“Application of Contemporary Technologies in Civil Engineering”

Presented By:

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Chief Executive,
Engineering Consultants International (Pvt) Ltd.


بسم الله الرحمن الرحيم

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Chief Executive

Education:

BE (Civil), NED University of Engineering & Technology, Pakistan (1983)
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Professional Affiliation:

Vice President, Association of Consulting Engineers Pakistan (ACEP)
Fellow, Institution of Engineers Pakistan (IEP)
Member, FIDIC Integrity Management Committee
Member, Institute of Transportation Engineers (ITE)
Member, American Society of Civil Engineers (ASCE)
Member., American Society for Testing and Materials (ASTM)

Professional Expertise:

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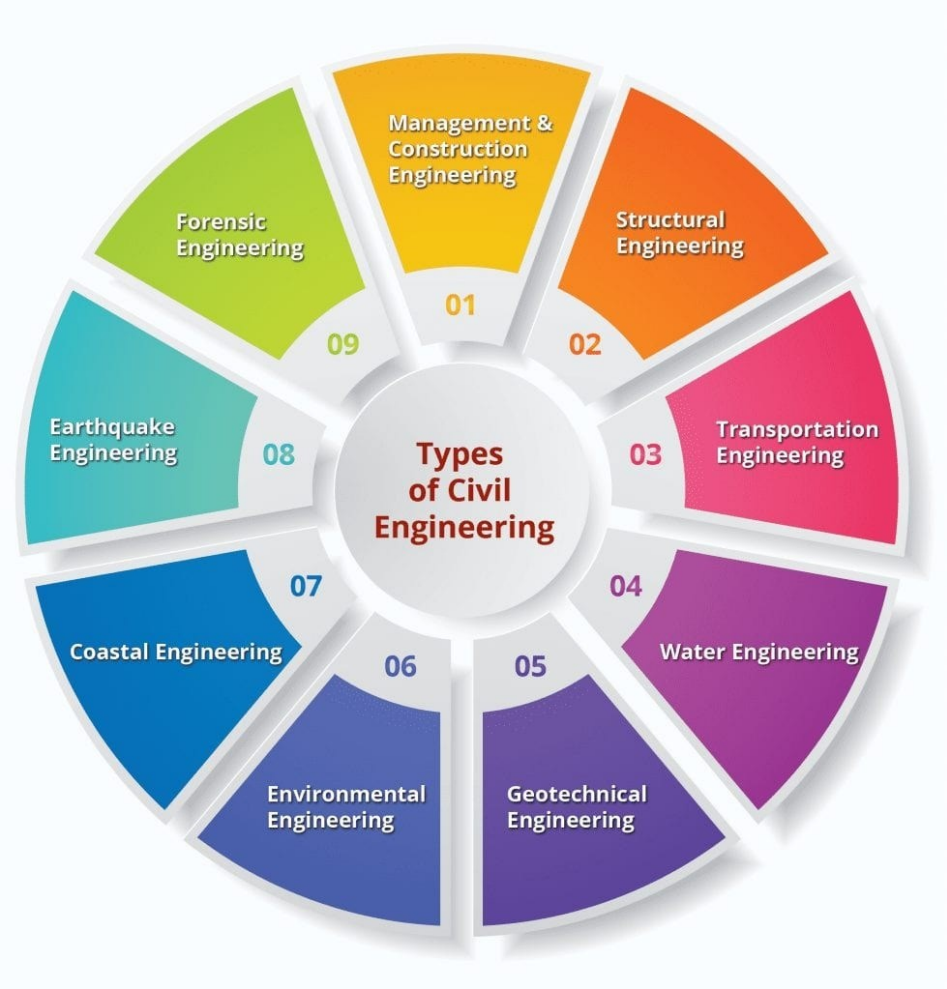
Countries of Work Experience:

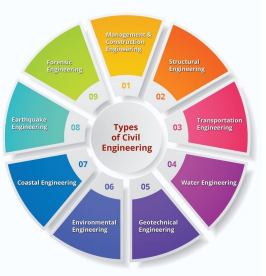
Pakistan, the USA, the Netherlands, the Kyrgyz Republic, Kazakhstan, Tajikistan, Uzbekistan, Turkmenistan, Malaysia, Turkey, the United Arab Emirates, the Sultanate of Oman, the Kingdom of Saudi Arabia, Kuwait, Qatar, Bahrain, and Maldives.

Presentation Outline

- ❑Purpose and Background
- ❑Contemporary Technologies
- ❑Technology Application in Pakistan
- ❑Constraints and Limitations
- ❑Conclusions and Recommendations

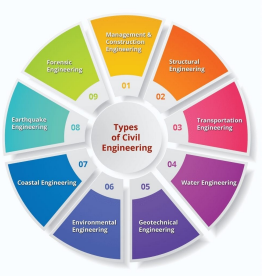


Purpose and Background



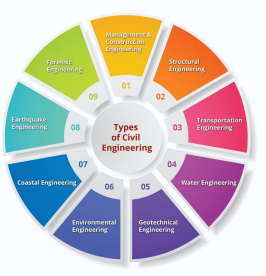
- Changing Perspectives (Traditional vs Contemporary Ways)
- Signification of Information and Data
- Distinction between Data, Knowledge, and Wisdom
- Application of Technologies to facilitate knowledge-based cost-effective optimal solutions.
- Important to Understand Technologies and its Limitations
- Continued Research for Improvement through Training, Skill Development, and Keeping up with technological improvements.

Contemporary Technologies



- Building Information Modeling (BIM)
- Light Detection and Ranging (LiDAR)
- Ground Penetrating Radar (GPR)
- Drones and Unmanned Aerial Vehicles (UAVs)
- O-D Visualization for Travel Demand using Cell Phone Data (ODV)
- 3D Printing
- Machine Learning and Artificial Intelligence
- Robotics
- Wearable Devices
- Connected Jobsite (Cloud-Based Applications)
- **And many more are evolving every passing day!**

Technology Application in Pakistan



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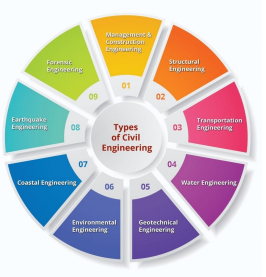
Building Information Modelling (BIM)



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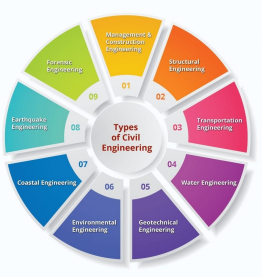

