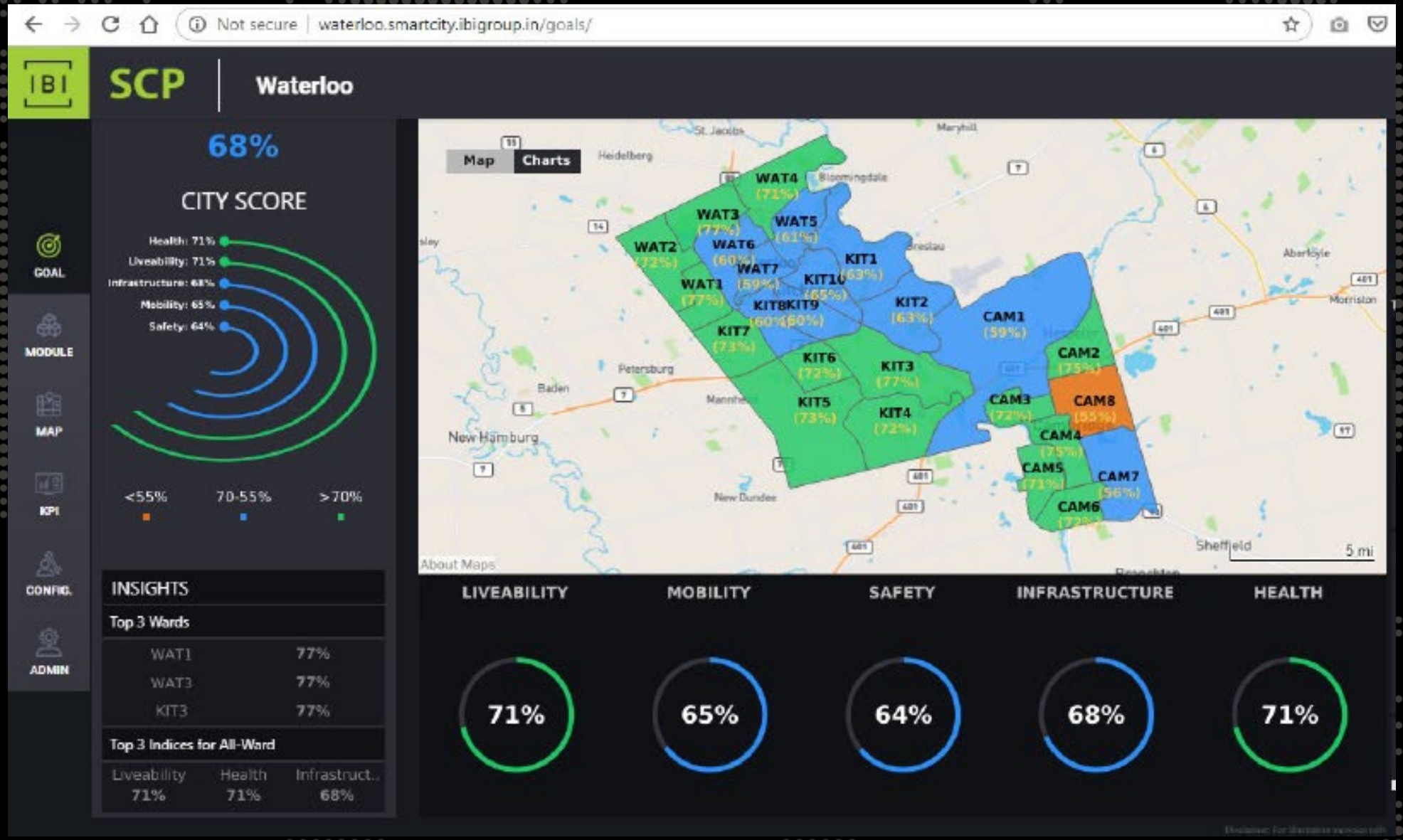


Solution Thinking - Sentiment Analytics

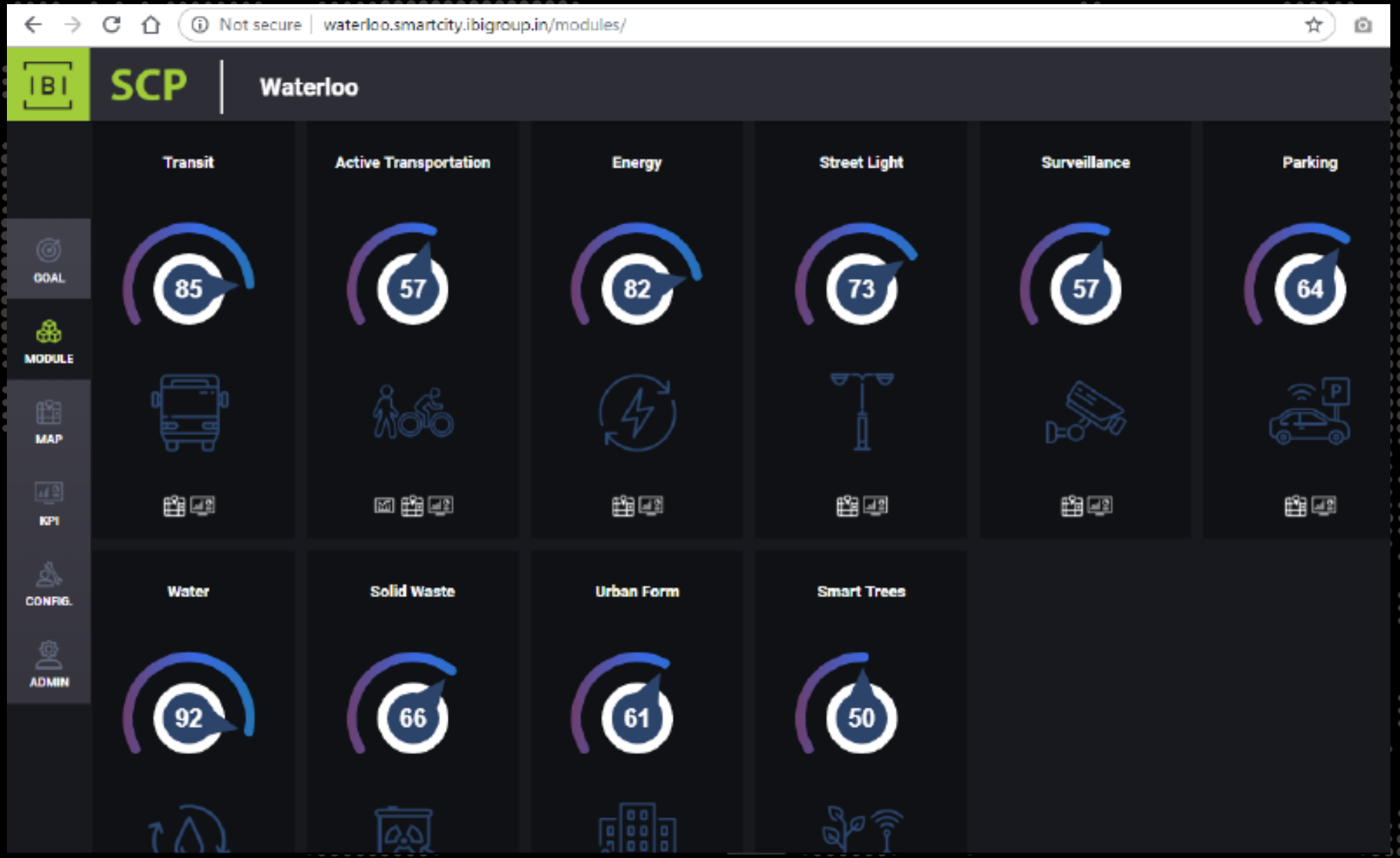


Post Data	AN..	HA..	L..	LO..	Ne..	SAD	WO..
Rainbow BRT..	0	0	56	1	7	0	0
Cross safely ..	0	0	25	0	4	0	0
निगडी दापोड़..	0	0	22	0	8	0	0
Underpass o..	0	0	22	0	8	0	2
Welcome to ..	0	0	19	0	14	0	0
Public Bicycl..	0	0	14	0	2	0	0
Ride Rainbo..	0	0	10	0	2	0	0

