



Whitepaper

Reimagining Commutes with AI and GenAI For Smarter Mobility and Higher Productivity

Scale at Speed™

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Executive Summary

Organizations lose millions due to commuting inefficiencies that impact productivity and employee well-being. Employees spend excessive time in traffic, leading to unpredictable delays, fatigue, minimal collaboration and lower business performance.

This whitepaper presents a **strategic roadmap for enterprises** to use **Artificial Intelligence (AI)** and **Generative AI (GenAI)** to transform commuting and urban mobility. This solution enables measurable business and societal impact by optimizing routes, allowing dynamic rescheduling, and improving employees' commute time more effectively.

Key Benefits

Reduce commute time by **10 to 15%**; save up to **20** hours per employee per month

Convert **30 to 40%** of in-transit time into productive work boosting efficiency

Lower costs for fuel, parking, and tolls while improving sustainability

Enhance employee engagement and well-being, reducing attrition and enabling smarter work-life balance

Support ESG goals through reduced emissions and smart mobility solutions

Figure 1-1: Why it is important?

Aligning with Tech Mahindra's Digital Vision

Our goal is to **make daily commute efficient and enhance quality of life** with AI and GenAI. This initiative aligns with Tech Mahindra's vision for **digital transformation and sustainability**, positioning us as a leader in smart mobility innovative solutions.

Addressing Commute Challenges that Impact Performance

Daily commuting challenges directly affect productivity and well-being. Our analysis of data and survey confirms these challenges are faced across service staff, students, and employees from private and public sectors.

Key pain points include:

- **Direct Costs**

Employees incur expenses for fuel, parking fees, tolls, and rideshare services. Limitations in public transport increases these costs. The "opportunity cost" of non-productive travel time impacts overall output.

- **Indirect Productivity Loss**

Long travels cause fatigue leading to frequent changes in activities. Traffic delays result in late arrivals, missed meetings, and connectivity issues, disrupting collaboration and reducing organizational effectiveness.

Key Hypothesis

Implementing AI/GenAI can reduce commute time up to **15%** and turn **~40%** of travel time into productive tasks or learning.

AI powered automation assists individuals to manage smart ways of working, improve daily routines, and support modern lifestyles. This allows enterprises, universities, and healthcare providers to achieve individual, organizational, and their collective goals more efficiently.



How AI and GenAI Power Smart Mobility

AI and GenAI work together to deliver powerful automation, each contributing distinct strengths.

Traditional AI

These are used for tasks like routing, demand forecasting, dynamic pricing, anomaly detection, and traffic analytics. These features help manage congestion, improve estimated arrival times, and boost transport efficiency.

Generative/Agentic AI

Enables conversational intelligence and workflow automation. Modern platforms use private and public large language models (LLMs) and Agentic AI solutions to build bots to perform complex tasks. Key capabilities include:

- **Natural Language Copilots**

Chat-based assistants support travel planning, managing meeting schedules, and boosting productivity while commuting.

- **Content Generation**

GenAI creates summaries, emails, reports, meeting minutes, and converts voice notes into actionable items.

- **Simulation and Digital Twins**

Enterprises, city planners simulate transport networks and test policies before implementation.

- **Commute-focused AI and GenAI use cases**

- **Personal commute optimization**

For individual commuters and employees, AI and GenAI offer personalized route planning and productivity tools:

- **Multi-Modal Personalized Route Planner**

Combines real-time traffic updates, public transport, micro-mobility options, weather updates, and user preferences like cost, travel time, minimal walking, and safety.

- **AI Role**

Predicts arrival times, analyzes travel patterns, and forecasts congestion.

- **GenAI Layer**

GenAI provides a natural language interface. e.g., an employee might say: *"I need to reach location X by 9:00am with minimal walking"*. The system then responds with a detailed plan and alternative options.

Transforming Personal Commutes and Building Smart Cities

Dynamic Rescheduling Copilot

We are exploring key AI use cases for scheduling. When delays occur, this copilot:

- Anticipates disruptions and responds accordingly
- Alerts participants and suggests new meeting slots
- Adjusts calendar priorities and recommends audio calls during travel
- Creates quick updates for managers or customers

1) Commute-Time Productivity Assistant

Employees can dictate emails, listen to summaries, and handle tasks hands-free to stay safe and manage travel time productively.