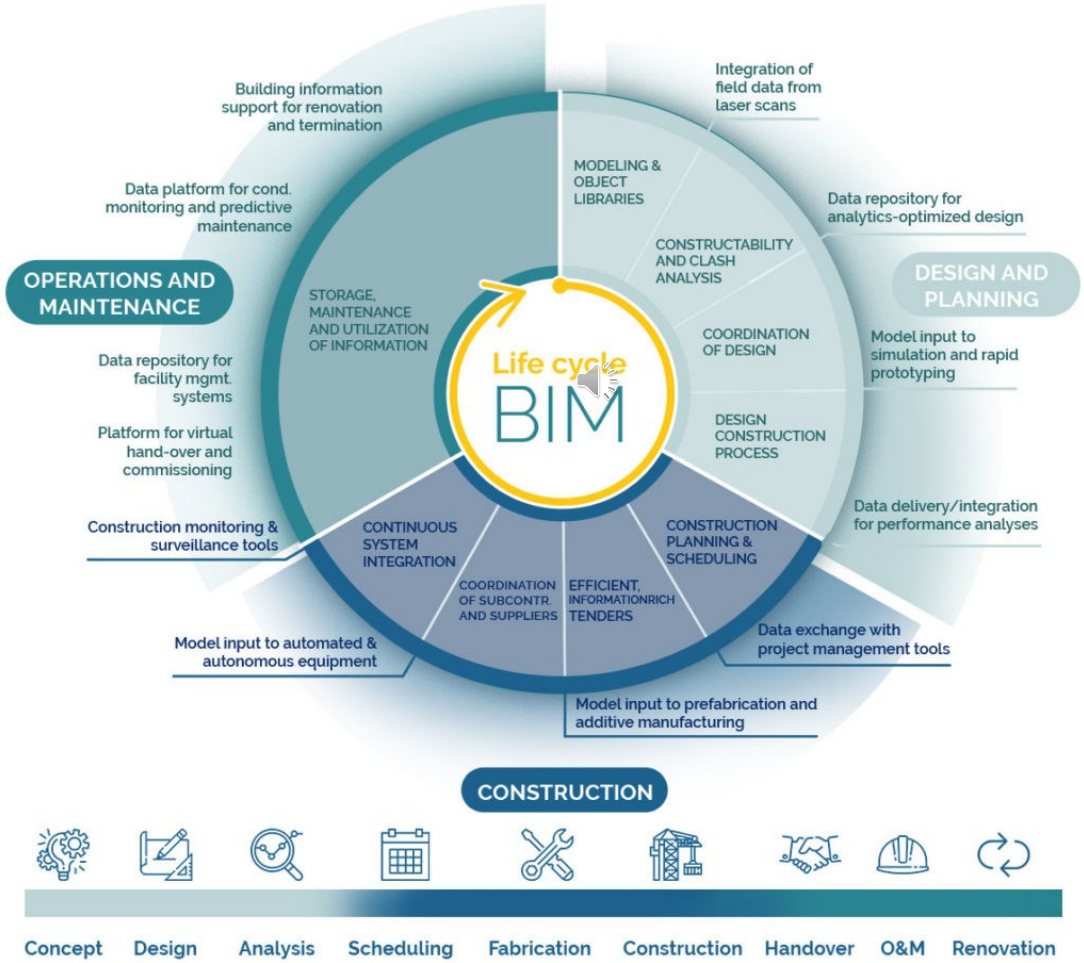

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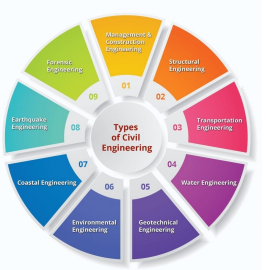
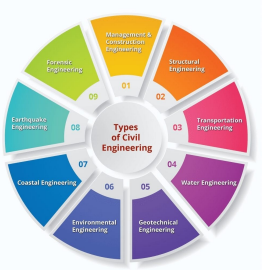
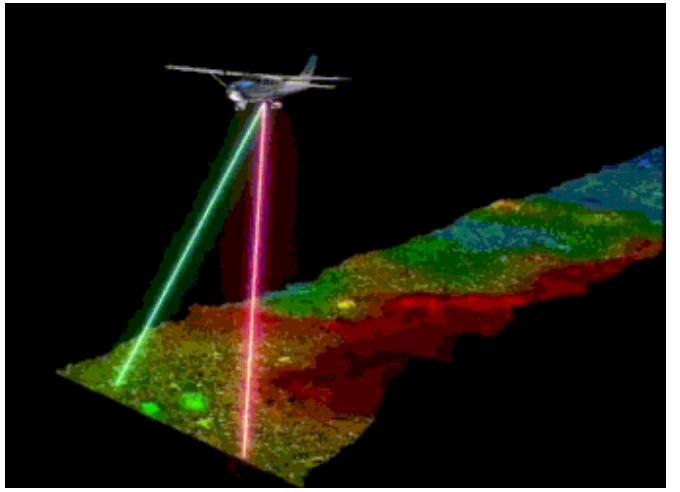


[Construction Simulation Software | ALICE Technologies]

Light Detection and Ranging (LiDAR)



- LiDAR is a remote sensing method that engineers use to examine data and related objects.
- LiDAR uses light in the form of a pulsed laser to measure ranges (also called variable distances) from the source to the object and create a “point cloud” data for data analysis.
- LiDAR light pulses, in combination with other data recorded by an airborne or mobile (car) system, generate precise 3D information about objects and surface characteristics.



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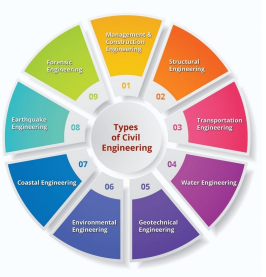
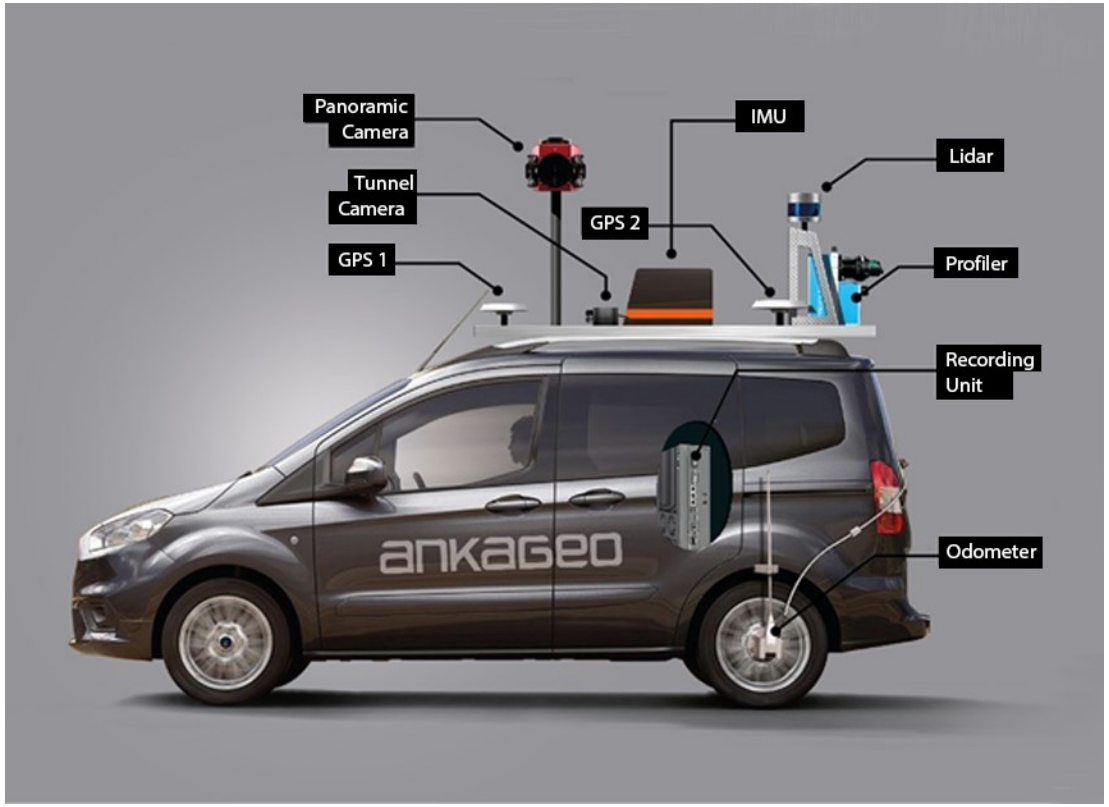


- A LiDAR instrument comprises of Laser, Scanner, Specialized GPS receiver, and other measurement gadgets.
- Typically, used on airplanes or helicopters to acquire data over broad areas of land but it is used for mobile mapping.
- LiDAR is used for a variety of applications, such as surveying terrain, mapping archaeological sites, creating digital elevation models, and collecting data for 3D city models. They are also used in disaster management, such as flood mapping and landslide risk assessment.