Solution Thinking – Strategic Decisions

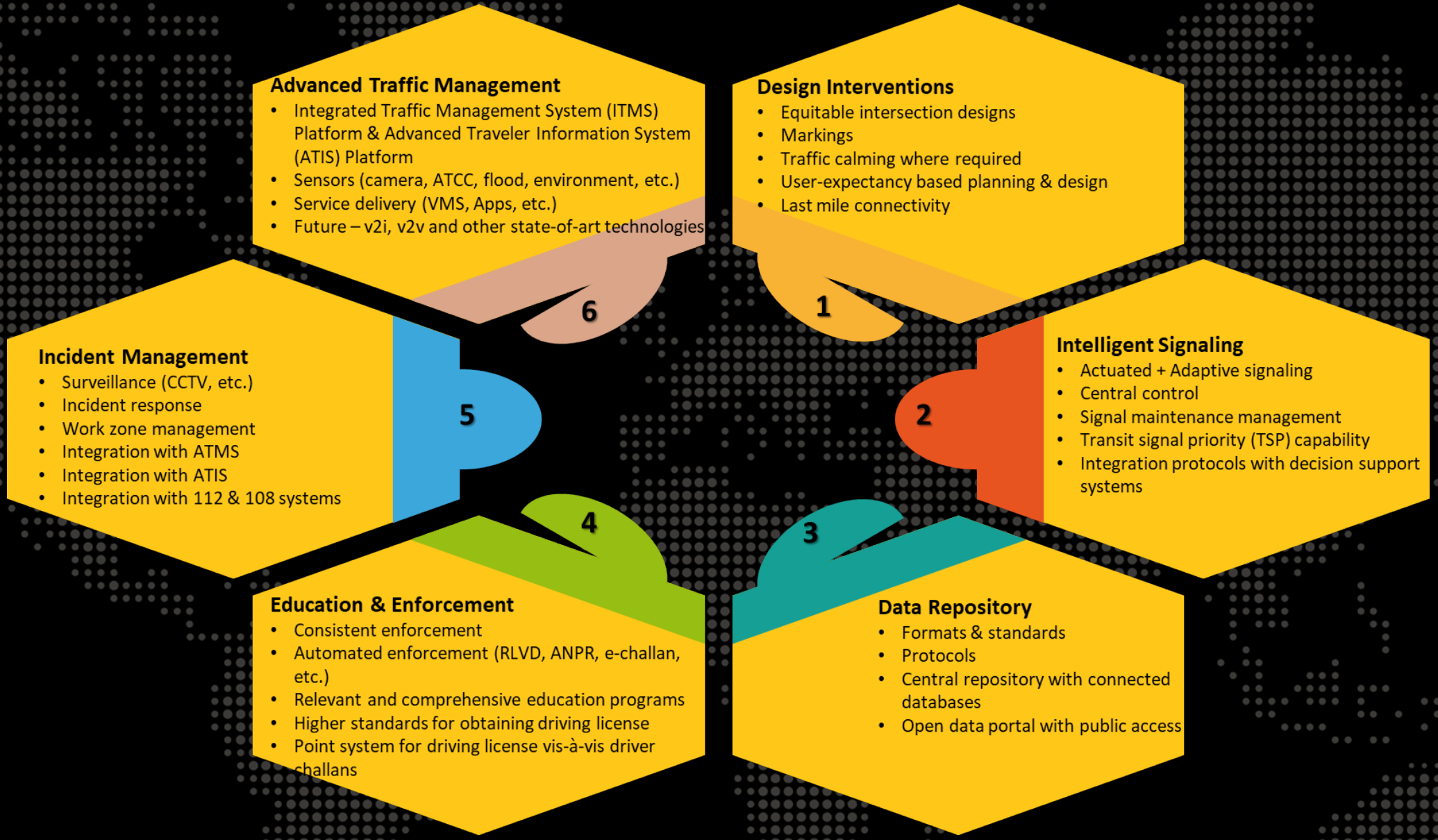


Solution Thinking – Integrated Decisions



Solution Thinking - Priorities

Solution Thinking – Need Analysis



Way Forward

Source: http://www.jantoo.com/cartoons/keywords/speed-of-light

We know the Challenges

ADMINISTRATIVE

- Impossible Deadlines
- Scope Creep
- Conflicting & Unrealistic Expectations

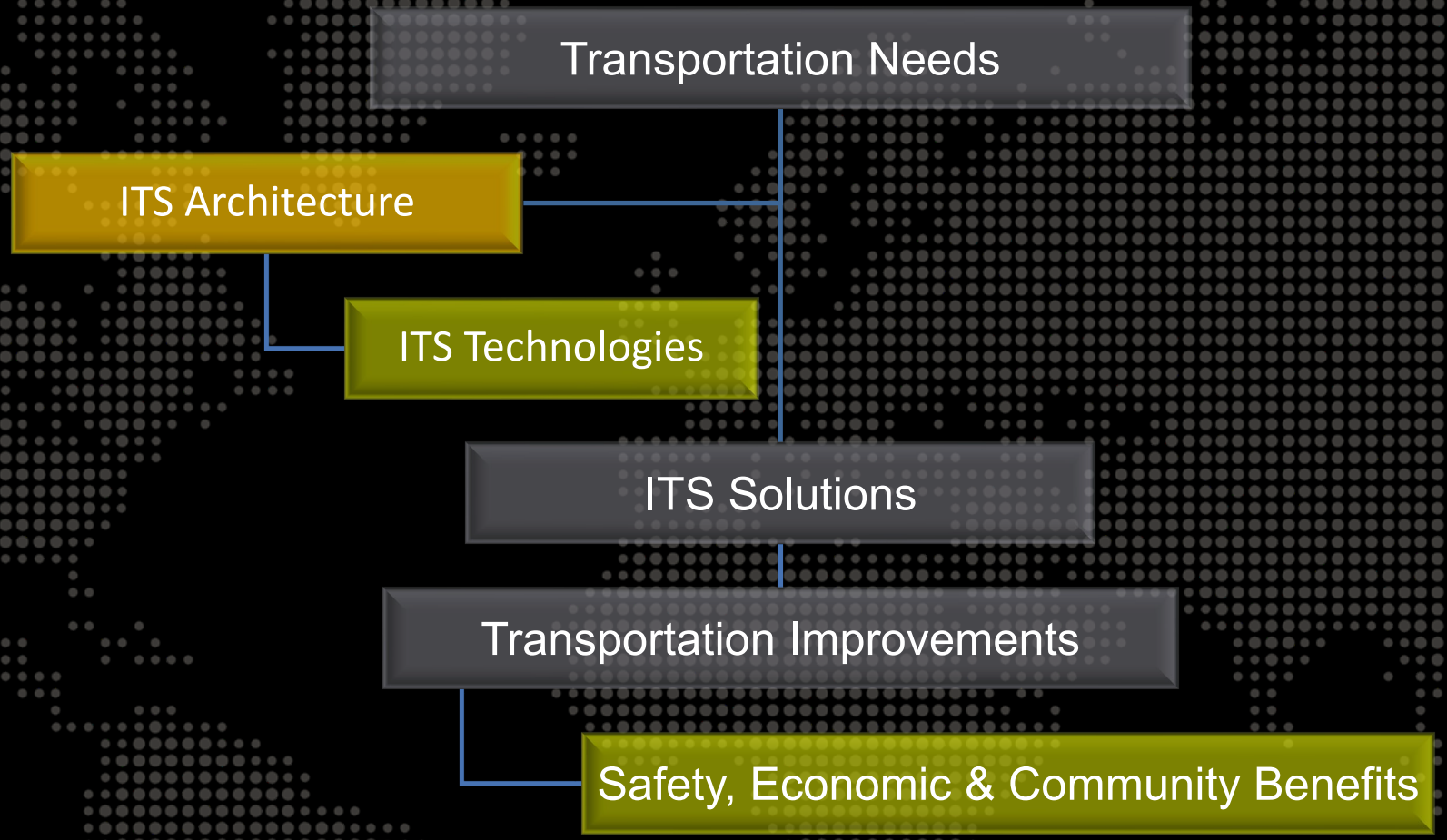
TECHNICAL

- Understanding Needs
- Setting of Scope
- Quality of Work
- Integrations

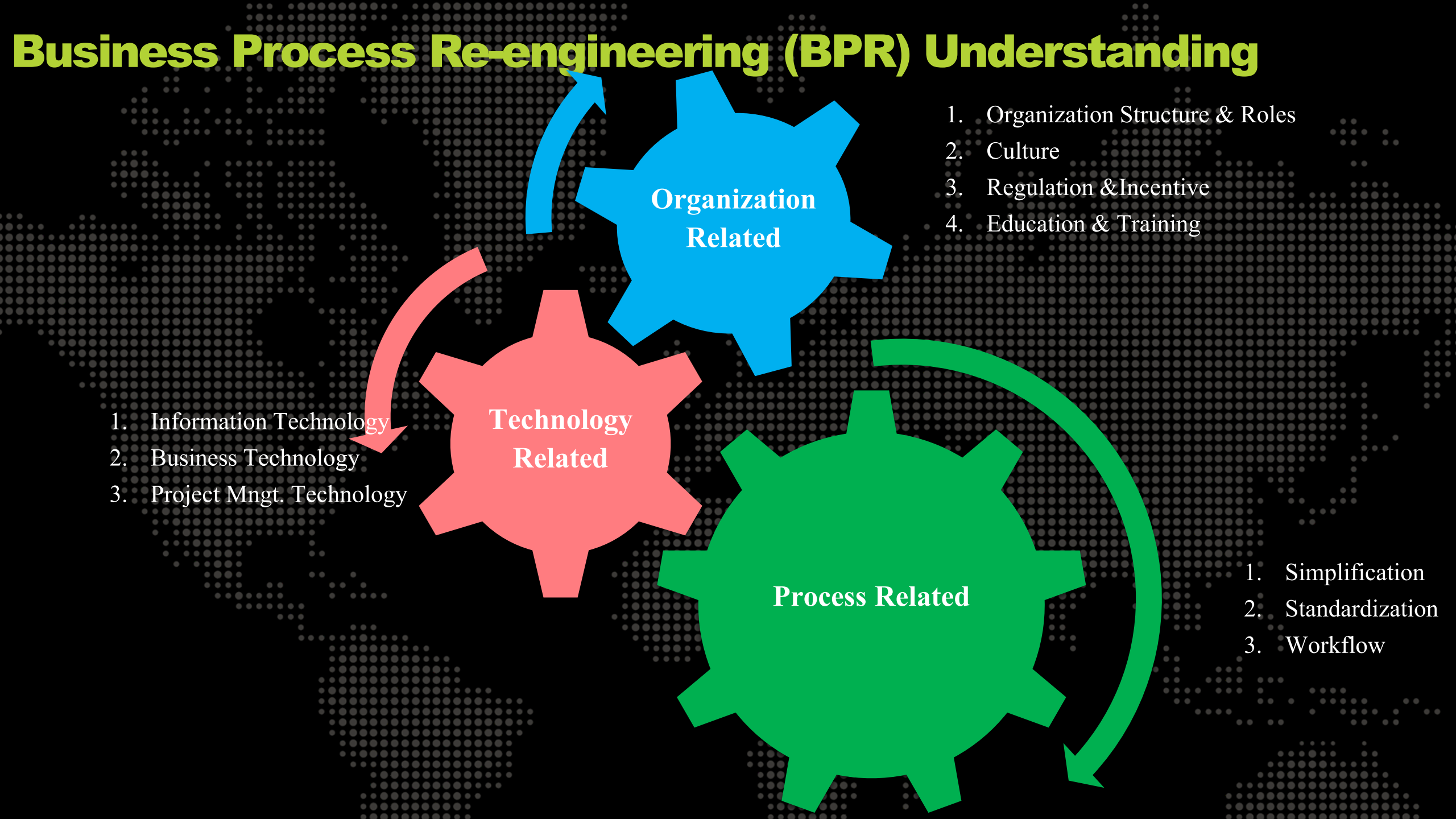
HUMAN

- Capacity

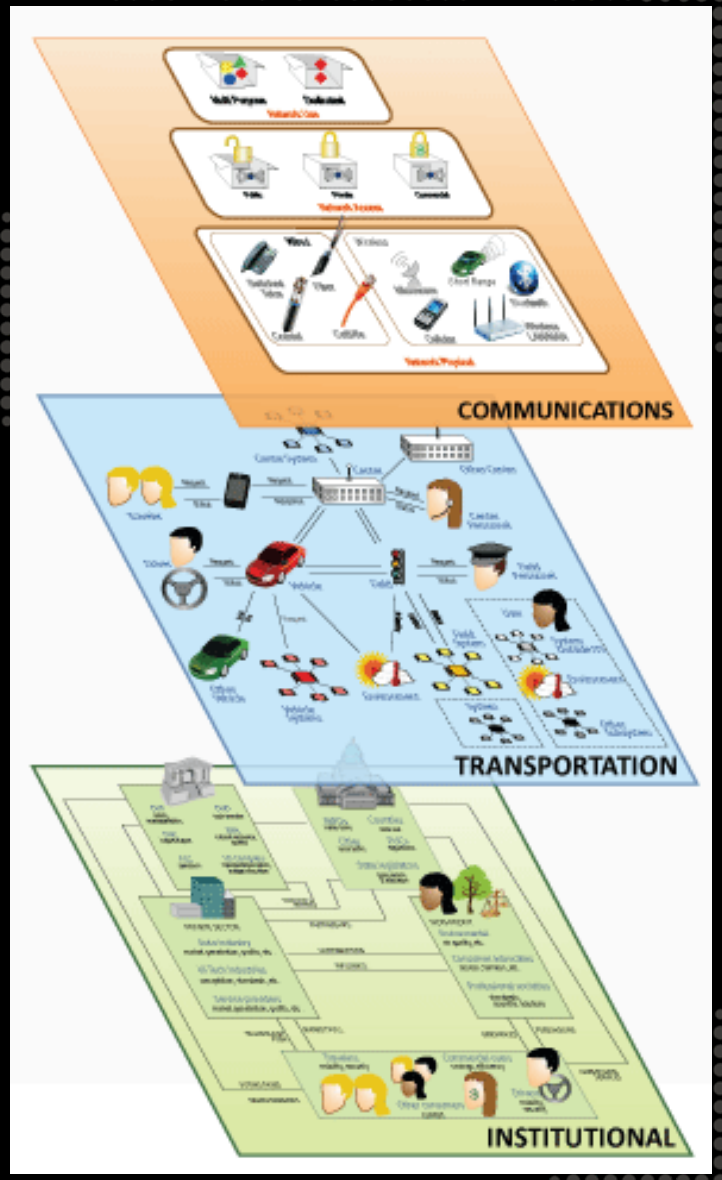
Technology Selection Understanding

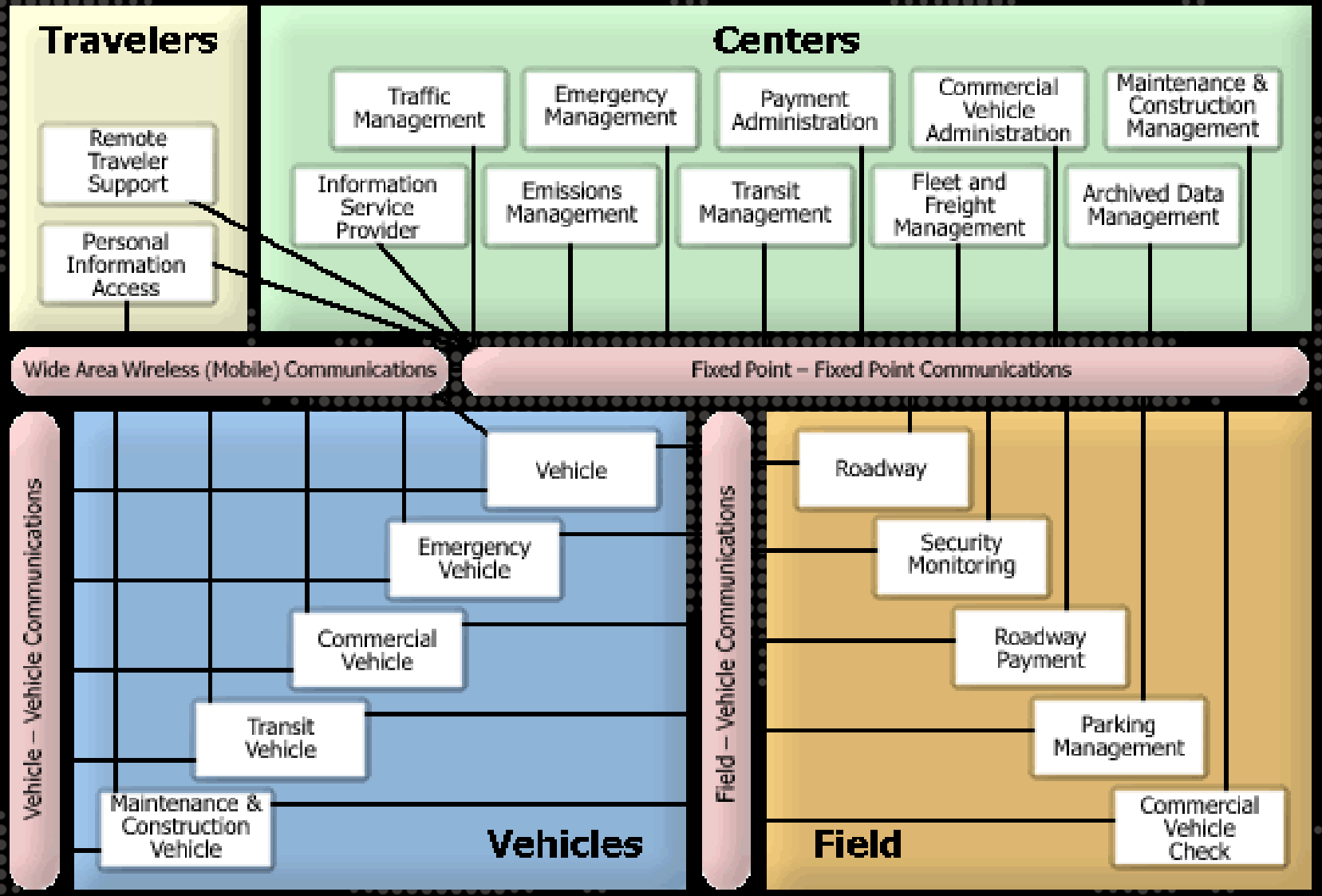


Business Process Re-engineering (BPR) Understanding



Architecture Understanding





Standards & Protocols Understanding

Standards

Prescribed set of rules, conditions or requirements

Protocols

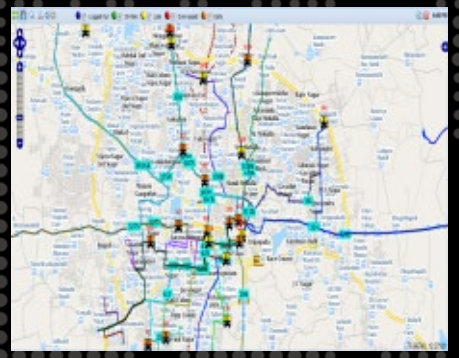
Set of rules or conventions formulated to control the exchange of data between two entities desiring a connection

- Benefits
  - Supports interoperability
  - Minimizes future integration costs
  - Facilitates regional integration
  - Supports incremental measurable development
  - Prevents technological obstacles
  - Minimizes operations and maintenance costs
  - Prepares for emerging technologies
  - Makes procurements easier
  - Makes testing easier

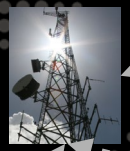
Protocol Understanding

- NTCIP Protocol for Traffic Signals?
- NMEA Protocol for AVL Data?