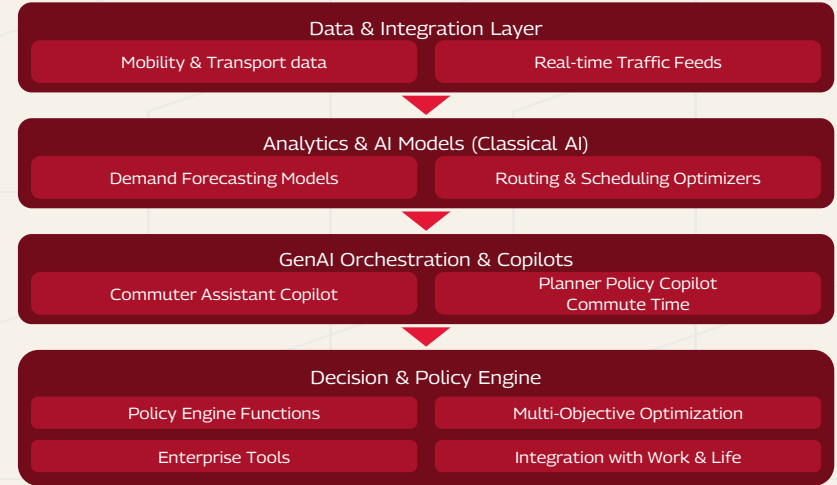


Figure 1-2: Architecture diagram for enhanced commuting solution using AI & GenAI

Transforming Personal Commutes and Building Smart Cities

2) Voice-First Interface

A voice-first interface enables safe and efficient commuting:

- **Dictating Emails and Notes**

Employees dictate content while AI organizes, refines, and routes it to workflows like support tickets, CRM records, or tasks.

- **Listening to Summarized Content**

The system delivers brief summaries based on travel time. For example: *"Create a 20-minute briefing from today's tickets, meeting minutes, and dashboards."*

- **Safety by Design**

Hands-free interaction reduces distractions. Proactive reminders help minimize screen use and supports safety compliance.

3) Enterprise and City-Level Applications

GenAI helps streamline both enterprise operations and city infrastructure beyond personal commutes:

- **AI-optimized Office Schedules and Hybrid Work**

AI helps coordinate businesses or teams based on project priorities, integrates with transport APIs, identifies low-traffic routes and recommends staggered shifts.

- **Traffic Signal and Corridor Optimization**

Computer vision and edge AI track intersections, classify vehicles, and spot violations. Reinforcement learning adjusts signals to prioritize ambulances, and school/college buses reduce delays.

- **Smart Parking and Last-Mile Guidance**

AI predicts parking availability, suggests ideal pricing for park-and-ride versus CBD options, and offers route guidance with walking time and cost.

- **Mobility-as-a-Service (MaaS) Orchestration**

AI balances demand across transport modes, while GenAI bots handle ticketing, refunds, and end-user feedback.



Applying Innovation to Public Quality-of-Life

AI and GenAI offer opportunities beyond commuting. They improve healthcare, education, government services, environmental safety, and energy efficiency. These applications benefit society and align with organizational goals.

Healthcare and Well-Being

AI chatbots and symptom checkers offer instant support, easing call center workloads. AI assistants handle 24/7 triaging, bookings, and FAQs in local languages.

Personal Health Copilots

GenAI offers personal recommendations for sleep, diet, and exercise using step data, electronic health records, and doctors' care plans. It simplifies complex medical advice and supports population health analytics by predicting outbreaks, mapping hotspots, and driving targeted health campaigns through SMS, WhatsApp, and IVR in local languages.

Education and Skills

AI-driven adaptive learning platforms personalize education in local languages and adjust difficulty levels in real time. GenAI-powered tutors give clear, step-by-step guidance on smart devices for both online and offline learning.

Government Services and Citizen Engagement

Unified AI assistants on the web, WhatsApp, and kiosks handle routine queries about IDs, benefits, utilities, and complaints. This reduces helpdesk workloads **~60%** and supports smart-city deployments.

Benefit Targeting and Fraud Detection

AI models identify irregularities in welfare disbursement and improve subsidy allocation. This minimizes losses and promotes fair distribution.