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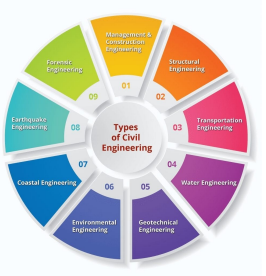
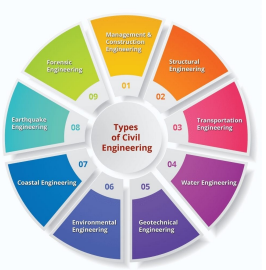
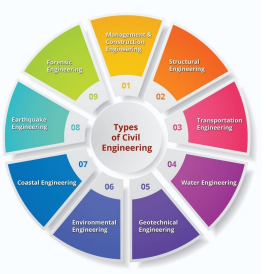


- LiDAR - Road Asset Management Systems, i.e., RAMS,
- RAMS facilitates decision-making for the development and maintenance management of road networks in cities, districts, and provinces of the country.
- RAMS is applicable at the Network Level (all road sections) or Project Level (specific road section) to develop annual development and maintenance plans for road maintenance agencies.
- An example of such a system is presented here which shows how the Road & Transport Authority (RTA) in Dubai is using this system to maintain the high quality of their road network system.

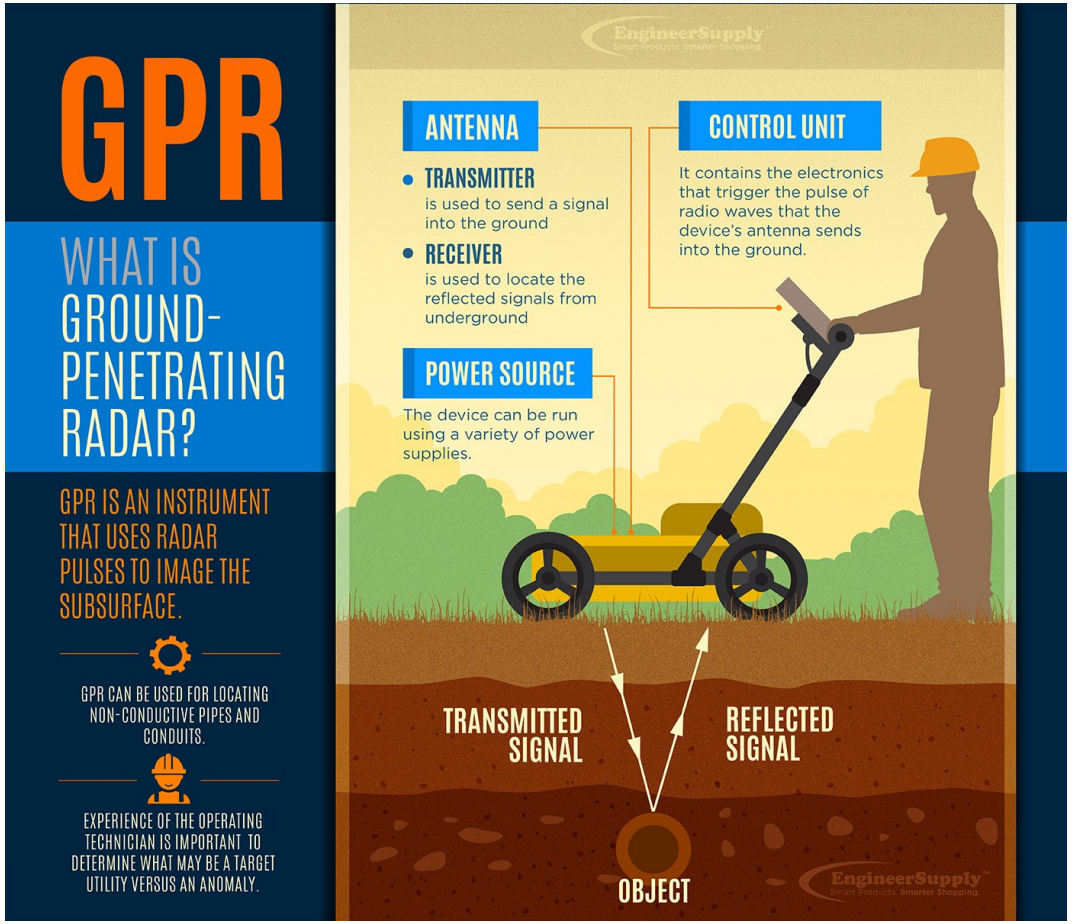
Light Detection and Ranging (LiDAR)



Ground Penetrating Radar (GPR)



- GPR is a geophysical model of locating underground utilities, including water, electric cables, sewer lines, voids, objects, and soil composition.
- This technology captures clear images of subsurface structures using radio waves and in a minimally invasive way.



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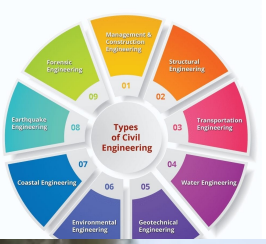