Single Application



Data Center

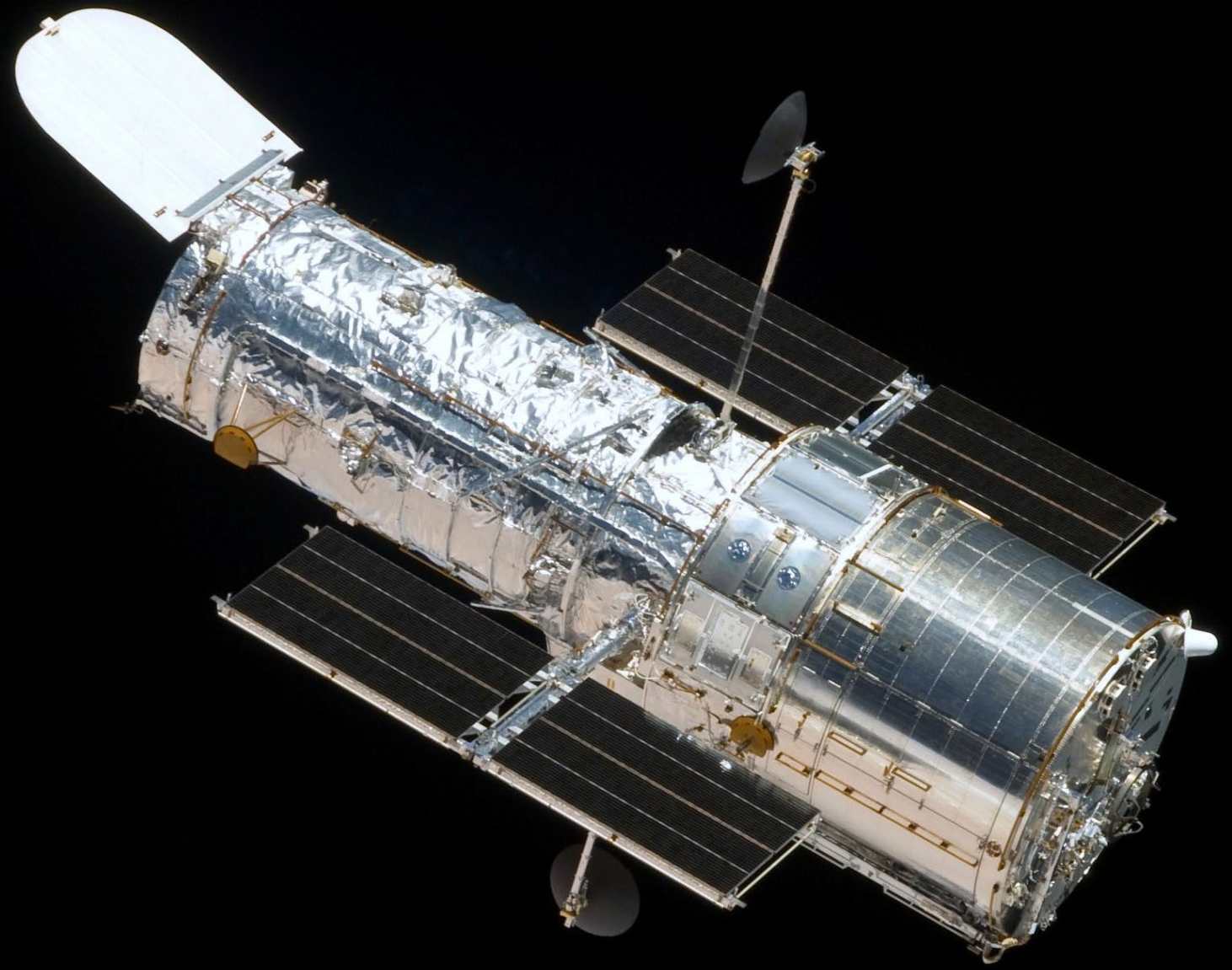


GSM/GPRS network

Source: DRCOG, 2006

Scope Questions Understanding

- Silos or Integrated System?
- SaaS or On-Prem Application?
- State Data Centre or Project Data Centre?
- Power Backup Hours?
- Communication Network – Leased or Owned?
- Technology Quality?
- PTZ Cameras or Fixed Cameras?
- Closed Loop Card or Open Loop Card?
- How many Control Rooms?
- Timelines?



Bid Process Challenges Understanding

- Market Scan & Understanding
- Solution Provider or System Integrator or Vendor?
- Balanced Contract
- Public Private Partnership? Years?
- Payment Terms?
- Least Cost or Quality-Cost-Based Selection (QCBS)?

Capacity Limitations Understanding

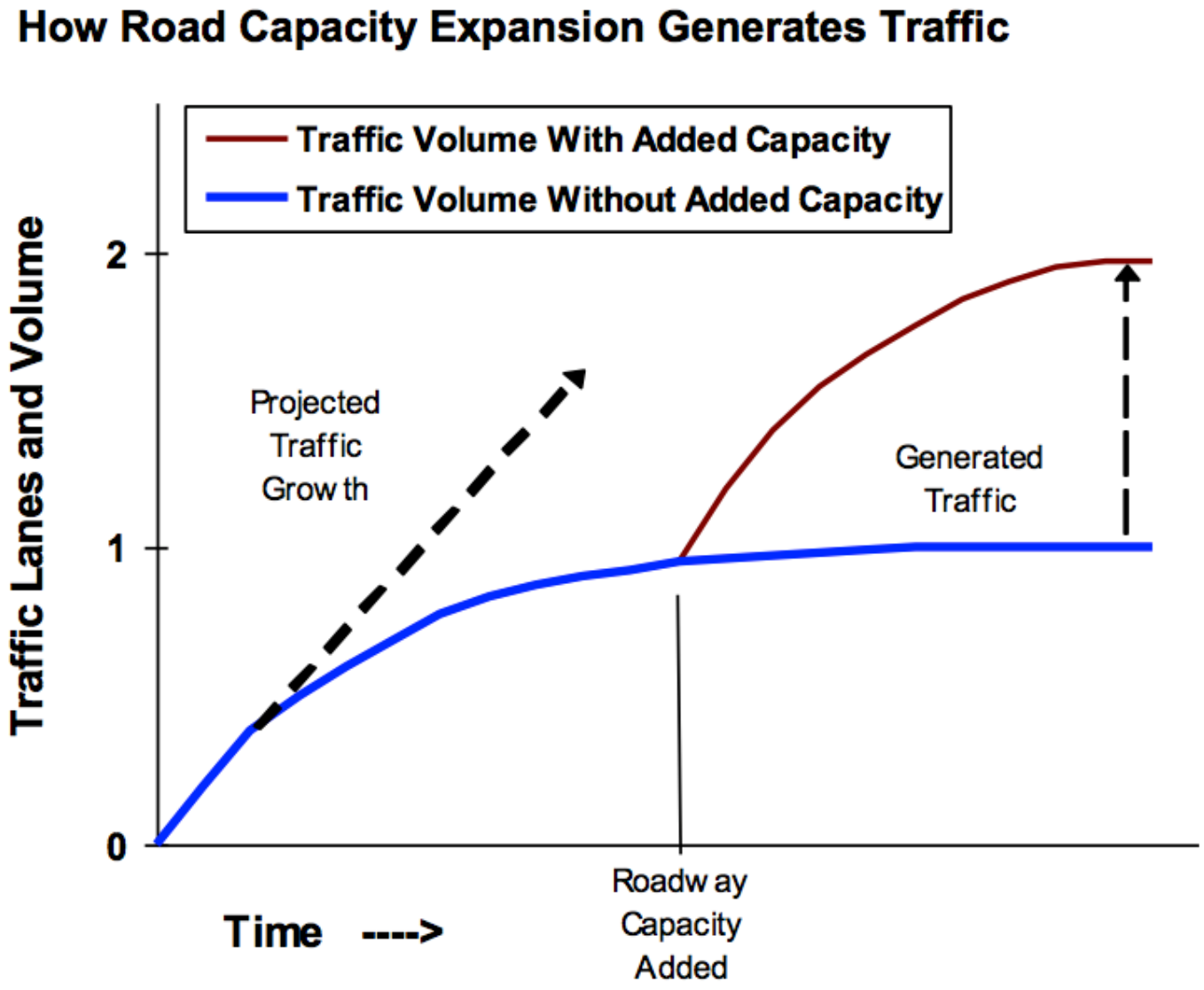
Side Effects Understanding: Infrastructure

WHAT'S UP WITH THAT: BUILDING BIGGER ROADS ACTUALLY MAKES TRAFFIC WORSE

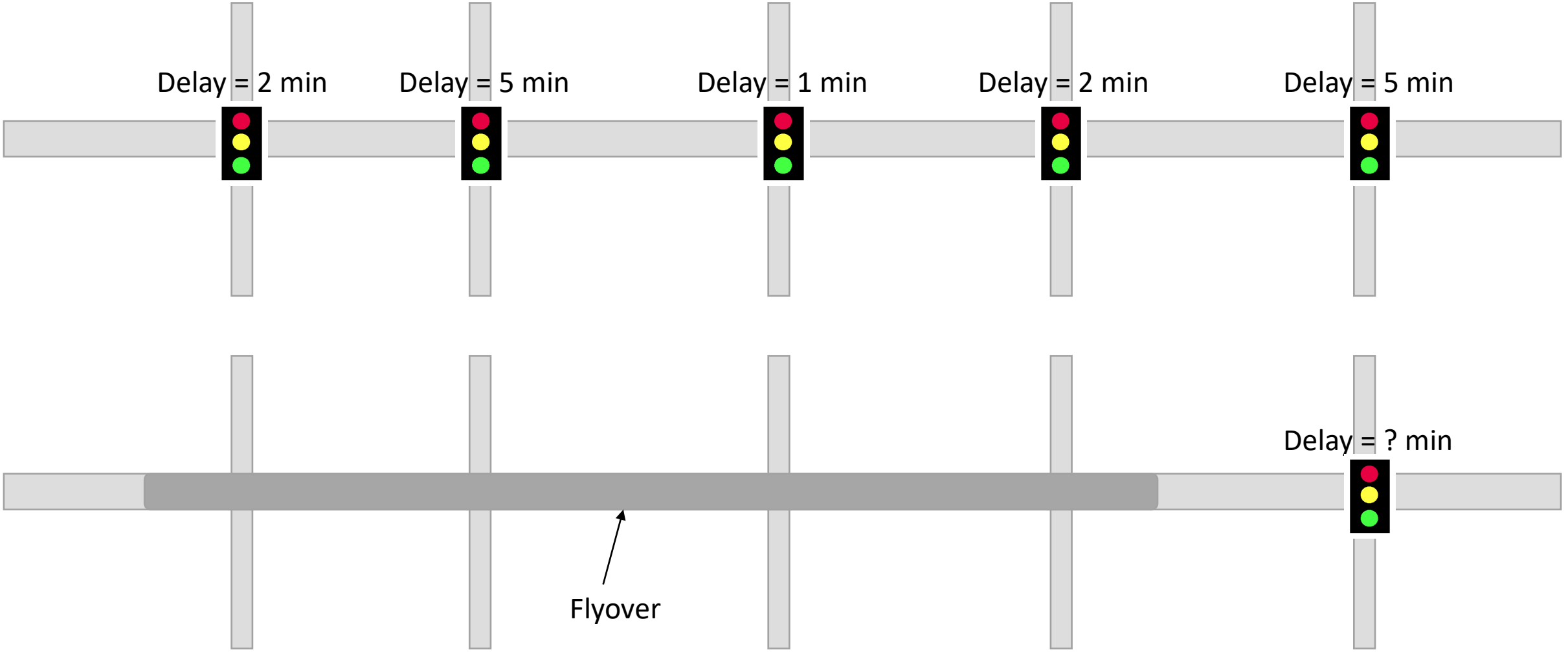
Stuart Dee/Getty

I GREW UP in Los Angeles, the city by the freeway by the sea. And if there's one thing I've known ever since I could sit up in my car seat, it's that you should expect to run into traffic at any point of the day. Yes, commute hours are the worst, but I've run into dead stop bumper to bumper cars on the 405 at 2 a.m.

As a kid, I used to ask my parents why they couldn't just build more lanes on the freeway. Maybe transform them all into double decker highways with cars zooming on the upper and lower levels. Except, as it turns out, that wouldn't work. Because if there's anything that traffic engineers have discovered in the last few decades it's that you can't build your way out of congestion. It's the roads themselves that cause traffic.