Environment, Safety, and Urban Life

AI provides polluted air quality and heat risk alerts. e.g., *"Avoid outdoor exercises from 2-5pm; here's an indoor alternative."*

Disaster Prediction and Response

AI platforms use real-time data to predict disasters, send alerts, and coordinate corrective actions. Integrated workflows connect authorities, meteorological departments, hospitals, emergency services, and transport agencies. These systems generate multilingual alerts and optimize emergency routes during floods, cyclones, landslides, other climate events, delivering faster and accurate responses.

Energy Optimization

AI streamlines HVAC, lighting, and EV charging to optimize energy usage while maintaining comfort. GenAI copilots provide real-time data and insights that help technical, non-technical teams and leadership in making informed decisions on energy efficiency.

Delivering Business Impact and ROI from Smart Mobility



A **10-15%** reduction in commute time saves thousands of productive hours annually.



Lower fuel, parking, and toll expenses result in **savings** for employees and enterprises.



Higher CSAT scores and **lower attrition** enhance employee well-being.



Optimized routes and shared transport lead to **lower emissions**.

Building Trust through Data, Ethics and Governance Principles

Our approach is ensuring privacy, fairness, transparency, and accountability.

- **Privacy and Data Minimization**

We ensure identity data is separated from behavioral data using differential privacy, this data will be used to protect individual confidentiality.

- **Fairness and Accessibility**

Our systems support low-resource languages and low-end devices, ensuring inclusivity and accessibility for end-users.

- **Human-in-the-Loop**

Humans make critical decisions. Traffic controllers, doctors, and civil servants make final calls. AI offers suggestions that users can choose to override.

- **Procurement and Standardization**

We adopt to open APIs and vendor-neutral interfaces for interoperability, with logging and audit capabilities for transparency and compliance.

Roadmap to Success and Key Metrics

Our implementation strategy follows a structured, phased approach to ensure smooth adoption and measurable impact.

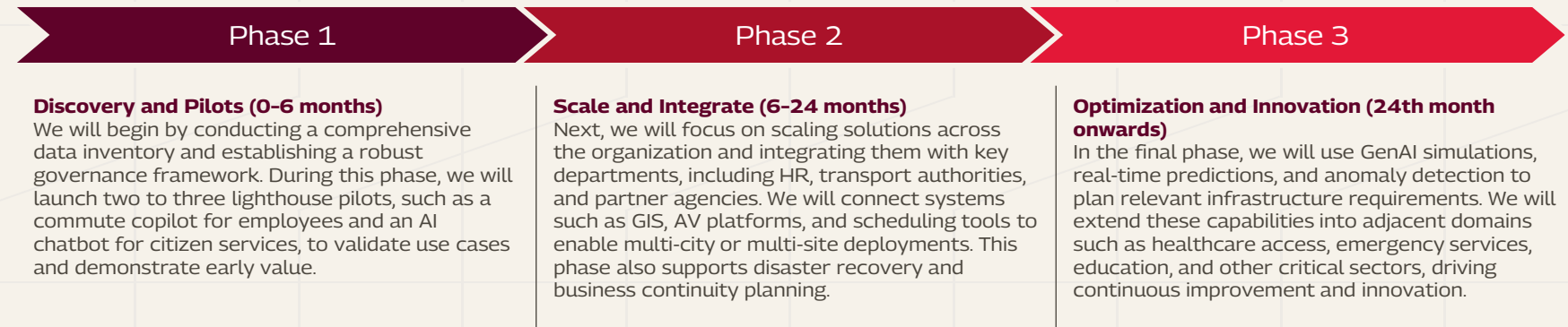


Figure 1-3: Implementation Roadmap

Building Trust through Data, Ethics and Governance Principles

Suggested and Recommended KPIs

To measure success and ensure continuous improvement, we track the following key performance indicators (KPIs).

