Transportation Engineering Track: Program Overview

Comprehensive Skills for Modern Infrastructure Design

Your Name

Program Goal

This program is meticulously designed to empower participants with the essential knowledge and practical capabilities required to **comprehensively understand, analyze, plan, and design sophisticated transportation infrastructure systems.**

Culmination: Applied Design Project

The program culminates in a hands-on project that challenges participants to integrate theoretical knowledge. This involves the **design of a basic road layout and a functional traffic signal plan tailored for a small urban area**, simulating real-world engineering scenarios.

Core Topics

Highway Planning & Geometric Design

Focuses on the strategic development of road networks and the precise engineering of their physical configurations to ensure optimal traffic flow and user safety.

Traffic Flow & Control Devices

Delves into understanding traffic behavior, optimizing flow, and applying control devices such as signals and signage in accordance with established standards (e.g., MUTCD).

Pavement Design

Encompasses the structural engineering of road surfaces, covering material selection, multi-layer construction, and long-term durability considerations.

Public Transportation

Explores the comprehensive planning, efficient operation, and seamless integration of mass transit systems (e.g., buses, rail) to enhance urban mobility.

Phase 1: Foundational & Core Concepts (Months 1 & 2 - Online)

Delivery Mode
Fully Online

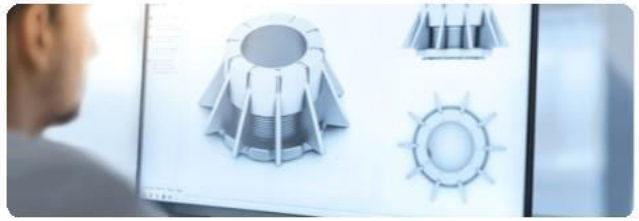
Primary Objective
Strong Theoretical Understanding

Key Focus Areas

Transportation Planning

Understanding strategic development of transport networks and urban mobility solutions, including data-driven planning.

Strategic | Urban Mobility | Analysis



Design Principles

Core concepts for designing efficient and safe transportation infrastructure, utilizing CAD approaches.

Geometric | CAD | Efficiency

Practical Exercises

- **Conceptual Problem-Solving:** Engage with realistic scenarios to apply theoretical knowledge.
- **Analytical Calculations:** Master quantitative methods for design and analysis.
- **Engineering Standards Introduction:** Familiarization with critical industry guidelines and specifications.

Month 1: Planning, Geometric Design & Traffic Flow Fundamentals

The foundational first month establishes critical principles in transportation engineering, from conceptual planning and intricate highway geometric design to the dynamics of traffic flow and its characteristics.

Week 1 — **Week 2** — **Week 3** — **Week 4**

Week 1: Introduction to Transportation Engineering & Highway Planning

This week introduces the broad scope of transportation engineering and the strategic processes involved in highway planning. Participants will explore the development and management of road networks.
Key Concepts: Overview of transportation systems, Planning

Week 3: Highway Geometric Design - Vertical Alignment & Cross-Sectional Elements

Building on horizontal design, this week covers vertical alignment (grades and vertical curves) and the critical design of cross-sectional elements. Topics include lanes, shoulders, and intersection geometrics

Month 2: Pavement, Public Transport, Safety & Economics

Month 2 delves into the practical and analytical aspects of transportation engineering, covering critical topics from traffic control and pavement design to public transport, safety protocols, and the economic principles governing infrastructure projects.

Week 5: Traffic Control & Management

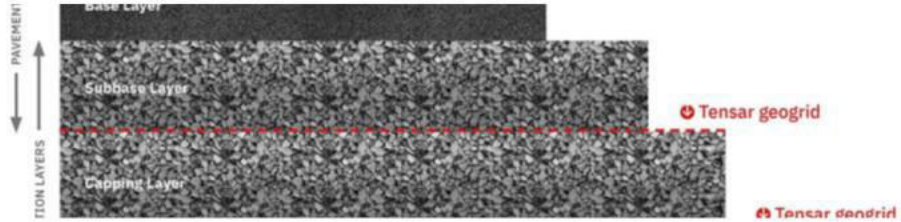
Signs & Markings: Apply MUTCD for highway sign selection, design, and placement.

Signals: In-depth study of traffic signal design, operation, and timing plans based on official standards.

Capacity & Calming: Optimize intersection capacity and implement traffic calming measures.

MUTCD | Signals | Capacity

Week 6: Pavement Materials & Design



Types & Materials: Explore pavement types and properties of materials, including advanced sustainable geomaterials.

Design Basics: Learn principles of flexible/rigid pavement design for structural performance.

Sustainability: Review innovations in pavement design for eco-efficiency and durability.