Side Effects Understanding: Signalling & Infrastructure Development



Side Effects Understanding: Signalling & Operations Management

SR Nagar Junction – current operation

U-Turn

U-Turn

Sanjeeva R

DigitalGlobe

Google earth

Imagery Date: 2/25/2016 17°26'29.72" N 78°26'27.76" E elev 1800 ft eye alt 4641 ft

U-turn eases traffic congestion

After closure of Mettuguda intersection, traffic flow is stopped for 30 seconds to help pedestrians

MARRI RAMU

Introduction of U-turns away from junctions is easing traffic congestion. There are many examples in Hyderabad and Cyberabad Commissionerates, but the latest is Mettuguda junction in Secunderabad, earlier known for traffic mess through the day.

Recently, the Hyderabad Traffic Police closed the median at the bustling Mettuguda junction, stopping the traffic flow coming from Malkajgiri from taking right turn towards Secunderabad or straight into the lane leading to the local residential colony.

WISE MOVE
At Mettuguda

Closure of the divider also means no right turn for vehicles coming from Tarnaka and moving towards Malkajgiri. Since majority of the traffic volume constitutes people moving in these two directions, the junction was blocked most of the time.

With people crossing the road from different directions and residents of adjacent localities trying to reach the junction from different lanes, it often used to be chaotic. After closing the median, two U turns were introduced on either side of this intersection one of which is near the church. Now, vehicles coming from Malkajgiri side have to turn left and proceed towards Tarnaka side. Those heading towards Tarnaka and beyond can move without any interruption. Commuters going to Secunderabad can turn right only after taking the U-turn after the church. "Traffic from Malkajgiri side can flow continuously without any obstruction towards Tarnaka and Secunderabad," North Zone Traffic ACP A. Muthyam Reddy says. Commuters heading towards Malkajgiri from Tarnaka side too cannot turn right.

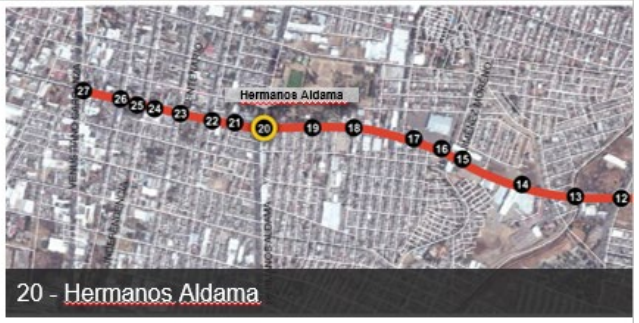
They have to move straight a few yards from the junction and turn right at the other U turn and head for Malkajgiri. Traffic in this direction is also uninterrupted. "However, for the convenience of pedestrians, the traffic flow is stopped for 30 seconds in both the directions. People use the zebra cross and can reach either side of the junction," explains North Zone DCP L.S. Chauhan.

Initially, there was resistance from the local shop owners who contended that the changes would affect their business prospects as no customer would stop due to continuous traffic flow. Eventually, they realised it was inevitable and the usual traffic mess has disappeared at the junction.

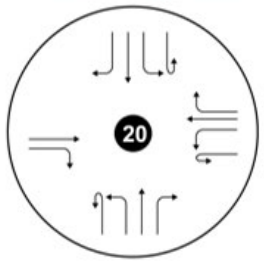
Traffic now flows freely at Mettuguda junction in Secunderabad. - PHOTO :MARRI RAMU

Side Effects Understanding: Alternative Analysis

SEGUNDA VISITA DE CAMPO



[PDF] A Before and After Study of Delay at Selected Intersection..
ntl.bts.gov/lib/jpodocs/repts_te/9243.pdf
by WC Taylor - Related articles
total **intersection delay** and the **percentage** of vehicles required to stop at the ... This **change** was composed of a **decrease** in **delay** for the major movement and ...



Actual

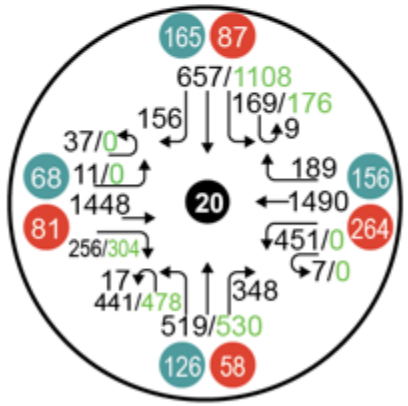
SEGUNDA VISITA DE CAMPO

20 – Hermanos Aldama – 2015

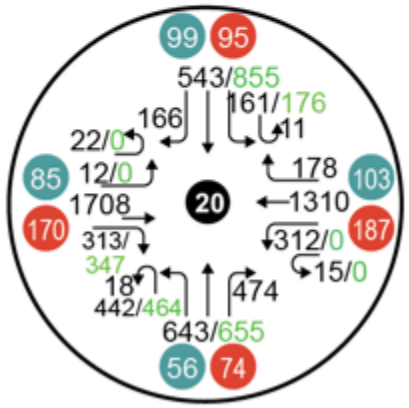
Leyenda

- Intersección de estudio señalizada
- Geometría del Carril
- Vuelta libre a la derecha
- # Volumen de trafico mixto y BRT
- # Volumen de peatones
- # Volumen ciclista

Scenario	Peak	20 – Hermanos Aldama – 2015								
		Intersection			EBT			WBT		
1	AM	1.42	138	F	1.2	136.1	F	0.65	17.4	B
	MD	1.23	93.5	F	1.15	129.4	F	0.59	11.1	B
	PM	1.35	109.3	F	1.19	139.1	F	0.58	14.6	B
2	AM	1.38	121.8	F	1.34	194.3	F	0.65	10.4	B
	MD	1.23	90.5	F	1.22	138.5	F	0.59	3.9	A
	PM	1.33	110.3	F	1.29	168.1	F	0.58	3.2	A
3	AM	1.29	132.1	F	1.17	116	F	1.21	130.3	F
	MD	1.17	102.4	F	1.16	109.1	F	1.04	70.7	F
	PM	1.27	123.1	F	1.25	145.4	F	0.98	45.6	F



AM Peak Volume



MD Peak Volume

PM Peak Volume

Documentation Understanding

- Design Documents
- Acceptance Testing Documents
- Training Documents

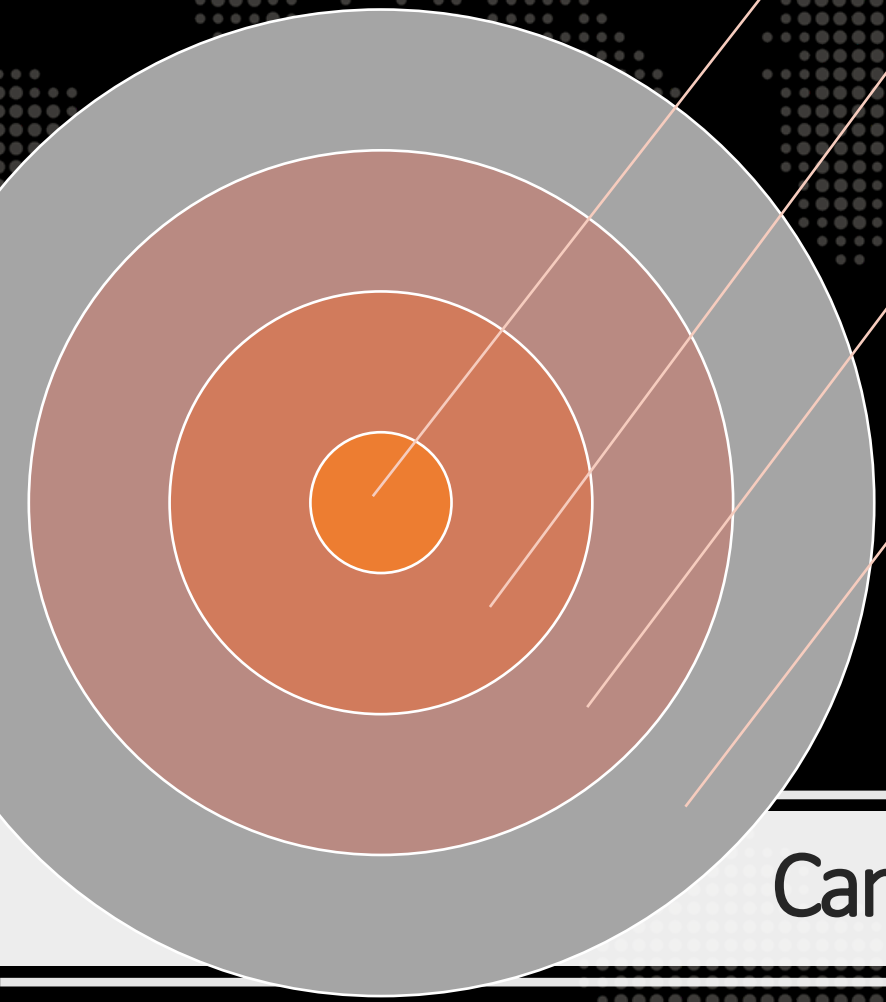
S.No.	SDD version Control					
1	AVL Design Document					
	Date	2017-10-24	2019-06-30	2019-07-31	2019-08-27	
	Version	4	5	6	7	
2	POS Design Document					
	Date	2017-10-05	2019-07-01			
	Version	4	5			
3	DMS Design Document					
	Date	2017-09-05	2019-06-28	2019-08-06		
	Version	3	3.1	3.2		
4	VPSD Design Document					
	Date	2017-09-09	2019-06-28	2019-08-06		
	Version	3	4	5		
5	Communication Design Document					
	Date	2017-06-25	2019-07-02	2019-07-23	2019-08-02	2019-08-16
	Version	1	2	3	4	5
6	Data Center Solution Document					
	Date	2017-10-24	2019-07-03			
	Version	3	4			
7	IMS Solution Document					
	Date	2017-09-04	2019-07-01	2019-07-24		
	Version	3	5	6		
8	PIS Design Document					
	Date	2017-09-07	2019-06-30	2019-07-23		
	Version	4	5	6		
9	EPABX Solution Document					
	Date	2017-07-18	2019-07-02	2019-07-24		
	Version	1.1	2	3		
10	AFCS Back Office System Design Document					
	Date	2018-03-06	2018-06-30	2019-10-05		
	Version	2.4	2.5	2.6		
11	Fare Gate Design Document					
	Date	2017-10-05	2019-06-30	2019-08-03	2019-08-20	
	Version	1	2	3	4	
12	PA System Design Document					
	Date	2018-01-31				
	Version	2				
13	ETM Design Document					
	Date	2018-04-30	2019-07-16	2019-08-29	2019-10-04	
	Version	1.3	1.4	1.5	1.6	
14	Business Intelligence Reports and Dashboards					
	Date	2017-09-26	2019-08-06			
	Version	1	2			
15	Incident Management System – IMS-II					
	Date	2017-09-26	2019-06-21	2019-08-08		
	Version	1	1.1	2		
16	Web Portal & Mobile App System Design					
	Date	2018-03-24	2019-06-26	2019-07-24		
	Version	1.3	1.4	1.5		