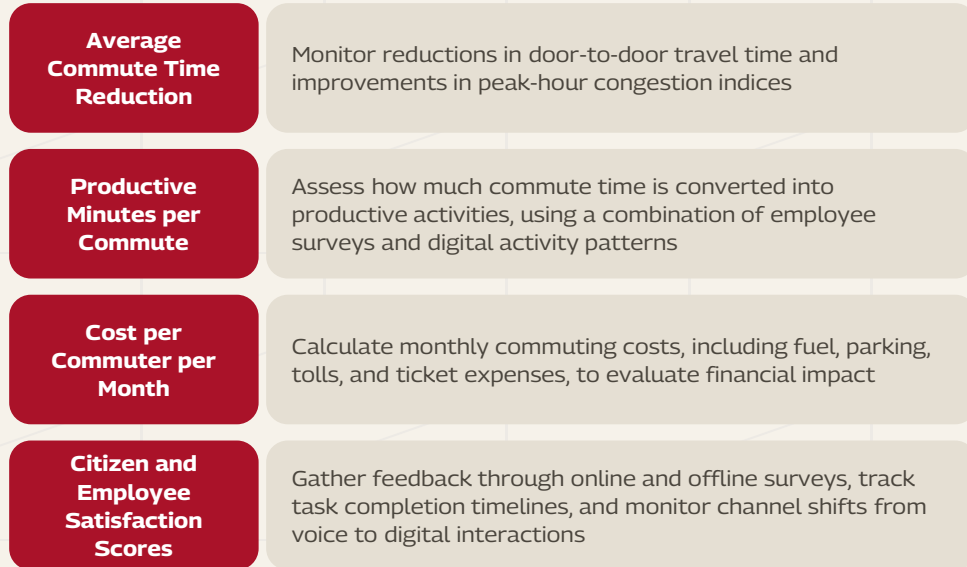


Figure 1-4: Recommended KPIs



Design Principles and Best Practices

We apply optimization and GenAI to provide trustworthy, safe, and easy-to-use solutions that can scale and remain transparent.

Combining GenAI with Classical Optimization

We use classical algorithms such as Vehicle Routing Problem (VRP), multi-modal shortest path, and linear programming as our core engines. GenAI provides a conversational interface and personalized recommendations.

GenAI capabilities include:

- Gathering user preference in natural language based on location, province and context
- Calling underlying optimizers and traffic APIs for accurate route planning
- Clearly explaining trade-offs, e.g., *“Faster service requires a small additional fee”* or *“One transfer instead of none reduces travel time by 15 minutes”*

Design for Real-Time, Multi-Modal Data

GenAI integrates live traffic, GTFS schedules, rideshare availability, parking occupancy, and weather data. Cached historical data supports forecasting and pattern detection, recurring bottlenecks.

Keeping Humans in Control

GenAI offers alternatives, like employees receive alternate route options as recommendation. The services from organizations, universities, private/public enterprises, group shuttle scheduling, carpools, and staggered shifts require manager approval before activation irrespective of weather conditions.

Personalization with Guardrails

We are ensuring users can set stable preferences through safety guardrails:

- **Modes allowed:** “No bikes,” “Prefer metro,” “Avoid surge-priced cabs.”
- **Constraints:** Walking distance limits, accessibility needs, and safety preferences like well-lit roads or female-only compartments.

Design Principles and Best Practices

Reliability, Safety, and User Experience

We recommend prioritizing safe, conservative options.

- Prefer routes with known lighting, sidewalks, and lower accident rates
- Buffer times for critical events, voice-first, hands-free interaction to reduce distractions
- Explicit reasons for changes like: *"Route updated due to bad-weather"* or *"Schedule adjusted to avoid traffic-congestion"*

Privacy, Consent, and Data Minimization

We are ensuring essential data is collected, e.g., employee information. Users' opt-in to share location, calendar, commute history and can review or delete preferences at any time. Data is anonymized to protect privacy and optimize services at fleet and city levels.

Robustness and Evaluation

We regularly evaluate and validate GenAI-assisted schedules based on various scenarios:

- On-time arrival rates and average door-to-door time
- Cost per commuter on a weekly, monthly, and quarterly basis
- Missed connections, rebooking's, and user overrides

Enterprise and Fleet-Specific Practices

For employee shuttles or shared cabs:

- GenAI groups and routes based on live sign-ups, ensuring maximum fairness (e.g., no one always being last dropped)
- Integration with HR calendars and office access control helps predict attendance while allowing manual overrides

For public transit agencies:

- GenAI assists planners in generating scenario schedules during festivals, weather disruptions, metro outages using simulation engines and demand models

Data Sources and Categories for Proposed Solution

Our solution uses a wide range of data sources for precise forecasting and GenAI-driven optimization. These categories support strong analytics and informed decision-making.

