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16. Abstract

Intelligent Transportation Systems (ITS) offer a powerful, cost-effective approach to improving roadway safety and efficiency, especially when traditional infrastructure expansion is either impractical or fails to meet longer-term needs. Their ability to address complex challenges are driving substantial growth in the ITS field as transportation systems evolve and new demands emerge. Supporting this growth requires a skilled ITS workforce responsible for planning, designing, implementing, and operating these new systems to deliver everyday benefits to American travelers. At the same time, workforce needs are continually evolving as emerging technologies like automation, artificial intelligence, and shared mobility transform the transportation landscape. This document provides a high-level overview of ITS career opportunities organized by topic areas of interest (e.g., engineering, planning, policy), highlighting both established and emerging roles across employment sectors.

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Chapter 1. Introduction

As transportation networks become increasingly complex and interconnected, the demand for innovative solutions to improve safety and efficiency is more urgent than ever. Intelligent Transportation Systems (ITS) and Transportation Systems Management and Operations (TSMO) are at the forefront of this transformation, leveraging advanced technologies, data analytics, and real-time information to optimize the performance of transportation infrastructure. These dynamic fields offer a wide range of career opportunities for professionals and individuals soon to enter the workforce with a broad array of backgrounds including engineering, data science, planning, policy, and systems integration.

This report explores various career opportunities within ITS and TSMO, highlighting the skills, qualifications, and educational backgrounds that are most in demand. It also examines emerging trends, such as automation, vehicle-to-everything (V2X) communications-based technologies, and smart infrastructure, which are shaping the future of the workforce in these sectors. By understanding the evolving roles and competencies required in ITS and how ITS and TSMO are interrelated, students, job seekers, and professionals can better prepare for and navigate careers in this vital and rapidly growing area of transportation.

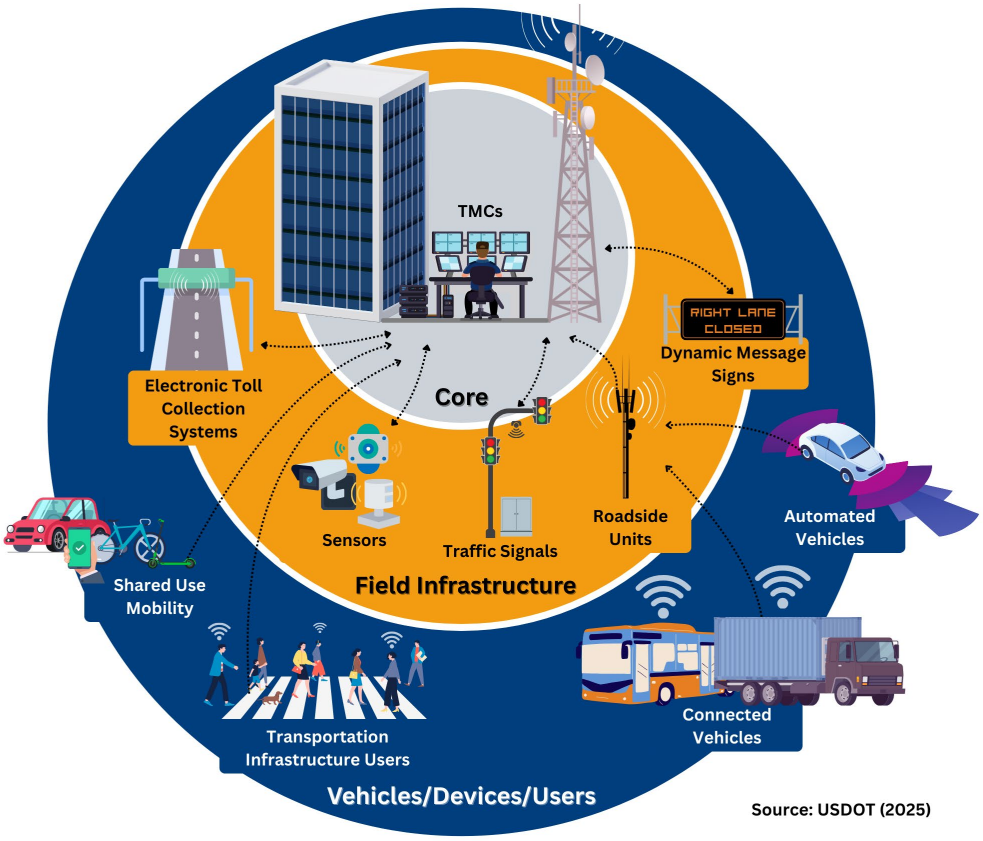
Overview of Intelligent Transportation Systems (ITS)