Installation Understanding

Acceptance Testing Understanding

- Installation Testing
- System Acceptance Testing
- Burn-in Testing
- Operational Testing

RFP#	System	Description	Sub-system	Test Precondition	Test Procedure	Expected Result
9	AFCS	The AFCS system shall support both on-board and off-board ticketing system.	Common	Environment: Test Location - Test setup at Control centre Pre-condition - On-board and off-board devices at NEC office to do transactions	Offboard ticket will be issued through POS and ETM devices. On-board ticketing will be issued through ETM devices.	Ticket should issued for all the rider types.
10	AFCS	The AFCS system should allow payments via cash and smart cards.	Common	Environment: Test Location - Test setup at Control centre Pre-condition - Smart Cards with E-Purse amount to allow payments via Smart Card.	ETM Scenario : 1. Issue a QR-Ticket via ETM with cash . 2. Issue a QR-Ticket via ETM with SC as payment media POS Scenario : 1. Issue a QR-Ticket via POS/ETM with cash . 2. Issue a QR-Ticket via POS/ETM with SC as payment media	ETM Results: 1. Ticket payment via cash should be issued successfully 2. Ticket payment via Smartcard should be issued successfully. POS Results: 1. Ticket payment via cash should be issued successfully 2. Ticket payment via Smartcard should be issued successfully.
11	AFCS	The central system shall be delivered with a fully functioning Graphical User Interface (GUI).	Common	Environment: Test Location - Test setup at Control centre Pre-condition - UAT environment of AFCS-BO set up at NEC office.	1. Login to BO by using appropriate credentials 2. Click On Device Management -> Desktop POS -> Desktop POS Inventory & Desktop POS Settings 3. Click On Device Management -> Gate -> Station Gate Inventory & Station Gate Settings. 4. Click On Device Management -> Mobile Ticketing Machine -> MTM Inventory & MTM Settings.	1. Login should be successful and display home page by default 2. User should be able to access desktop POS inventory and settings 3. User should be able to access Gate inventory and settings 4. User should be able to access ETM inventory and settings
12	AFCS	The GUI shall be based on standard windows controls or an equivalent operating system.	Common	Environment: Test Location - Test setup at Control centre Pre-condition - UAT environment of AFCS-BO set up at NEC office.	1. Login to BO by using appropriate credentials 2. Click On Device Management -> Desktop POS -> Desktop POS Inventory & Desktop POS Settings 3. Click On Device Management -> Gate -> Station Gate Inventory & Station Gate Settings. 4. Click On Device Management -> Mobile Ticketing Machine -> MTM Inventory & MTM Settings.	1. Login should be successful and display home page by default 2. User should be able to access desktop POS inventory and settings 3. User should be able to access Gate inventory and settings 4. User should be able to access ETM inventory and settings
13	AFCS	All screens with non-paging data shall open and populate with data within 3 seconds.	Common	Environment: Test Location - Test setup at Control centre Pre-condition - UAT environment of AFCS-BO set up at NEC office.	1. Login to Back Office system using appropriate credentials 2. Click on any one option like device management, media management these have non paging data.	1. Verify that Login is successful and display home page by default 2. Observe that the user should be able to access the populated data with in 3 seconds and should be possible to open non paging data as well Note:4.1. The populated data will take more time if the internet bandwidth is not good, it may take more then 3 seconds.



Quantified Policy Objectives

Conventional Treatments

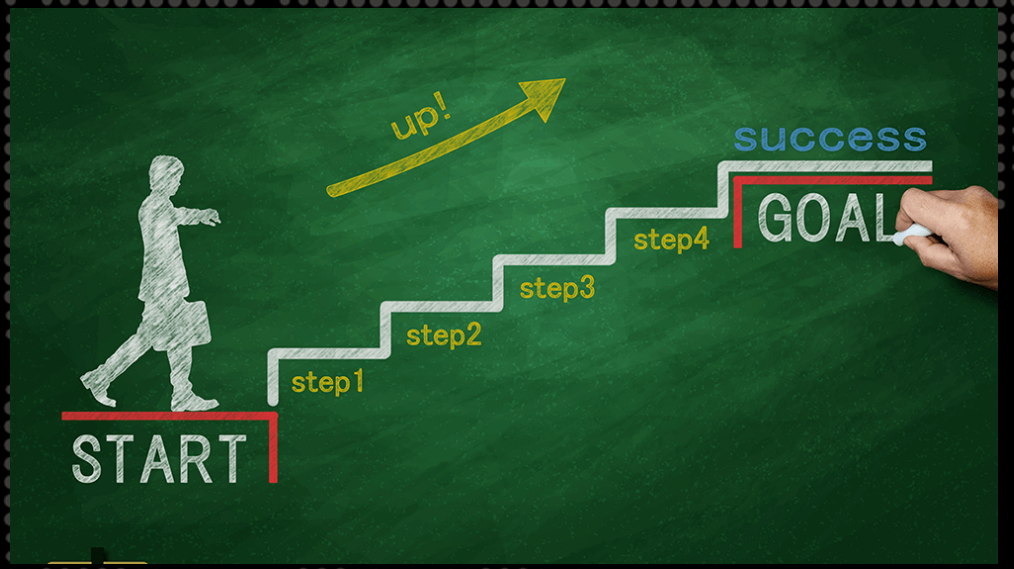
- Fix Potholes?

Intersection Improvements

Holistic Interventions

Technology

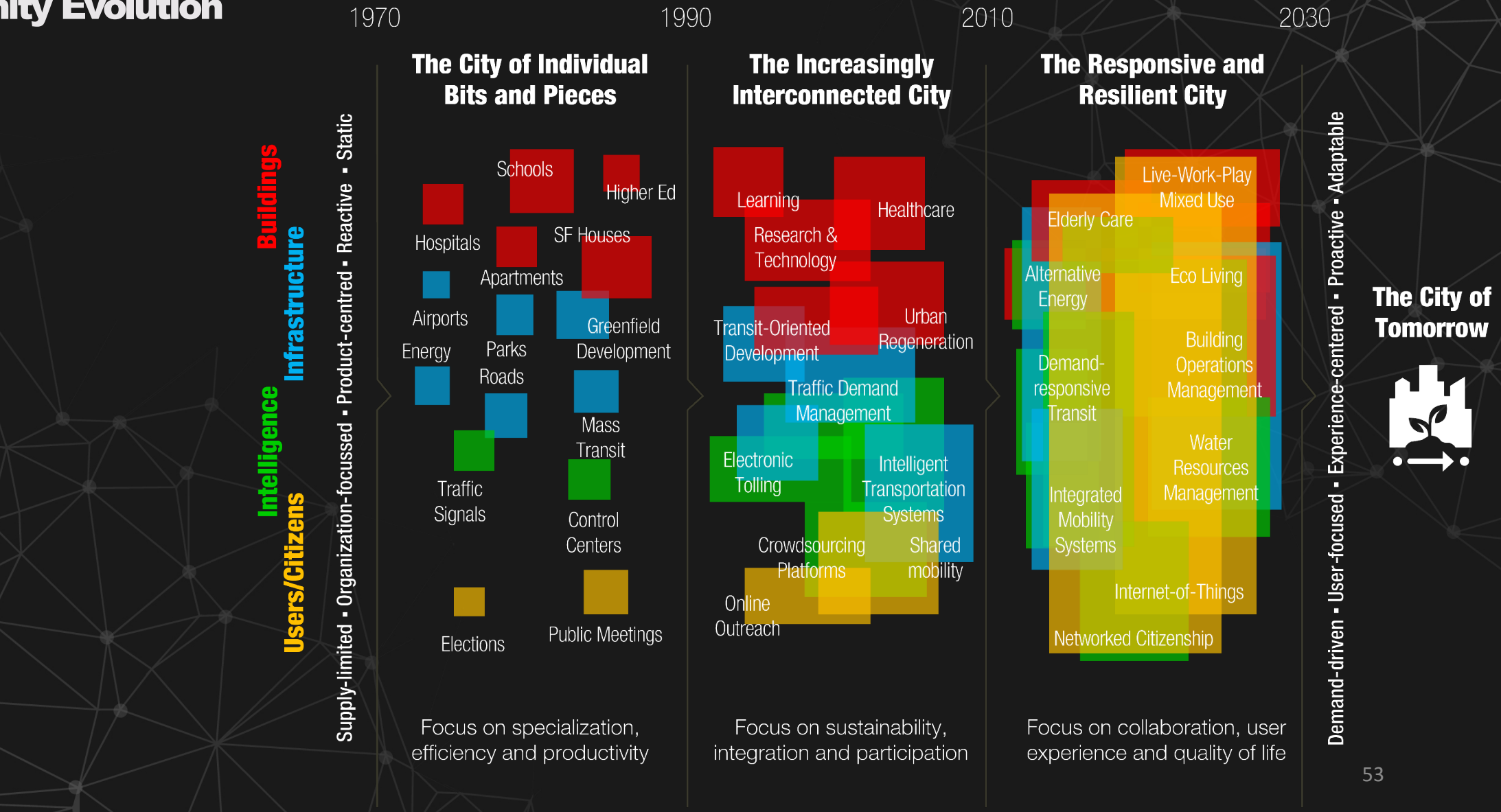
- Reliable
- Accurate
- Timely



Can we fix and move forward?