Core Internal Demand Data	Commercial and Marketing Data	Customer and Behavioral Data
Non-negotiable base for any forecasting model.	Prevents GenAI models from over-learning promotional spikes or price fluctuations.	Critical for granular insights and GenAI-driven forecasting.
<p>Historical Demand or Sales</p> <p>We will capture transaction-level history by product, SKU, service, location, channel, and date/time to identify seasonality, trends, and base demand patterns.</p> <p>Returns, Cancellations, and No-Shows</p> <p>This helps distinguish the true demand from net shipped or served quantities.</p> <p>Inventory and Stockout History</p> <p>We will track periods where demand was suppressed due to lack of availability rather than lack of interest.</p>	<p>Pricing and Discount History</p> <p>List price, realized price, discounts, coupons, and price change dates.</p> <p>Promotions and Campaigns</p> <p>Start and end dates, channels (online, offline, SMS, social), and intensity (budget, impressions).</p> <p>Channel Mix</p> <p>Data split by channel (retail, e-commerce, dealer, distributor, B2B) to model different elasticities.</p>	<p>Customer Profiles and Segments</p> <p>For B2C: demographics, location, segment tags. For B2B: industry, size, and account tier.</p> <p>Behavioral Signals</p> <p>Web and app analytics (views, carts, searches, abandonment), inquiry and lead data, and quote requests. These indicators often precede actual orders and help with short-term demand sensing.</p>

Data Sources and Categories for Proposed Solution

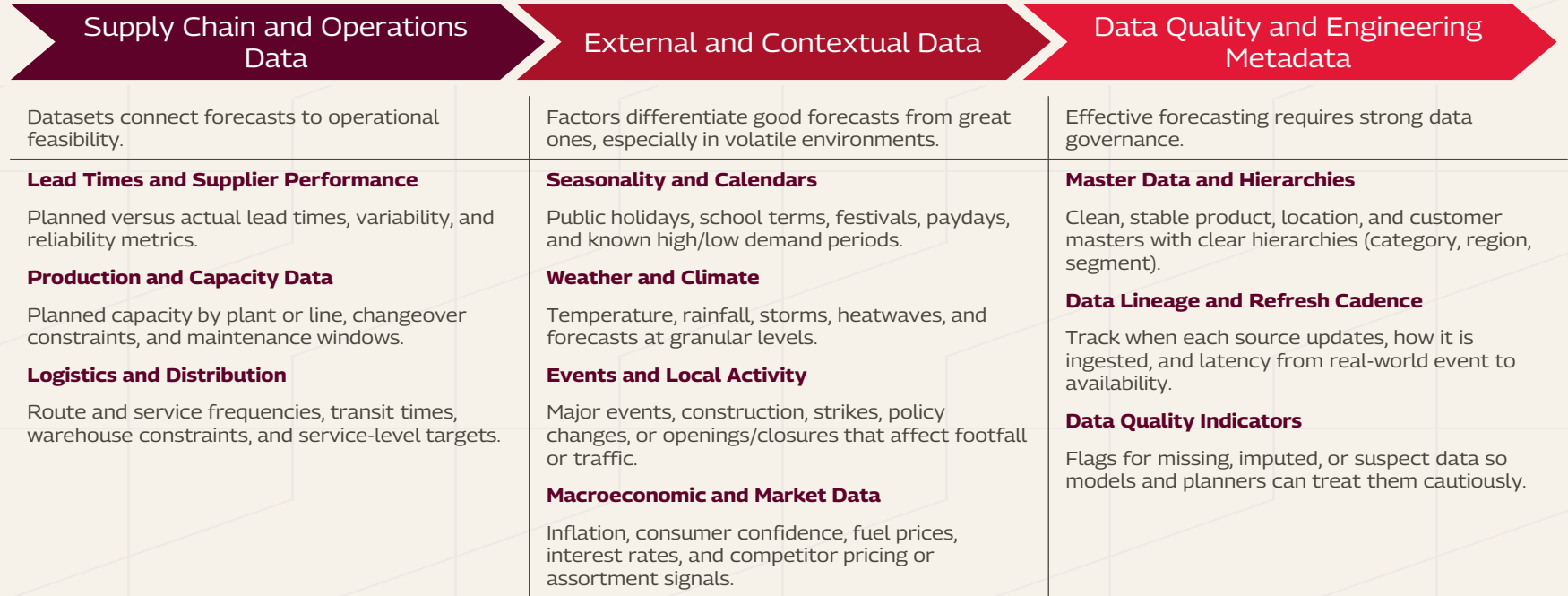


Figure 1-5: Data Classification and Sources

When users provide context such as retail, transport, or healthcare, a GenAI model can select relevant data sources and design an integration schema tailored for forecasting and prediction.