Safe and efficient transportation systems are essential for economic growth, social connectivity, and overall quality of life. However, balancing safety and efficiency presents challenges that can lead to substantial societal costs if not properly managed. For example, privately owned and operated vehicles provide many user benefits (speed, convenience, etc.) but also contribute to significant costs in the forms of collisions and traffic congestion. In 2023, motor vehicle crashes resulted in 40,990 fatalities and cost Americans an estimated $1.85 trillion—$460 billion in economic costs and $1.4 trillion in quality-of-life costs (TRIP: A National Research Nonprofit, 2024). In 2024, the average American driver spent 43 hours in traffic, resulting in a total cost across the U.S. of $74 billion in lost time alone (INRIX, 2025). Impacts of congestion on the trucking industry are also significant, with costs reaching $108 billion in 2022, an increase of 15% from the previous year (American Transportation Research Institute, 2023). ITS are key to addressing these challenges due to their proven ability to advance safety, optimize traffic flow efficiency, and enhance mobility in ways that are cost-effective and flexible. The ITS workforce includes the people who are responsible for planning, designing, installing, operating, and maintaining these technology-based systems. These people are essential to delivering the full benefits of ITS, including fewer roadway fatalities, improved mobility, and lower travel costs for the millions of Americans that use the transportation system each day.

The basic components of ITS include sensing and data collection technologies, communications networks, transportation management centers (TMC), and control systems. When integrated, these systems provide TMCs with real-time network information to help inform optimal management strategies and timely safety interventions. Commonly deployed ITS technologies include traffic detectors, closed-circuit television (CCTV) cameras, electronic toll collection, ramp metering, dynamic message signs (DMS), automatic passenger counters (APC) and automatic vehicle location (AVL) for transit vehicles, as well as truck parking information systems and weigh in motion (WIM) technology for freight. Historically,

these various ITS technologies have operated independently without corridor- or system-level coordination. In recent years, these technologies have become more integrated, enabling new, more effective approaches, such as integrated corridor management (ICM) and active traffic management (ATM). ICM leverages real-time data to proactively manage corridors (e.g., freeways, arterials, bike and pedestrian infrastructure, parking) using a combination of ITS technologies. Example technologies include traveler information systems, multi-modal integration, dynamic and managed lanes, among others. ATM strategies also use real-time data to dynamically manage network conditions focused on specific facilities (rather than an entire corridor). Example strategies include dynamic speed limits, hard shoulder running, queue warning systems, ramp metering, among others. These more established ITS strategies and technologies have traditionally relied on a workforce with expertise in ITS hardware (e.g., sensors, traffic controllers), telecommunications, traffic flow, and safety for their planning for design, implementation, and operations and maintenance.

In recent years, the transportation sector has evolved with advancements in technology. The widespread adoption of smartphones equipped with global positioning system (GPS) are enabling new mobility service models (e.g., ride-hailing, microtransit, and shared-use mobility), real-time traveler information systems, and enhanced traveler and driver behavior data collection via onboard smartphone sensors. Artificial intelligence (AI), machine learning (ML), and real-time analytics are transforming vehicle and infrastructure technologies, including automation and dynamic decision-making systems. Finally, improvements in wireless communications, sensing, and computing technologies are paving the way for vehicle-to-everything (V2X) technologies, which facilitate real-time communication among vehicles, infrastructure, and non-motorized road users. These technologies, while beneficial, require new skillsets more focused on data, analytics, and software for their design, implementation, and operations and maintenance. As a result, existing ITS roles are being reshaped and drawing in professionals with new expertise. The modern ITS ecosystem, including examples of both established and emerging ITS technologies, is shown below in **Figure 1**.