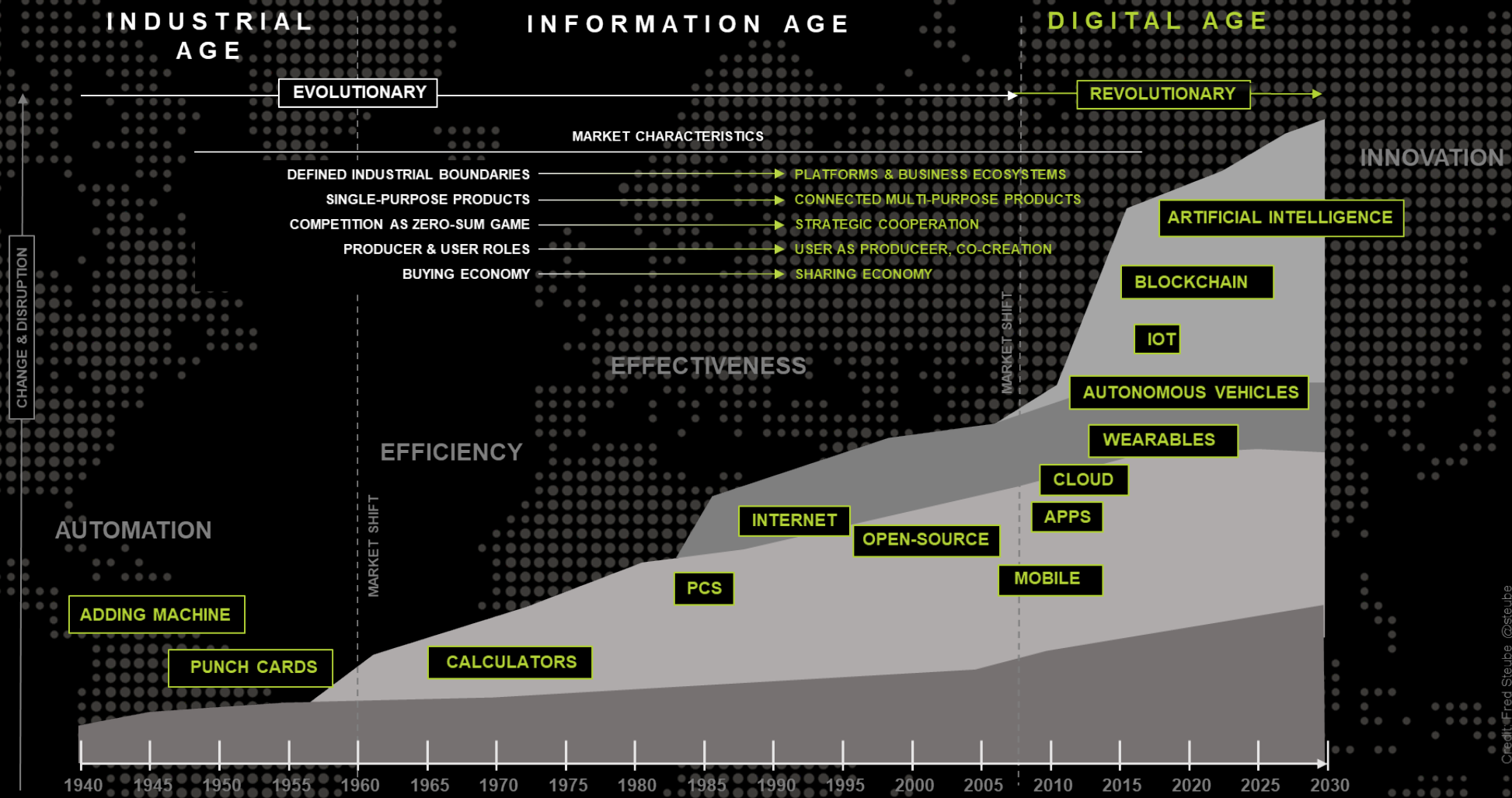
Get on the World Stage...

City/Community Evolution



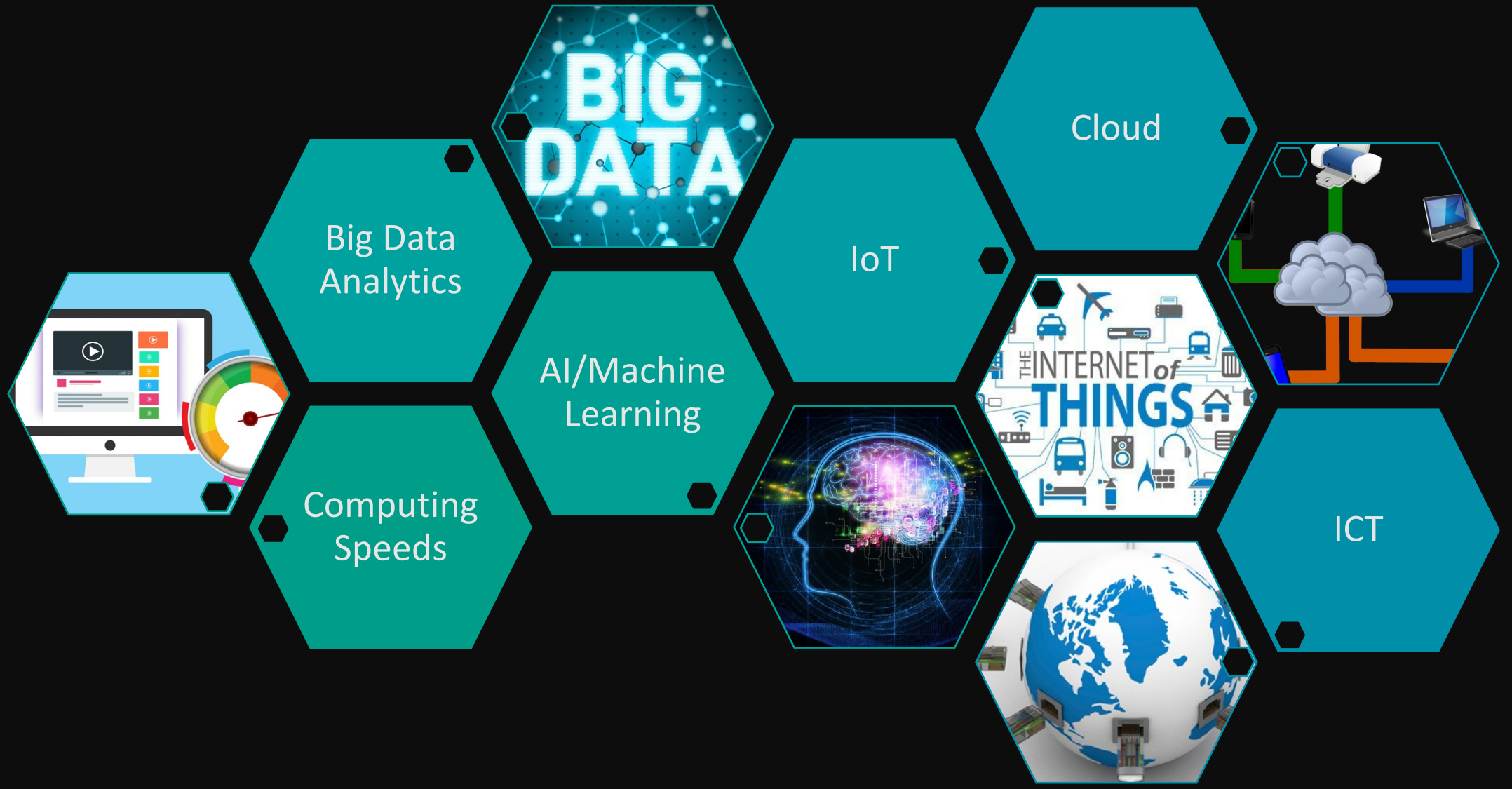
Get on the World Stage...

Technology Evolution



Get on the World Stage...

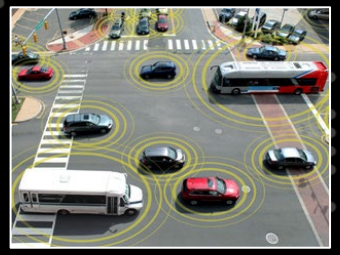
Digital Age Technologies

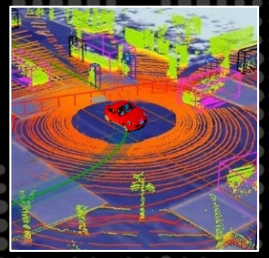


Get on the World Stage…

Technology convergence will revolutionize transportation, dramatically improving safety and mobility while reducing costs and environmental impacts

- Connected Vehicles
- Vehicle Automation
- Internet of Things
- Machine Learning
- Big Data
- Mobility on Demand





Smart Cities

Benefits

- Order of magnitude safety improvements
- Reduced congestion
- Reduced emissions and use of fossil fuels
- Improved access to jobs and services
- Reduced transportation costs for gov’t and users
- Improved accessibility and mobility

According to police, a group of 17 women — all of whom had studied at St Paul's Convent in Davangere — were travelling to Goa for a trip in the minibus.

At least 13 people were killed and eight were injured after a minibus collided head-on with a truck on the Hubballi-Dharwad bypass road in north Karnataka on Friday morning, police said.