Privacy and Consent Practices for Mobility Data Collection

We prioritize privacy and transparency in all data collection processes.

Consent Practices

We obtain explicit, informed consent to collect mobility data, use clear language and allow users to withdraw at any time. Enterprise APPs use granular opt-ins with defaults set to “off”.

Data Minimization and Purpose Limitation

Minimum data-inputs required for defined purposes, demand forecasting or route optimization is collected. Aggregated data is selected over precise GPS traces. Clear documentation and data are discarded when no longer needed.

Transparency and Community Engagement

Clear privacy policies explained data collection, storage, and usage. Community engagement is conducted through consultations to build trust. Users can access, correct, or delete their data.

Security and Access Controls

We apply robust cybersecurity practices, including 128/256-bit encryption, access logs, and role-based restrictions. Regular audits and breach response plans ensure compliance. Sensitive data access is restricted through IAM-policies and DLP standards.

Sharing and Anonymization

Sensitive data is shared only securely and minimally, applying aggregation and differential privacy protections after sharing. Law enforcement access is legally limited; vendor policies are reviewed for compliance and public datasets are obscured.

Evaluating Model Fairness for Transit Users

Fairness ensures that AI-driven mobility solutions serve all users equally.



Embedding Fairness in AI Mobility Models

It's important to assess how recommendation systems, generative models, and simulations impact different user groups.

Recommendation Fairness

Multimodal route or service recommendations, we will check if certain groups often receive longer, more expensive, or less safe options when better alternatives exist. These evaluations consider origin-destination and time of day to ensure fairness.

Synthetic Mobility and Simulation Fairness

When deploying generative mobility models or digital twins, we will compare flows and accessibility for vulnerable versus advantaged groups. Metrics like “common part of commuters and structural similarity” confirm that patterns remain fair across all segments.

Incorporating Perceived Fairness and Qualitative Input

Numerical fairness does not always match user perception. We combine quantitative and qualitative insights through rider surveys and mixed method reviews to refine thresholds, acceptable wait times.

Governance, Monitoring, and Iteration

Fairness evaluation is an ongoing exercise that must be integrated into operations for continuous assessment.

- **Fairness Dashboards and Reporting**

We track equity KPIs like access gaps, wait-time disparities, and error gaps over time for policy changes or model releases.

- **Impact Assessments**

Transport-specific algorithmic impact assessments before deployment, noting trade-offs, (e.g., minor efficiency loss to improve services) and revisit them periodically.

Embedding Fairness in AI Mobility Models

Measuring Group Fairness metrics

Industry standard group fairness metrics and their evaluation criteria are shared as best practice recommendations.

Define Groups and Outcomes

1

- **Sensitive Attributes to detect barriers:**

Income (low, medium, high), race/ethnicity (where legally permissible), and disability (including mobility, visual, and cognitive categories).

- **Outcomes to Audit requirements:**

Binary decisions such as “received high-quality service” or “assigned faster route”, and continuous evaluation measures like predicted wait time and accessibility scores.

Practical Implementation

3

- Construct stratified evaluations for each sensitive attribute and intersectional groups (e.g., low-income disabled riders).
- Visualize gaps using bar charts and calibration plots. Large gaps indicate potential unfairness.
- Use proxies where direct labels are restricted, such as area-level deprivation indices or accessibility flags.
- Compare models with and without sensitive features to assess bias. Train a “blinded” version (removing income/race/disability) and compare fairness metrics to the full model.

Apply Core Fairness Metrics

2

- **Demographic Parity:**

Validate that the rate of positive outcomes is similar across groups. For example, riders offered fast routes, or discounted fares should not be disadvantaged unless justified by policy. Check if positive outcome rates are consistent across end-user groups:

$$P(Y^A=1|A=a)$$

$\hat{Y} = 1$ means a positive result (e.g., loan approval or job offer).

A is a protected attribute (like income, race, or disability).

a and b refer to different groups within that attribute (for example, income brackets or racial categories).