Source: USDOT, 2025

Figure 1. ITS Ecosystem Consisting of Transportation Management Centers (TMC), Field Infrastructure, and Vehicles/Devices/Users

Purpose

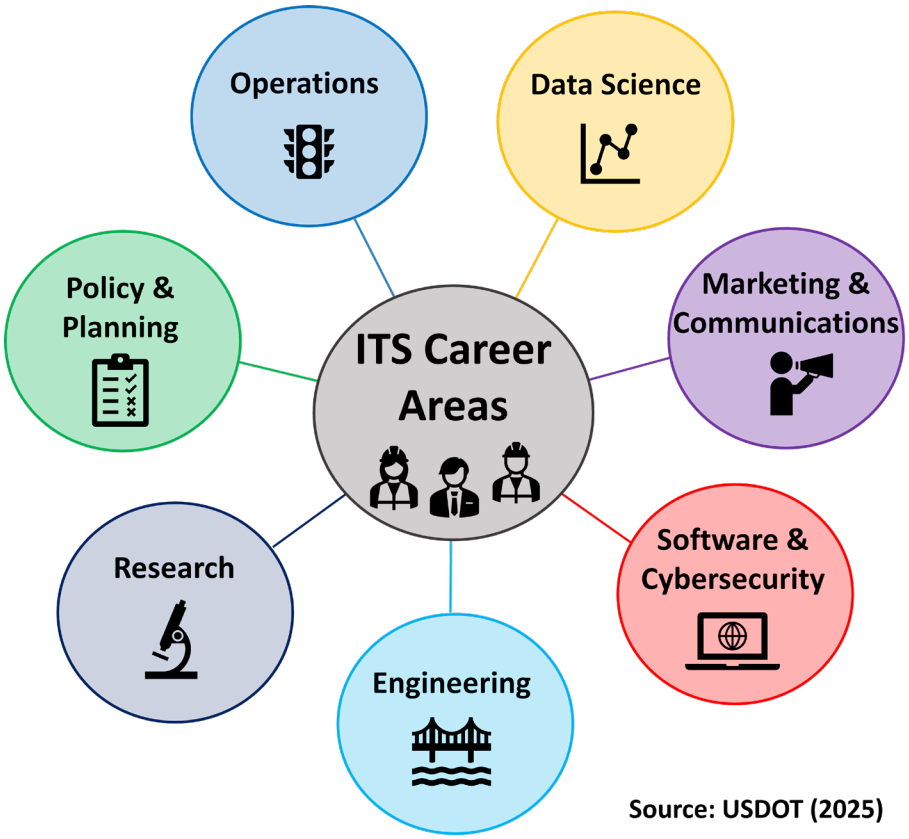
This document offers a high-level overview of potential ITS careers categorized by topic areas for those exploring or considering a future in the field, which includes students, job seekers, and experienced professionals. It highlights both established and emerging roles across employment sectors, showcasing the broad, dynamic, and evolving opportunities available within the ITS sector.

Scope

This report provides information and offers guidance for individuals interested in pursuing a career in ITS, regardless of their educational background or level of experience. It highlights both established and emerging opportunities across a range of employer sectors, including public agencies, private industry, non-government organizations, and academic/research institutions. To support career planning, the report also covers emerging trends and technologies shaping the future of the ITS field, such as vehicle connectivity, automation, AI/ML, and shared mobility services. Note that while this document aims to provide a representative overview of career opportunities in ITS, it does not provide an exhaustive list of all possible opportunities.

Chapter 2. ITS Career Opportunities

ITS is a dynamic and rapidly evolving field offering a wide range of career opportunities for individuals with different skills and backgrounds. Traditionally focused on traffic engineering, infrastructure operations, and systems integration, the ITS field is expanding as emerging technologies reshape the transportation landscape. This transformation is generating new opportunities in areas including software development, cybersecurity, data science, and automation, while also broadening the scope of more established ITS roles in planning, engineering, and policy. This chapter provides examples of both established and emerging ITS opportunities grouped by topic area to help guide individuals based on their educational and experiential backgrounds and areas of interest. **Figure 2** highlights these topic areas.