Get on the World Stage

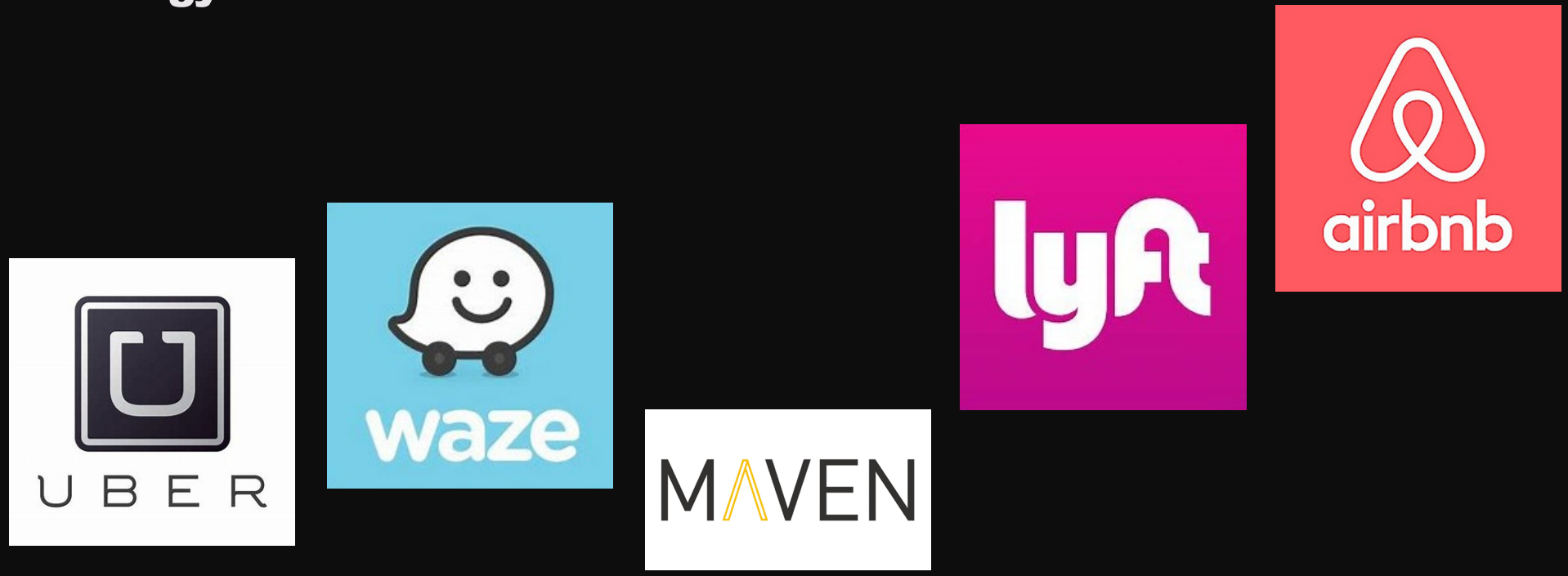
Autonomous Vehicles

Get on the World Stage

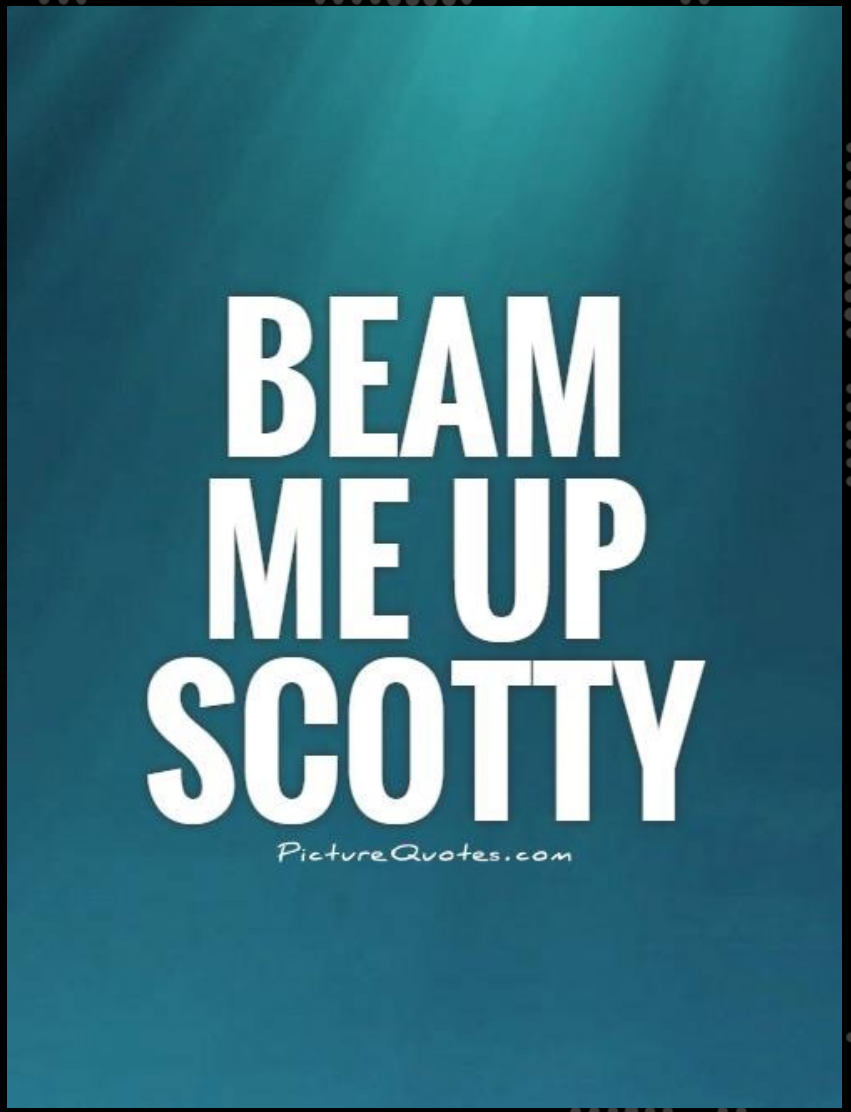
Drones

Get on the World Stage...

Disruption Technology

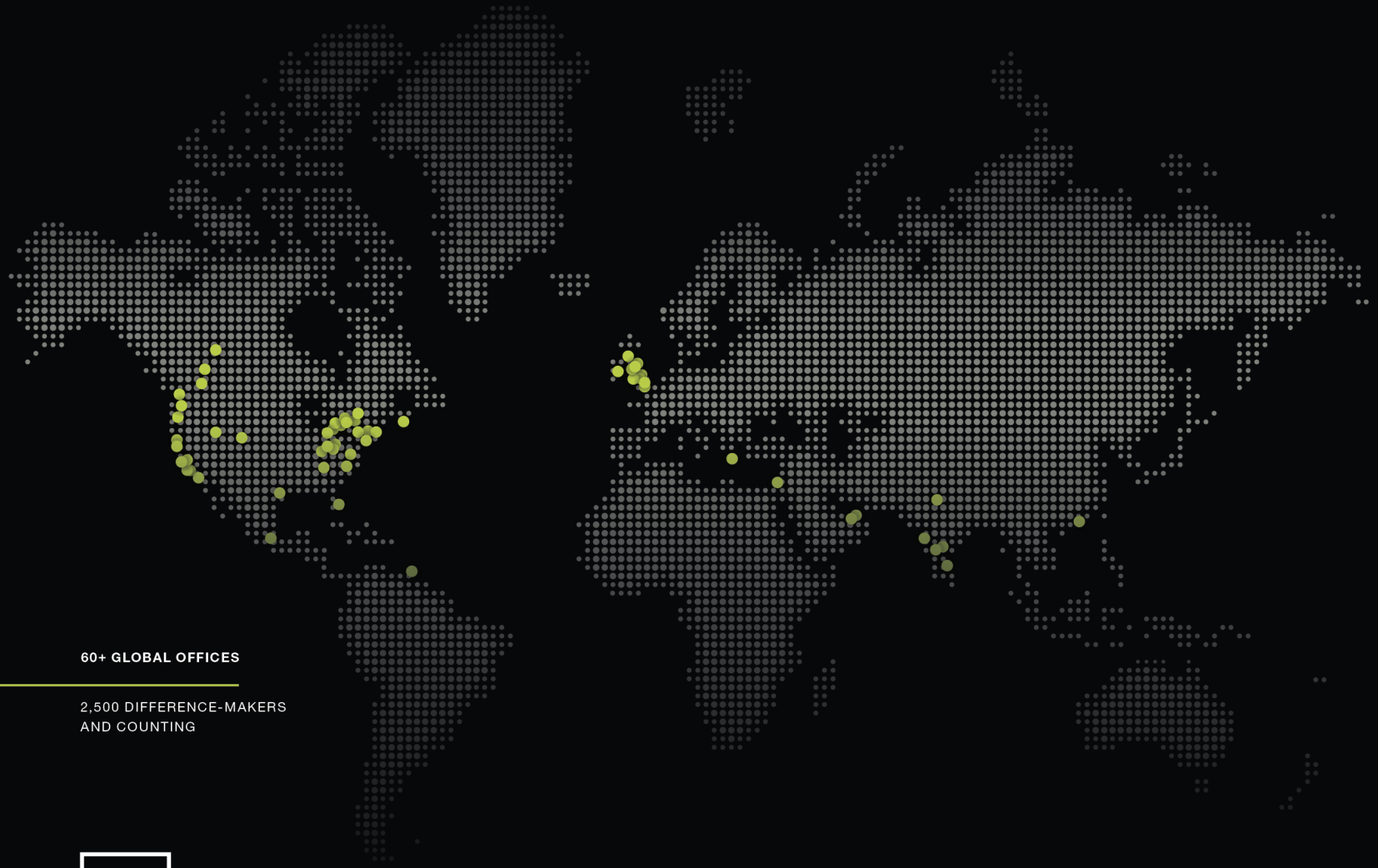


And keep getting smarter until…




Thank You!

Defining the cities of tomorrow



60+ GLOBAL OFFICES

2,500 DIFFERENCE-MAKERS
AND COUNTING

CANADA
CALGARY
EDMONTON
FORT MCMURRAY
HALIFAX
HAMILTON
KINGSTON
LONDON
OTTAWA
RICHMOND HILL
TORONTO
TORONTO WEST
VANCOUVER
WATERLOO

UNITED STATES
ALBANY
ALEXANDRIA
BAKERSFIELD
BINGHAMTON
BOSTON
CANTON
CINCINNATI
DENVER
HOUSTON
IRVINE
KNOXVILLE
LOS ANGELES
NEW LEXINGTON
NEW YORK CITY
POMPANO BEACH
PORTLAND
RALEIGH
SALT LAKE CITY
SAN DIEGO
SAN FRANCISCO
SAN JOSE
SAN LUIS OBISPO
SEATTLE
SOUTHFIELD
WESTERVILLE

UNITED KINGDOM / IRELAND
BIRMINGHAM
BRIGHTON
CARDIFF
DUBLIN
GLASGOW
LIVERPOOL
LONDON
MANCHESTER
NEWARK
ROCHDALE

INTERNATIONAL
ABU DHABI
ATHENS
BANGALORE
DUBAI
HONG KONG
HYDERABAD
MEXICO CITY
MUMBAI
NEW DELHI
PUNE
TEL AVIV
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