- **Equal Opportunity and Equalized Odds:**

Equal opportunity refers to ensuring True Positive Rate (TPR) is similar across groups, given the same true need. On the other hand, ensuring true positive rates and false positive rates are similar across groups, balancing missed interventions and wasted resources is termed as equalized odds.

- **Disparate Impact or Selection Rate Ratios:**

Compute ratios of positive outcome rates between each group and the highest-served group. Use thresholds like 0.8 (80% rule) as a signal for review.

Policy Alignment and Trade-Offs

4

- Decide acceptable trade-offs, such as favoring disadvantaged groups for subsidies.
- Document observed gaps, mitigation plans, and intentional policy choices.

Continuous Monitoring

5

- Build fairness dashboards to track demographic parity gaps, TPR/FPR gaps, and selection ratios over time and across releases.
- Audit intersectional groups regularly, as severe unfairness often appears in combined attributes rather than single ones.

Figure 1-6: Steps to measure group fairness



Architectural Workflow for Intelligent Mobility

This mobility architecture has 6 integrated layers enabling intelligent decision-making and high-quality user experiences.

1. Data and Integration Layer

This layer gathers and harmonizes data from multiple sources to create a unified base for analytics and decision-making. It consolidates real time mobility data (traffic feeds, GTFS schedules, vehicle GPS, rideshare APIs, parking occupancy, incidents), enterprise data (travel preferences, calendars, shift-rota, historical commutes), and contextual data (weather, air-quality, events, holidays, safety-heatmaps). Policy data covering fares, subsidies, and service constraints are integrated. Data flows through ETL pipelines into a central repository, while API-GW exposes transport, policy data to downstream services.

2. Analytics and AI Models (Classical AI)

This layer enables predictive and optimization capabilities:

- Demand forecasts for origin-destination patterns, peak demands, and mode splits
- Route planning, scheduling using VRP, ILP, and reinforcement learning for multi modal journeys
- Traffic and environmental analysis for congestion, incidents, travel times, and emissions

- Fairness calculators for accessibility measures, Lorenz curves, Gini coefficients, and group fairness

Outputs include candidate routes, predicted wait times, reliability metrics, and policy levers for capacity planning and incentives.

3. GenAI Orchestration and Copilots

GenAI adds conversational and orchestration capabilities without making raw decisions.

- **Commuter Assistant Copilot** translates natural language requests into structured constraints and presents options with trade offs
- **Planner or Policy Copilot** converts high level goals into actionable plans for schedules, routes, or incentives
- **Productivity Copilot** integrates with email, chat, and meeting tools to suggest commute friendly tasks like dictation and summaries

Architectural Workflow for Intelligent Mobility

4. Decision and Policy Engine

The decisions are based on business rules, regulations, fairness constraints, and user consent. This includes constraints for ride times, walking distances, subsidies, and fares, as well as balancing time, cost, emissions, and equity. Outputs include final recommendations and operational decisions like added services, dynamic pricing windows, or staggered shifts.

5. Channels and Experience Layer

Personalized experiences are facilitated through mobile APPs, web portals, voice interfaces, kiosks, IVR systems, and in vehicle displays. Planners are given KPI's, heatmaps and data-analysis through dashboards. Integration of tools allows for rescheduling meetings, steps to dial-in, and public-good nudges like air-quality or heat risk notifications.

6. Governance, Monitoring and Feedback

This layer ensures compliance, fairness, and continuous improvement. Data monitoring and filtering. Fairness monitors track accessibility and equity indicators, alerting for breaches in thresholds. Observability tracks overrides, choices, and satisfaction scores, feeding back into model and policy refinement.



Logical Sequence of End-to-End Workflow

Our solution follows a structured six step flow:

1. Sense and Collect

Real-time mobility, user and context data is collected with privacy filters in place.

2. Predict and Optimize (AI)

AI models predict, generate alternate routes, schedules, and equity-modules evaluate fairness.

3. Orchestrate and Explain (GenAI)

Copilots translate user input, call AI functions, and display options with explanation.

4. Decide and Enforce (Policy Engine)

Business rules, legal requirements and fairness standard guide what is allowed.

5. Deliver and Interact (Experience Layer)

Users get routes, advisories, and suggestions; planners get dashboards.

6. Monitor and Improve (Governance)

Metrics such as time, cost, emissions, fairness, and satisfaction drive continuous refinement.