Source: USDOT, 2025

Figure 2. ITS Career Paths by Topic Area

The following sections provide additional details about ITS career opportunities within each topic area, highlighting the types of work one might encounter and helping align prospective workers' interests with relevant ITS roles. Also included in each topic area subsection are descriptions of common educational paths, high-level skills that would support success within the given topic area, and potential employers (which are covered in greater depth in **Chapter 3. ITS Opportunities by Sector**). Note that alternative pathways to ITS also exist with the appropriate cross-cutting skills (e.g., written/verbal communication,

stakeholder engagement, strategic planning, and data analysis). These high-level topic areas and job descriptions aim to be representative but are not exhaustive and do not capture every potential opportunity within each category. The subsequent sections were informed by the following resources: *Workforce Gaps & the Future of Intelligent Transportation Systems* (Intelligent Transportation Society of America, 2024), *Transportation Systems Management and Operations (TSMO) Workforce Guidebook* (Szymkowski, et al., 2019), *Transportation Systems Management and Operations (TSMO) Paraprofessional Workforce Development White Paper* (Lopez & Szymkowski, 2019), National Network for the Transportation Workforce website (National Network for the Transportation Workforce, 2025), and the *TSMO Moment Series* interviews (National Operations Center of Excellence, 2024). The following hyperlinks can be used to navigate directly to topics of interest: **Policy & Planning**, **Operations**, **Data Science**, **Marketing & Communications**, **Software & Cybersecurity**, **Engineering**, and **Research**.

Policy & Planning

Transportation policy involves developing, implementing, and analyzing traffic laws, regulations, and programs to address road safety issues and support the seamless integration of emerging mobility technologies. Policy careers provide opportunities to influence transportation design and operations in the mid-term to longer-term (through policy making) with potential large-scale impacts. As an ITS policy professional, one must grasp both the intricacies and broader impacts of ITS and emerging technologies to create effective, forward-looking policies at the local, state, and federal levels. Example policy topics include policies for enabling V2X and automated vehicles; establishing guidelines for the collection, use, and protection of data; addressing legal responsibilities and liabilities related to autonomous vehicles; ensuring ITS technologies are designed and support all road users; and guidelines for public and private investment in ITS projects and the development of new business models and services.

Entry-level policy positions often require a four-year degree. However, alternative pathways are also possible through on-the-job experience and/or specific policy-focused coursework. High-level skills that support success in policy roles include written and oral communication, stakeholder engagement, and strategic thinking (i.e., the ability to connect technology capabilities with long-term policy goals). Potential employers include consulting firms, technology developers, government agencies (federal, state, and local), state/local departments of transportation (DOT), metropolitan/regional planning organizations (MPOs/RPOs), and professional associations. An ITS policy career is a good match if you want to shape how emerging transportation technologies serve the public good through policy development and analysis. **Table 1** provides a few examples of ITS policy jobs, including some high-level responsibilities and examples of relevant skills.

Table 1. Example Jobs in ITS Policy

Example Job Titles	Example Responsibilities and Skills
ITS Policy Analyst	• Develop and evaluate policies related to ITS technologies. • Ensure alignment between technology and broader community goals/objectives. • Evaluate policy/regulation impacts on ITS deployments. • Support the development of ITS strategic plans. • **Skills**: Data analysis, cost-benefit analysis, economic impact analysis, basic computer programming.

Example Job Titles	Example Responsibilities and Skills
Connected and Automated Vehicle (CAV) Regulatory Affairs Specialist	• Track and interpret CAV policies/regulations at local, state, and national levels. • Ensure regulatory compliance through coordination with legal teams. • Support proposals and reporting with regulatory alignment. • **Skills**: Risk modeling, CAV standards and compliance analysis.
Technology Policy Manager	• Manage policy portfolios for various ITS technologies/solutions. • Align technology policies with broader planning and innovation goals. • Engage with stakeholders across industry, government, and the public. • **Skills**: Technology impact assessment, policy evaluation, standards development.