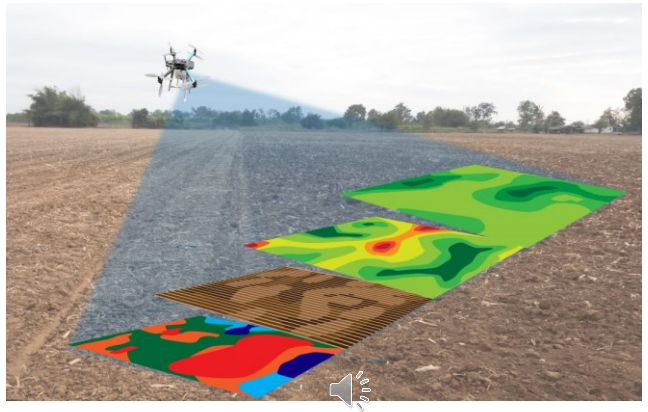

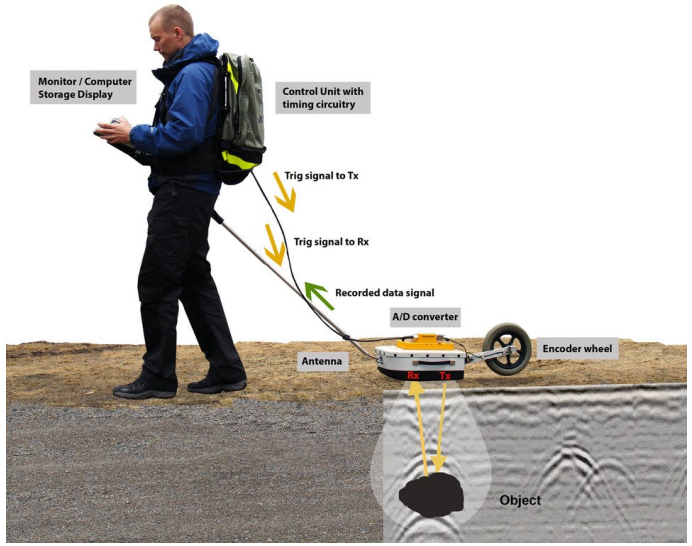

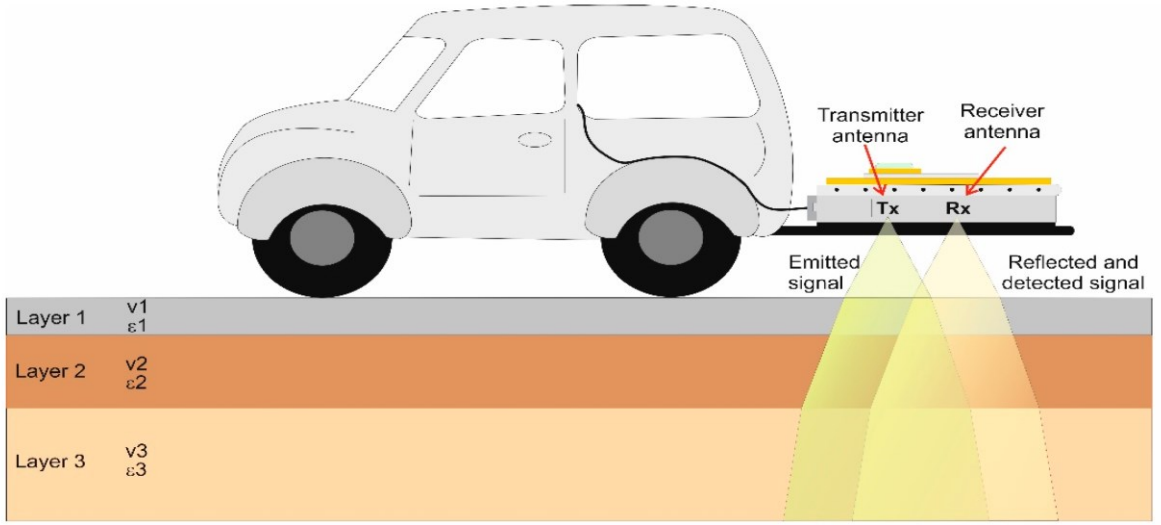

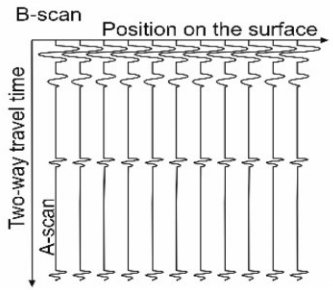

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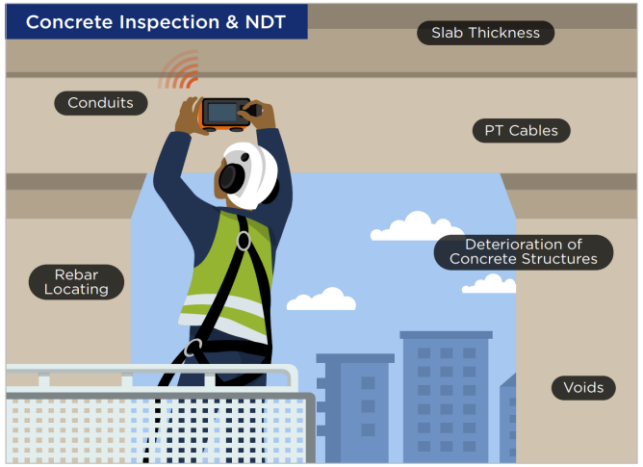

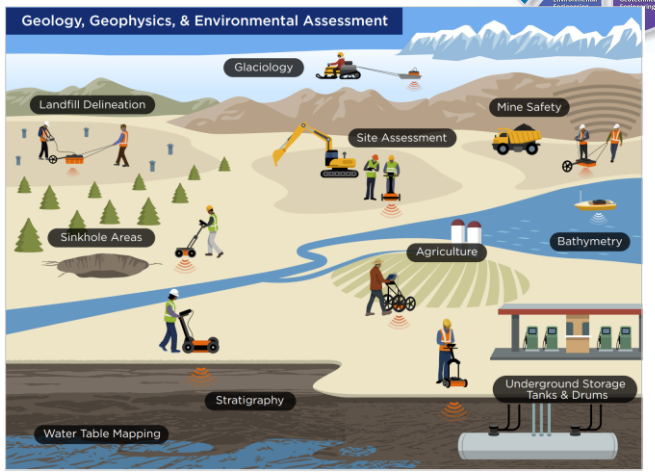

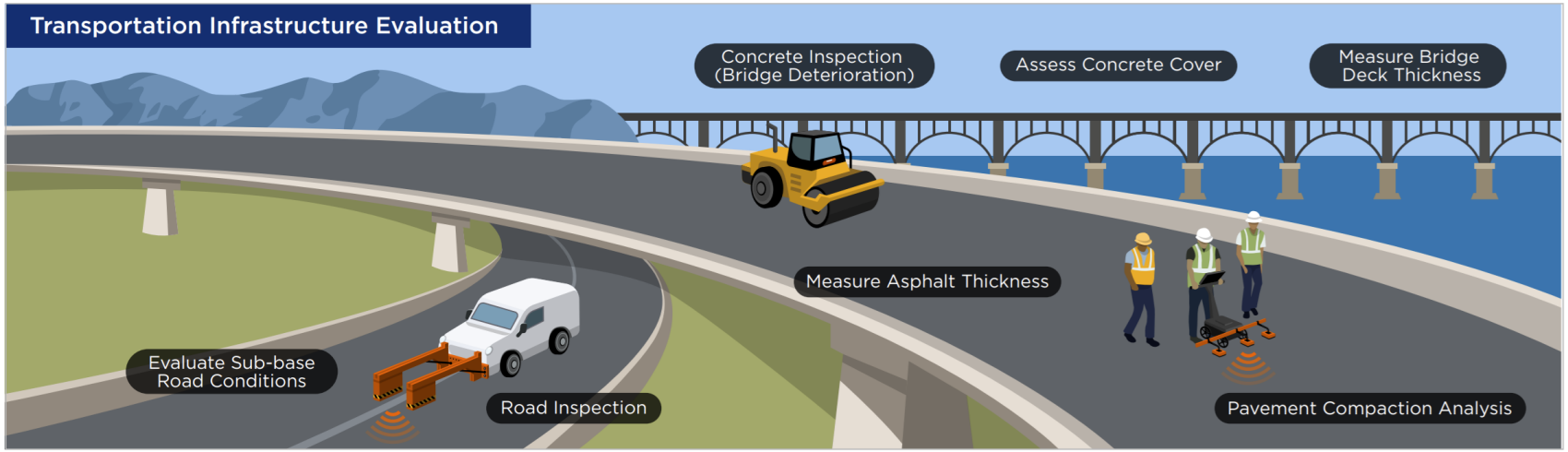

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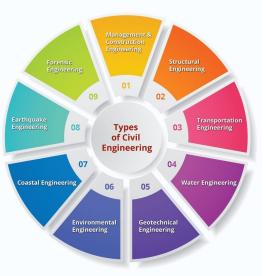