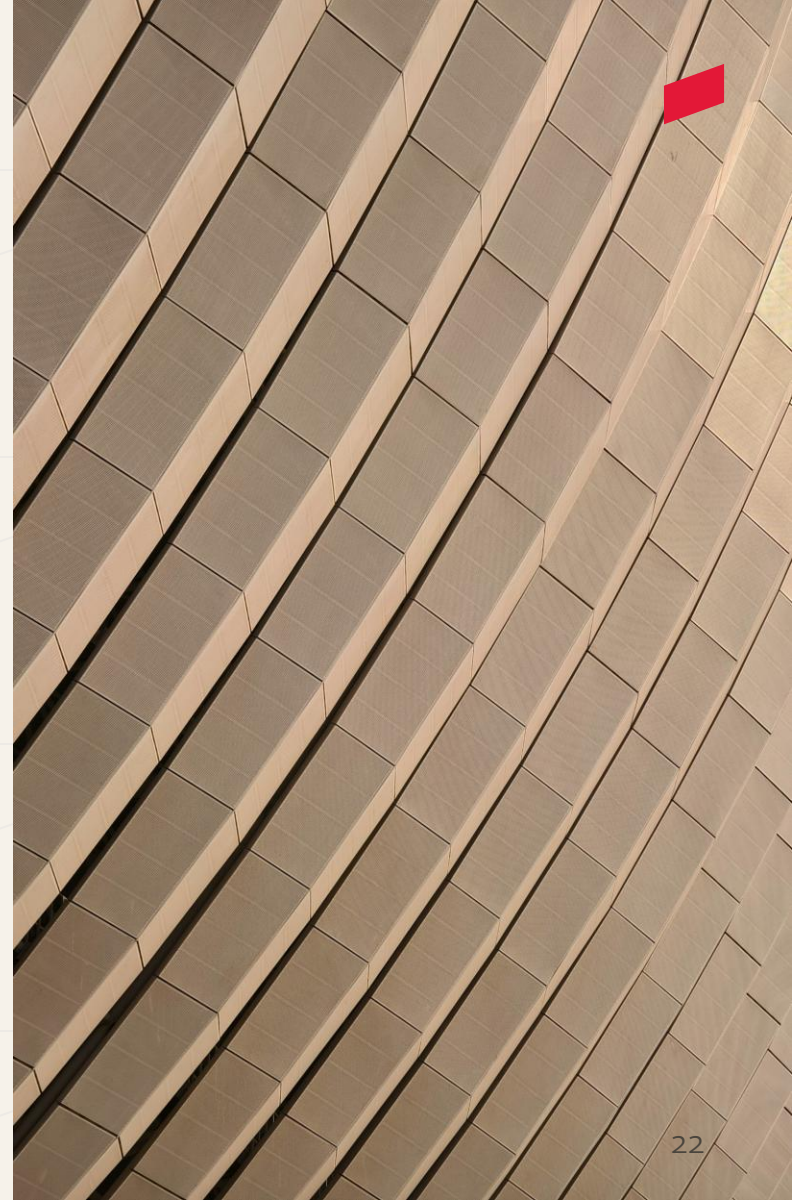
Key Takeaway - Driving Action for a Smart Future

AI and GenAI can redefine commuting and urban mobility by reducing travel time, improving productivity, and ensuring fairness. The results are measurable values for employees, enterprises, and society.

Leadership directions:

- Approve phased pilots in **30-45 days**
- Nominate a cross-functional task force
- Align this initiative with Tech Mahindra's sustainability and digital transformation goals

The future of commuting is smart, inclusive, and sustainable, we are ready to lead this transformation for our clients and employees.



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About Tech Mahindra

Tech Mahindra (NSE: TECHM) offers technology consulting and digital solutions to global enterprises across industries, enabling transformative scale at unparalleled speed. With 147,000+ professionals across 90+ countries helping 1100+ clients, Tech Mahindra provides a full spectrum of services including consulting, information technology, enterprise applications, business process services, engineering services, network services, customer experience & design, AI & analytics, and cloud & infrastructure services. It is the first Indian company in the world to have been awarded the Sustainable Markets Initiative's Terra Carta Seal, which recognizes global companies that are actively leading the charge to create a climate and nature-positive future. Tech Mahindra is part of the Mahindra Group, founded in 1945, one of the largest and most admired multinational federation of companies.



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