Transportation planners develop and implement strategies to safely and efficiently move people and goods. ITS planning, a specialized area within transportation planning, specifically focuses on leveraging and integrating new technologies to achieve these goals, often through scoped programs and projects. Planning careers provide opportunities to work within the community and contribute to real-world solutions that affect travelers and residents daily. As an ITS planning professional, one must align technology capabilities with community and regional transportation needs and balance numerous (and sometimes competing) objectives to improve overall system performance. These professionals lead the development of ITS Strategic Plans which engage stakeholders to develop a comprehensive roadmap that outlines how a region or agency will use technology to meet its transportation goals. They may also perform benefit-cost analysis to help make the business case for funding ITS projects. ITS planners also play an integral part on project development, working with systems engineers to develop Regional ITS Architectures—frameworks that guide the development and integration of transportation technologies within a specific geographic area—and Concepts of Operations (ConOps).

Entry-level positions often require a four-year degree, usually in civil engineering, urban planning, urban and regional planning, or transportation planning. However, alternative pathways are also possible with direct planning experience gained through on-the-job training and/or with specific planning focused coursework. High-level skills that support success in planning roles include written and verbal communication, stakeholder engagement, data analysis and visualization, transportation operations and evaluation, and knowledge of ITS technology capabilities and use cases. Potential employers include consulting firms, technology developers, government agencies (federal, state, and local), state/local departments of transportation (DOT), metropolitan/regional planning organizations (MPOs/RPOs), and professional associations. A career in ITS planning is well-suited for those who want to address real-world transportation challenges by collaborating with communities and leveraging emerging technologies. **Table 2** provides a few examples of ITS planning jobs, including some high-level responsibilities and examples of relevant skills.

Table 2. Example Jobs in ITS Planning

Example Job Titles	Example Responsibilities and Skills
Transportation Planner	• Develop/implement multimodal transportation strategies and comprehensive plans for cities/regions. • Integrate ITS solutions into broader planning studies. • Align solutions with local policy and land use development. • Coordinate with stakeholders (e.g., engineers, construction, maintenance, public). • **Skills**: Travel demand modeling, geographic information system (GIS) utilization, data analysis.
ITS Planner	• Develop ITS Strategic and Implementation Plans • Develop of Concepts of Operations (ConOps) and ITS Architectures • Develop more detailed ITS integration plans to inform procurement, operations, and maintenance. • Evaluate impacts of specific ITS components. • Research/promote implementation of emerging ITS technologies. • **Skills**: Stakeholder engagement, ITS architecture/standards development or utilization, cost-benefit analysis, data management.
Smart Mobility Planner	• Develop integration plans between ITS and emerging mobility services (e.g., ride-hailing, micromobility, microtransit) • Evaluate impacts of emerging transportation technologies and propose solutions to maximize system-level benefits. • Engage with state/local groups and internal departments to develop multimodal transportation strategies. • **Skills**: Transportation modeling/simulation, data collection, scenario analysis.

Operations

Transportation operations refers to the day-to-day management of transportation systems and components to ensure safe, efficient, and reliable movement of people and goods. Public-sector examples of operations roles include monitoring system performance (i.e., identifying and responding to incidents and congestion), managing operational strategies (e.g., ramp meters, reversible lanes), coordinating emergency response, supporting traveler information systems, and operating/maintaining ITS technologies. Private-sector opportunities in operations are more focused on monitoring, managing, and optimizing private vehicle fleets, such as ride-hailing, micromobility, freight, and delivery services. Across both public and private sectors, operations professionals monitor and respond to transportation system disruptions and inefficiencies to improve safety and mobility.

Many entry-level operations positions, such as TMC operators, Safety Service Patrol (SSP) drivers, or fleet operations specialists, require a high school diploma. These types of positions are responsible for monitoring network conditions from real-time camera feeds, identifying incidents, coordinating responses, monitoring and managing fleets, and/or directly addressing incidents (e.g., stranded vehicles, roadway obstructions). Operations roles that focus on private fleet optimization (using data to identify issues and alter fleet operations using mathematical models) typically require a four-year degree in a quantitative field, such as mathematics or operations research. High-level skills that support success in transportation operations include strong verbal communication, real-time decision-making (often in high-stress environments), stakeholder coordination, programming and mathematical expertise for some private

sector operations optimization roles, and knowledge of traffic management technologies and operational strategies. TMCs are the primary employers for public sector operations roles, while mobility service companies (e.g., ride-hailing, micromobility, microtransit) are the primary employers for private sector operations roles. An operations career is a good match if you enjoy working in fast-paced, real-time environments helping minimize impacts from system disruptions. **Table 3** provides a few examples of operations jobs, including some high-level responsibilities and examples of relevant skills.