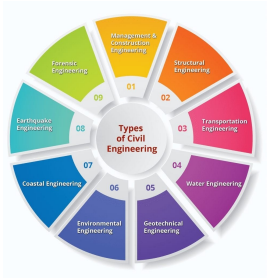
Advantages of GPR

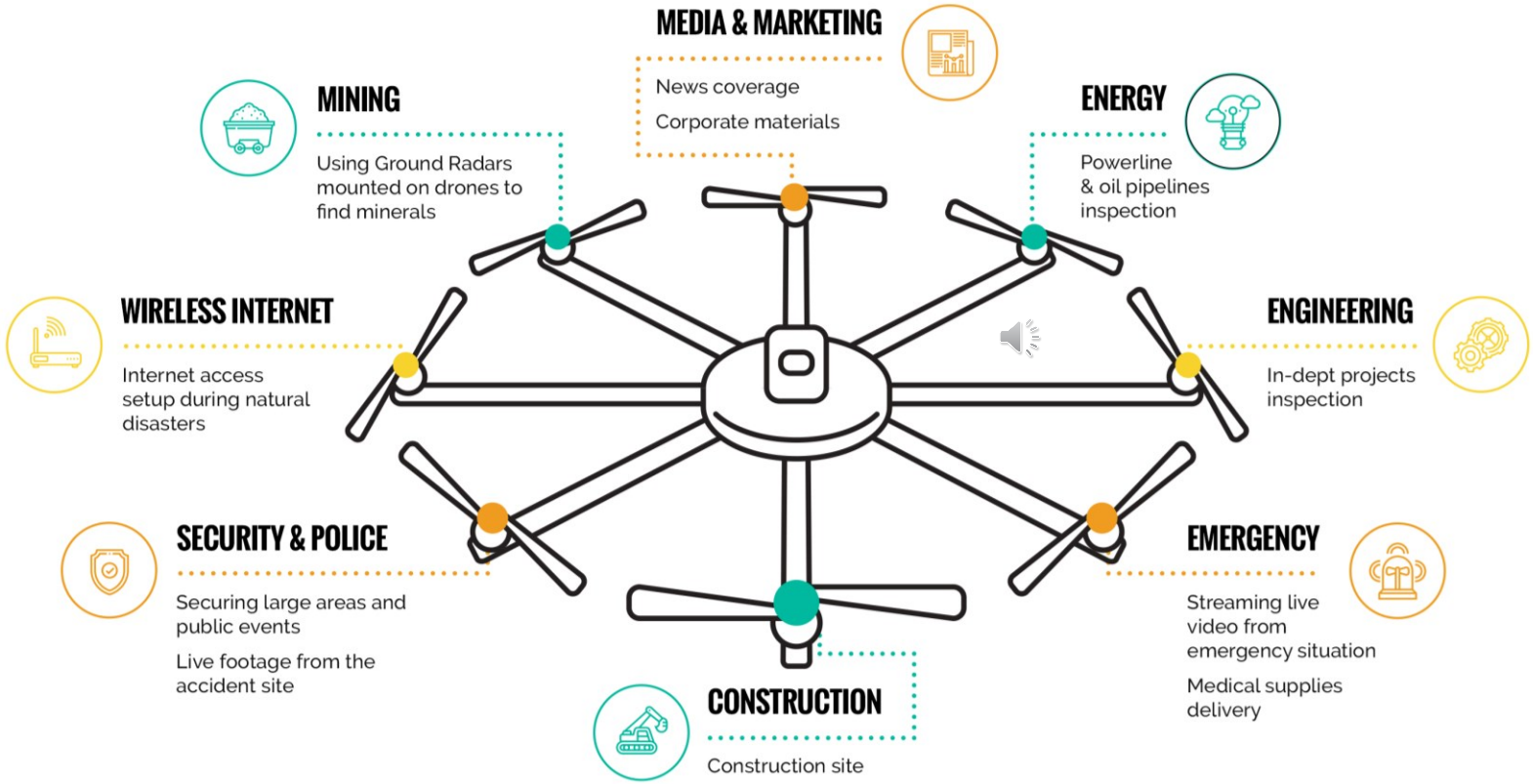
- Non-invasive method
- Saving money
- Applied for difficult sites
- Easy to use
- Increase site safety

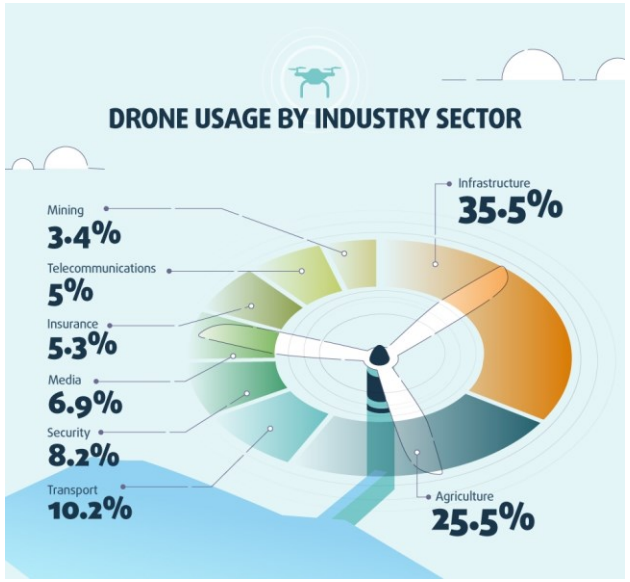
Disadvantages of GPR

- Takes time to collect data
- Intensive training is required
- Interpretation Skills required
- Flat Ground Surfaces
- Reduced coverage of obstructions
- Not effective in clays
- Interpretational error possible
- Post-processing is time consuming

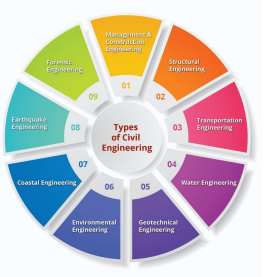
Unmanned Aerial Vehicles (Drones)



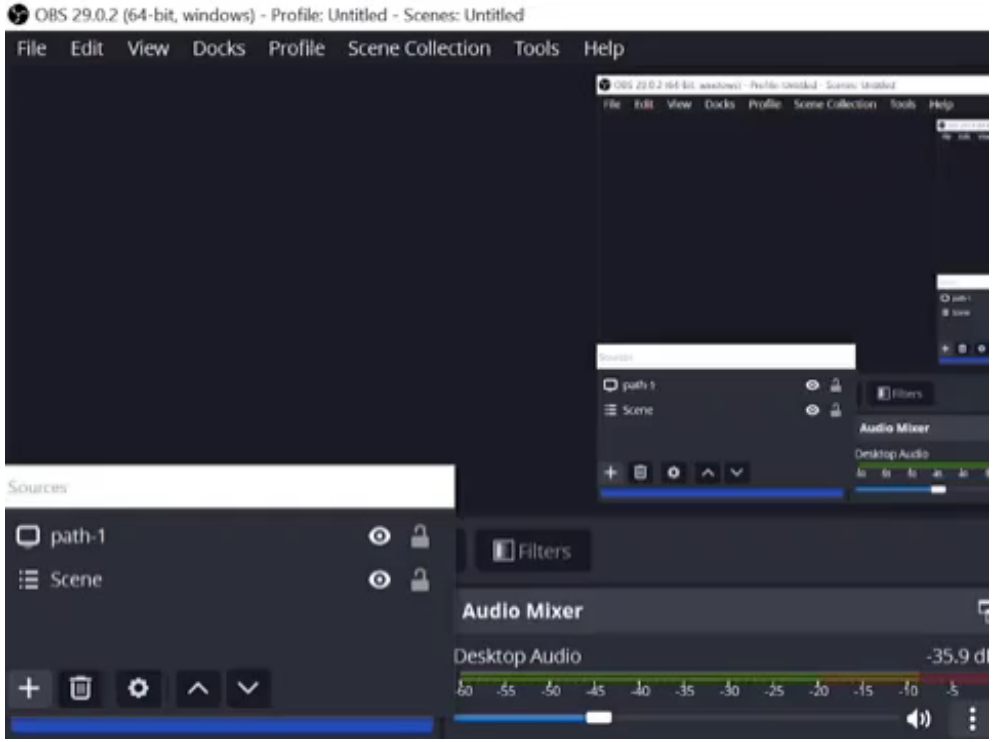




Unmanned Aerial Vehicles (Drones)