Flexible | Rigid | Sustainable

Week 7: Public Transportation Systems

Week 8: Safety, Economics & Scoping

Phase 2: Industry Immersion & Integrated Project (Month 3 - Offline)

Offline Immersion | Practical Application | Career Focused

Integrated Project: Hands-On Design & Application

Month 3 marks a pivotal shift to intensive, offline application. Participants will engage in a capstone integrated project, synthesizing all theoretical knowledge into tangible engineering solutions. This immersive experience simulates real-world project scenarios, demanding practical problem-solving and design expertise in a collaborative environment.

Road Layout Design

Conceptualization to Detailing: Apply principles of geometric design to create comprehensive road layouts. Focus on optimizing functional efficiency and ensuring safety.

Site-Specific Challenges: Address real-world constraints like topography and existing infrastructure to develop practical, sustainable designs.

Traffic Signal Plan Design

Intersection Optimization: Design sophisticated signal timings and phasing plans to ensure efficient traffic flow and minimize congestion.

Intensive Offline Application

This phase ensures deep understanding through direct, hands-on engagement, fostering dynamic collaboration and immediate feedback.

Hands-on | Collaborative | Experiential Learning

Software & Expert Guidance

Harness industry-standard software (CAD, simulation) with direct mentorship from seasoned professionals for critical insights and best practices.

Capstone Mini Project: Basic Road Layout & Traffic Signal Plan

Week 9: Road Layout Design | **Week 10: Traffic Signal Design**

Week 9: Urban Area Analysis & Road Layout Design

This phase initiates the project by defining the urban context and conceptualizing the road network, translating planning goals into initial geometric designs.

- **Urban Area Analysis:** Comprehensive study of the project site to understand its characteristics and traffic patterns.
- **Road Network Conceptualization:** Developing preliminary ideas for road configurations, hierarchies, and connectivity.
- **Geometric Design Application:** Applying principles of alignment and cross-sections for functional, safe layouts.
- **CAD Drafting:** Using CAD software to produce precise engineering drawings of the proposed road network.

Urban Planning | Network Design | CAD Skills | Site Analysis

Week 10: Traffic Flow Analysis & Traffic Signal Design

This phase focuses on optimizing traffic flow through detailed analysis and the design of efficient traffic signal plans for the proposed road layout.

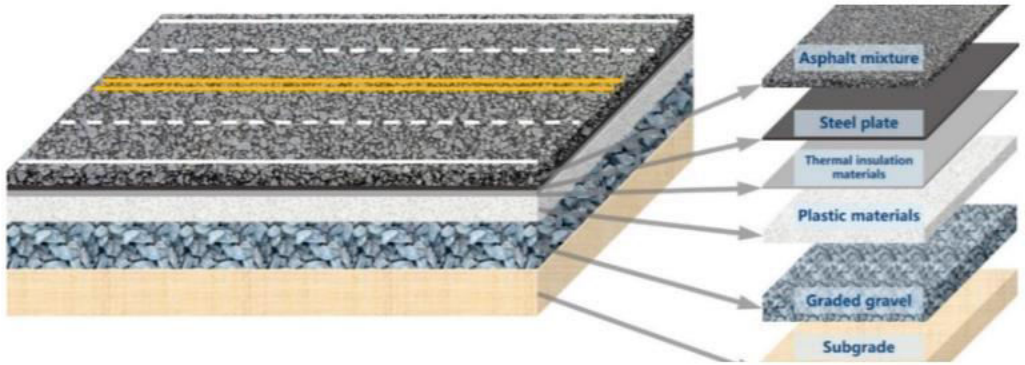
- **Volume Estimation:** Forecasting future traffic demands to inform design decisions and signal timing.
- **Intersection Selection & Analysis:** Identifying critical intersections for signalization and detailed operational analysis.
- **Fixed-Time Signal Timing:** Developing precise green, yellow, and all-red intervals for signal phases per MUTCD standards.
- **Signal Coordination Concepts:** Exploring methods to synchronize signals to improve arterial flow and reduce congestion.

Traffic Modeling | Signal Optimization | MUTCD | Flow Management

Project Implementation, Visualization & Showcase

The final weeks of the program are dedicated to solidifying practical application through advanced design and visualization, culminating in a comprehensive project showcase and strategic career launchpad designed to transition participants into successful professional roles.

Week 11: Advanced Pavement Design & Safety Integration



- **Pavement Recommendation & Sizing:** Select optimal pavement types and learn basic layer sizing for structural integrity, exploring sustainable materials like biomass by-product stabilized soils and warm-mix asphalt.
- **Safety Elements Integration:** Integrate critical safety features like skid resistance and clear zones,

Week 12: Project Showcase & Career Launchpad

- **Final Project Presentation:** Deliver a compelling presentation articulating design choices and solutions to an expert panel.
- **Comprehensive Documentation:** Prepare a complete technical report with calculations, drawings, and risk assessments.
- **Career Development Workshops:** Engage in