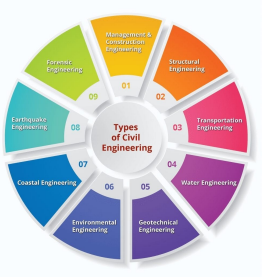


Modelling of a Highway Corridor

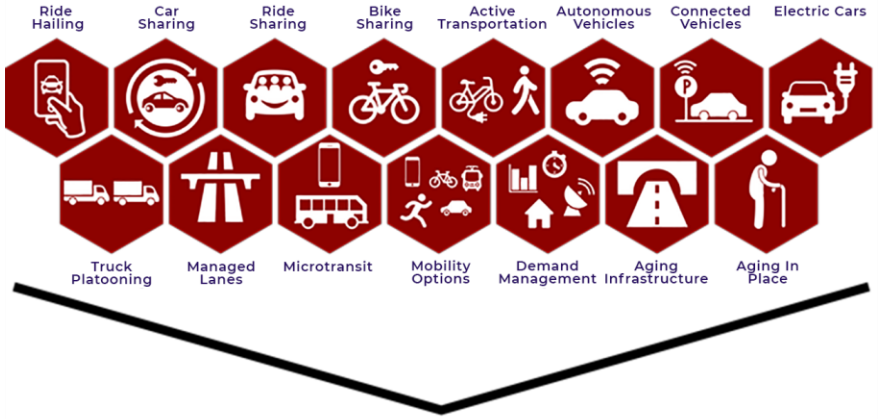


Modelling of A Neighbourhood of Quetta City

Transportation Planning

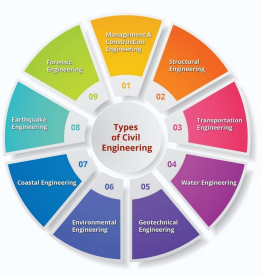


- Transportation planning is the process of looking at the current state of transportation in the region, designing for future transportation needs, and combining all of that with the elements of budgets, goals, and policies.



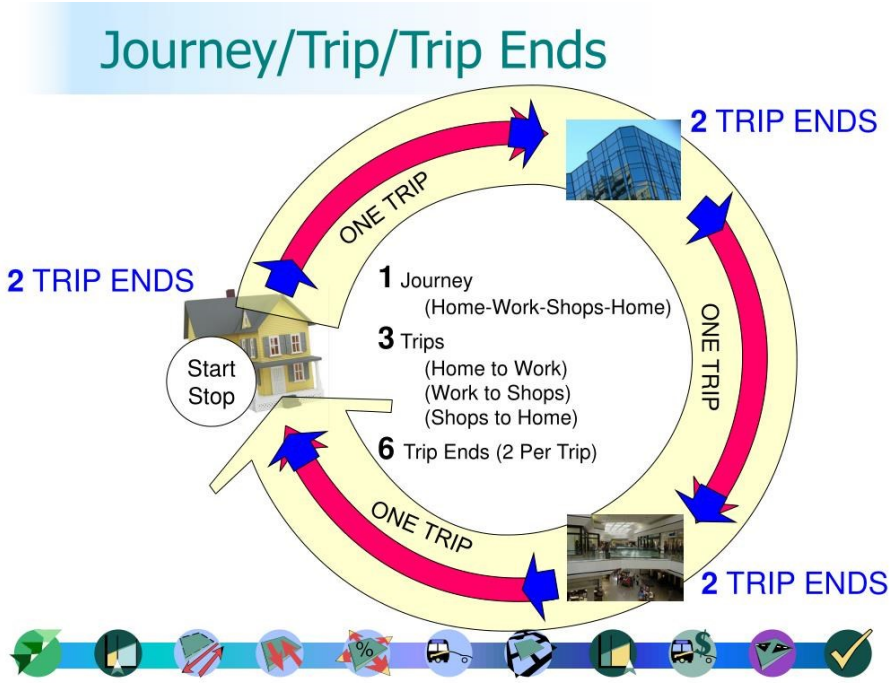
- It can be applied to develop transportation plans for a neighborhood, town, city, district, province, country, or region.

Transportation Planning



Information and Data Requirements

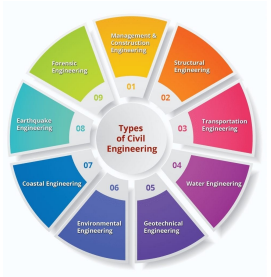
- Origin and Destination Surveys
- Linking Social Data (Demographics, User Activities
- Traffic Volumes & Operating Speeds

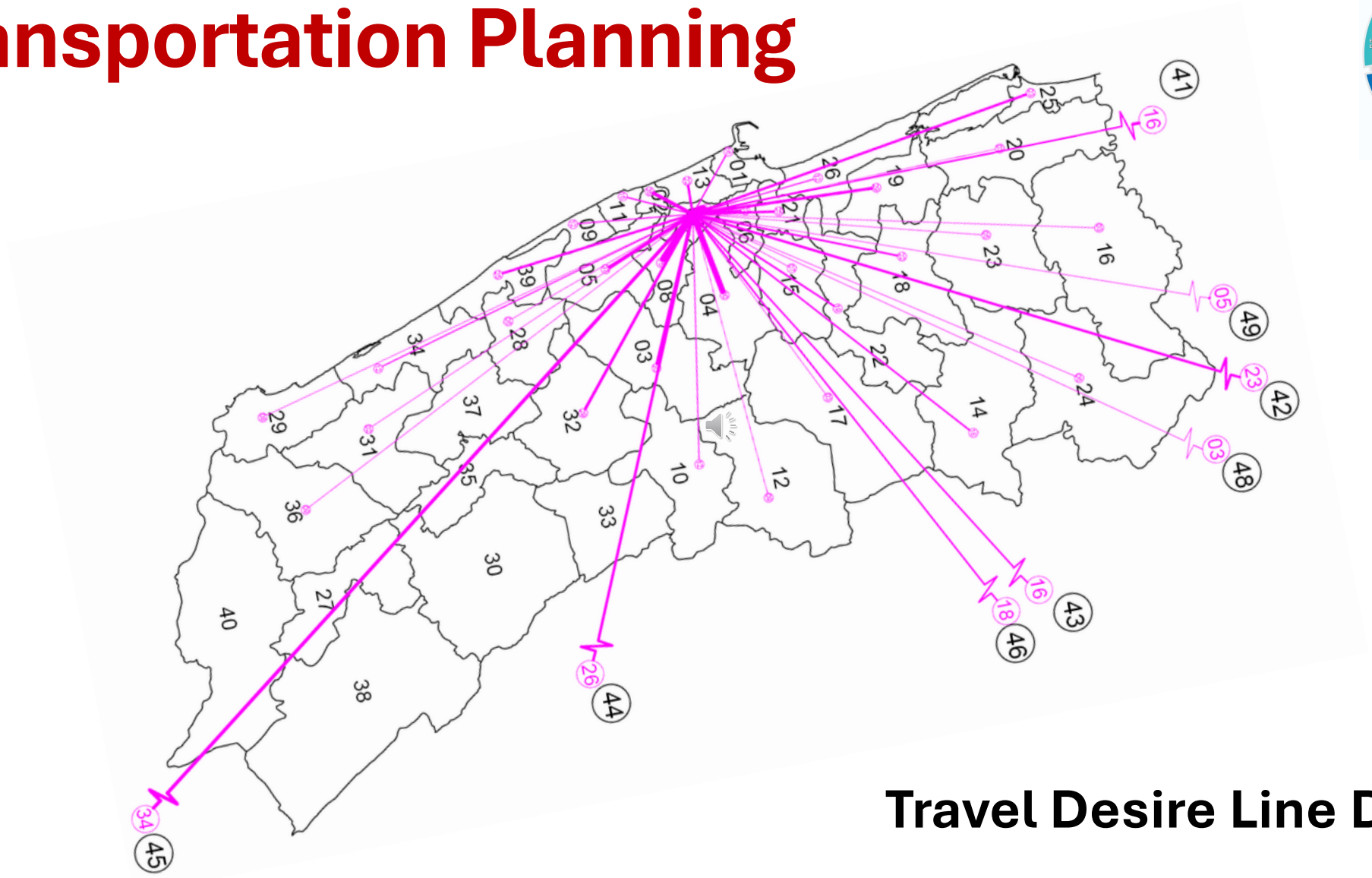


Data Analysis

- Corridor Analysis
- Intersection Analysis
- Safety Analysis

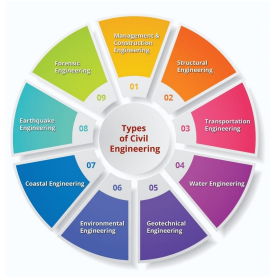
Transportation Planning

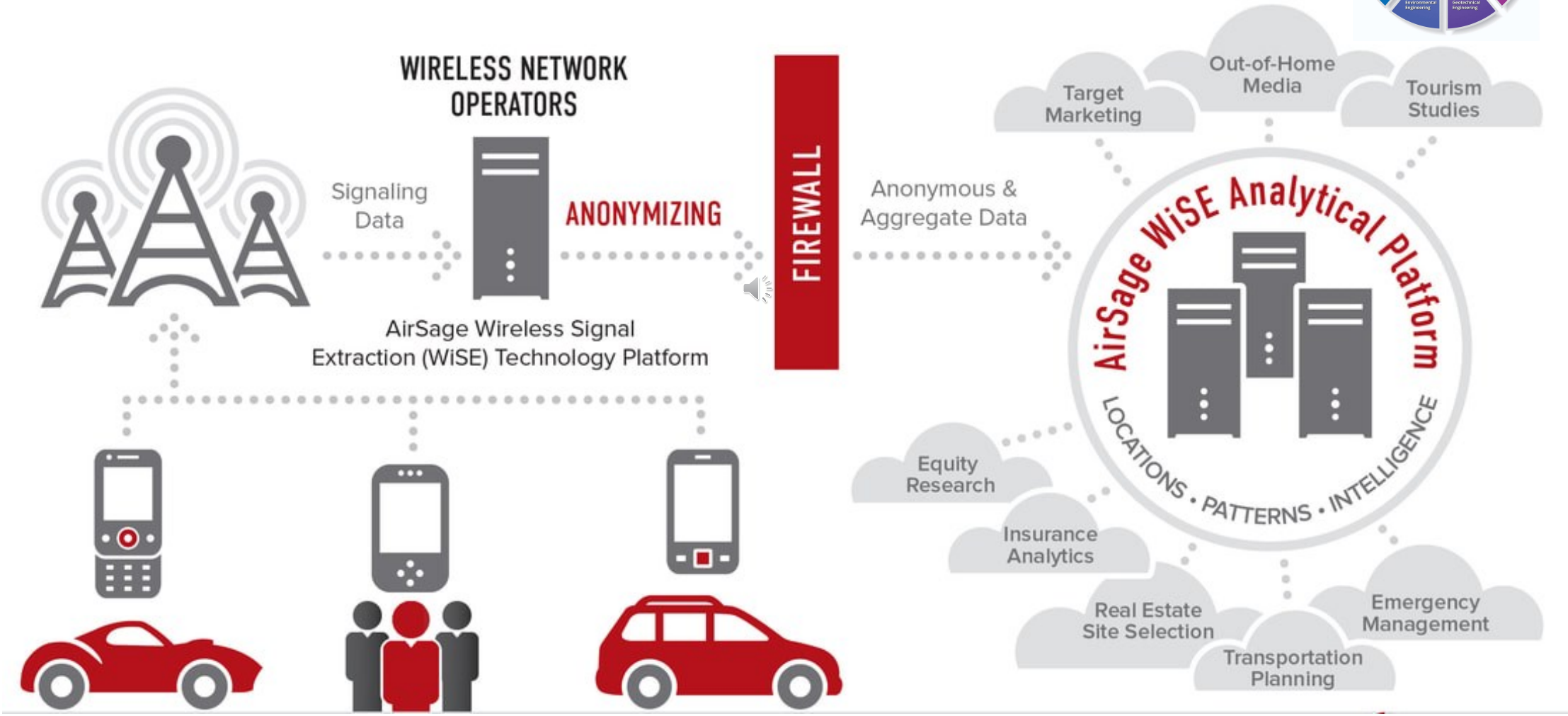




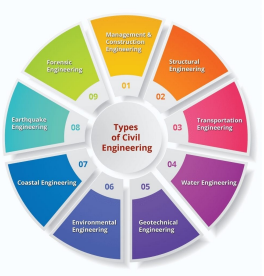
Travel Desire Line Diagram

Transportation Planning



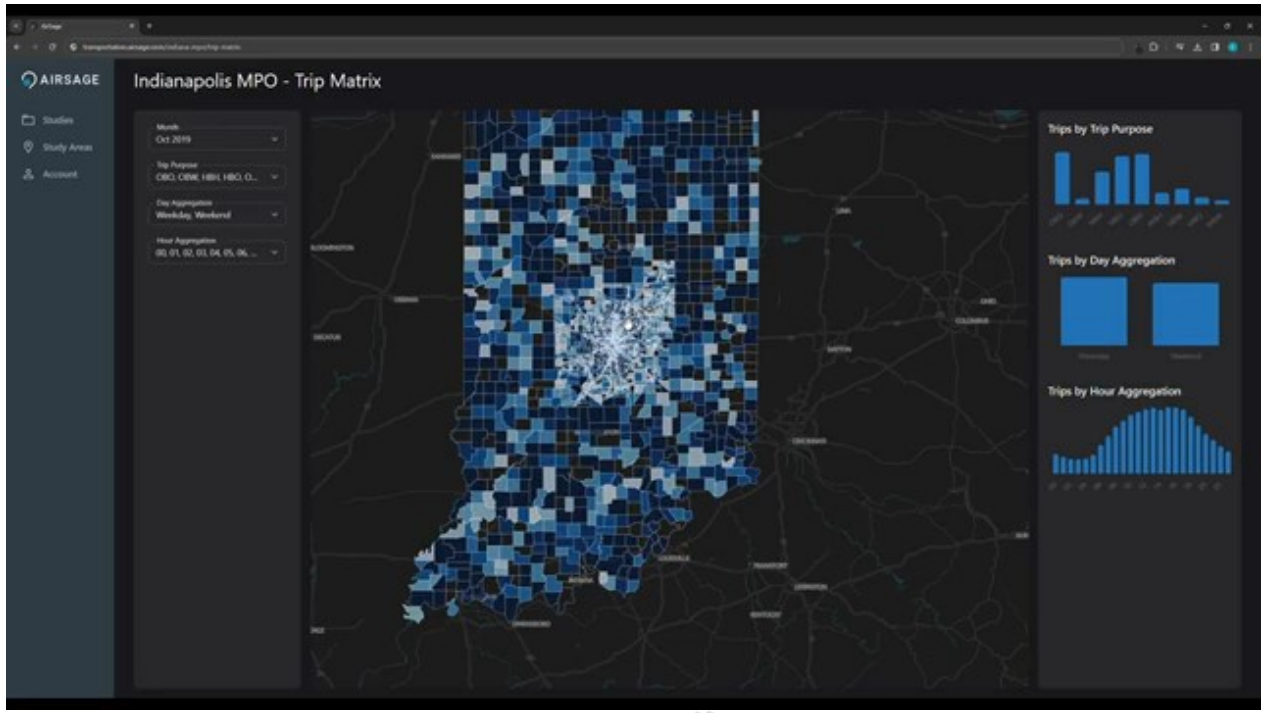


Transportation Planning



- In this illustration, an Area of Interest is shown which is divided into unique zones.

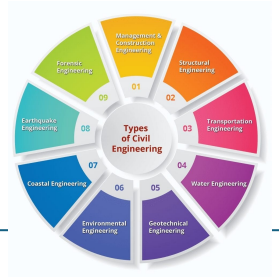
- Cell Phone Movement Data from Origin to Destination (e.g., Home-Office, Home-School, Home-Shopping, Home-Park, etc.) is shown, which can be categorized as:
  - Trips by Trip Purpose
  - Trips by Day Aggregation
  - Trips by Hour Aggregation



Conclusion and Closing Remarks

- Prerequisites for a Forward-Looking Progressive Pakistan.
- Meaningful Legislation and Regulatory Framework.
- Initiatives for Reversing the Brain Drain.
- Strong Industry-Academia Research Based Interaction.
- Meaningful Curriculum in Universities and Polytechnics.
- Mandatory Training Programs and Continuing Education Initiatives.
- Solutions through Customization and Product Development.

Recommended Readings



Building Information Modeling (BIM): Trends, Benefits, Risks, and Challenges for the AEC Industry

SALMAN AZHAR, PH.D., A.M.ASCE

ABSTRACT: Building information modeling (BIM) is one of the most promising recent developments in the architecture, engineering, and construction (AEC) industry. With BIM technology, an accurate virtual model of a building is digitally constructed. This model, known as a building information model, *can be used for planning, design, construction, and operation of the facility. It helps architects, engineers, and constructors visualize what is to be built in a simulated environment to identify any potential design, construction, or operational issues. BIM represents a new paradigm within AEC, one that encourages integration of the roles of all stakeholders on a project. In this paper, current trends, benefits, possible risks, and future challenges of BIM for the AEC industry are discussed. The findings of this study provide useful information for AEC industry practitioners considering implementing BIM technology in their projects.*

The architecture, engineering, and construction (AEC) industry has long sought techniques to decrease project cost, increase productivity and quality, and reduce project delivery time. Building information modeling (BIM) offers the potential to achieve these objectives (Azhar, Nadeem et al. 2008). BIM simulates the construction project in a virtual environment. With BIM technology, an accurate virtual model of a building, known as a *building information model*, is digitally constructed. When completed, the building information model contains precise geometry and relevant data needed to support the design, procurement, fabrication, and construction activities required to realize the building (Eastman et al. 2008). After completion, this model can be used for operations and maintenance purposes. Fig. 1 depicts the typical applications of BIM at different stages of the project life cycle.

A building information model characterizes the geometry, spatial relationships, geographic information, quantities and properties of building elements, cost estimates, material inventories, and project schedule. The model can be used to demonstrate the entire building life cycle (Bazjanac 2006). As a result, quantities and shared properties of materials can be readily extracted. Scopes of work can be easily isolated and defined. Systems, assemblies, and sequences can be

Leadership Manage. Eng., 2011, 11(3): 241-252

Governance of Technologies

in Industrie 4.0 and Society 5.0

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Azhar Zia-ur-Rehman

Atlantic Council
SOUTH ASIA CENTER

REPORT

State of Pakistan's Technology Landscape and Startup Economy

OCTOBER 2022 HAMNA TARIQ and UZAIR YOUNUS

The **South Asia Center** serves as the Atlantic Council's focal point for work on greater South Asia as well as relations between these countries, the neighboring regions, Europe, and the United States. It seeks to foster partnerships with key institutions in the region to establish itself as a forum for dialogue between decision-makers in South Asia, the United States, and NATO. These deliberations cover internal and external security, governance, trade, economic development, education, and other issues. The Center remains committed to working with stakeholders from the region itself, in addition to partners and experts in the United States and Europe, to offer comprehensive analyses and recommendations for policymakers.

INTRODUCTION

Pakistan's startups and technology sector witnessed unprecedented growth during the COVID-19 pandemic. 2021 was a record-breaking year, with technology startups raising $350 million, while over $227 million was raised in the first half of 2022; Pakistani startups have raised $322 million in 2022 so far.[1] Additionally, Pakistan's information technology (IT) services sector has emerged as the largest net services exporter in the country, with IT exports more than doubling from $1.19 billion in fiscal year (FY) 2019 to $2.62 billion in FY 2022.[2] Another key component of the country's technology sector is freelance work, where individuals provide technology services to global clients through platforms such as Upwork and Fiverr. This talent pool has experienced a tremendous increase in their earnings during the pandemic. While exact data for cumulative freelance earnings is not available, Pakistan is ranked as one of the largest freelance markets in the world. The national government has set a target of earning over $3 billion from this sector by 2024.[3]

The ongoing growth of Pakistan's technology ecosystem is not entirely unexpected. Pakistan is a young country with a growing middle class. Sixty-four percent of the population is below the age of thirty, an additional 2.5 million middle-income households are expected to be estab-

1 "Startups raise $104mn in Q2 amid VC funding slowdown," *Metis Global Link*, July 1, 2022. https://mettisglobal.news/startups-raise-104mn-in-q2-amid-vc-funding-slowdown/

2 Exports and Imports data, the State Bank of Pakistan. https://www.google.com/url?q=https://www.sbp.org.pk/ecodata/Exportsimports-Goods-Arch.xls&sa=D&source=docs&ust=1659034360198031&usg=AOvVaw0NsjctS6zSchassOx6o2s

3 "Govt eyes $3bln from freelancing IT exports by 2024," *The News International*, September 5, 2021. https://www.thenews.com.pk/print/887910-govt-eyes-3bln-from-freelancing-it-exports-by-2024

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THANK YOU **مهرباني** **شكريه**

If you have any questions or require additional information, please contact:

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