Table 3. Example Jobs in Transportation Operations

Example Job Titles	Example Responsibilities and Skills
TMC Operator	• Monitor live traffic feeds from cameras and sensors. • Identify and respond to incidents (e.g., crashes, congestion, debris). • Coordinate with emergency responders and maintenance crews. • **Skills**: Problem solving, communication, knowledge of ITS technologies.
SSP Driver	• Provide vital, front line link between travelers, agencies, and first responders. • Patrol and monitor important roadways to proactively address issues. • Aid stranded motorists, set up traffic control measures, remove safety hazards from roadways, and assist in evacuations and emergencies. • **Skills**: Communication, vehicle diagnostic systems utilization and assessment, incident management.
ITS/Traffic Signal Technician	• Install, program, maintain, and repair ITS systems. • Integrate hardware (controllers, sensors, ITS devices, networking equipment, etc.) and software systems. • **Skills**: Basic knowledge of computers, traffic signal and ITS electronics, traffic signal and related ITS standards, network communication devices, traffic signal and related ITS specifications.
Shared Mobility Fleet Operations Specialist	• Track real-time status and location of fleet vehicles, identify issues, and coordinate rebalancing efforts. • Manage maintenance and repair schedules for fleet vehicles. • Collect and evaluate operations data, identify issues, and report performance. • **Skills**: Data analysis, data visualization, fleet management software utilization.
Incident/Event Management Coordinator	• Lead coordination efforts in response to roadway incidents. • Develop response coordination plans with relevant stakeholders. • **Skills**: Communication, emergency planning, leadership, task delegation and management.

Data Science

Data science involves applying mathematical and statistical techniques to analyze data, uncover patterns, make predictions, and support evidence-based decision-making. In the ITS field, data science professionals are responsible for conducting advanced quantitative analyses, which also include managing, cleaning, integrating, and interpreting large datasets from a variety of sources such as weather sensors, traffic cameras, loop detectors, and transit ridership systems. They also develop and maintain data pipelines and analytical tools using programming languages like Python, R, or SQL. There is a growing demand for ITS data professionals as the volume of collected data increases, new technologies

and mobility service models continue to grow, and state/local agencies seek to implement data-driven decision-making processes.

Entry-level positions in data science often require a four-year degree (usually in fields related to statistics, computer science, data analytics, and information systems) because a minimum level of statistical and coding proficiency is needed. However, a four-year degree is not a strict requirement, as many of these skills can be obtained through specific high school, community college, and/or online classes. High-level skills that support success in transportation data science roles include statistical analysis, programming, data visualization, written and verbal communications (translating technical information to broad audiences), and transportation system knowledge. Potential employers include consulting firms, technology companies, government agencies (federal, state, and local), state/local DOTs, MPOs/RPOs, transit agencies, and toll authorities. A career in ITS data science is ideal for those interested in using advanced analytical techniques on complex, large-scale datasets to support decision-making and solve real-world transportation problems. **Table 4** provides a few examples of data science jobs, including some high-level responsibilities and examples of relevant skills.

Table 4. Example Jobs in Data Science

Example Job Titles	Example Responsibilities and Skills
Transportation Data Analyst	• Clean, validate, and analyze transportation datasets. • Evaluate performance and generate reports. • Monitor data feeds to inform real-time decision making (operations, incident management, etc.) • **Skills**: Statistics, time series/spatial analysis, data cleaning, data visualization, data and analysis interpretation and communication.
Transportation Data Scientist	• Analyze transportation datasets to identify trends and support operational and policy decisions. • Develop models to forecast and predict future traffic congestion, travel demand, crash risk, etc. • Communicate findings with engaging visualizations and dashboards. • **Skills**: Statistics, data wrangling, prediction/forecasting, AI/ML.
AI/ML Engineer	• Develop and train models to automatically detect and predict conditions based on large datasets from multiple sources. • Tune model parameters, design appropriate metrics, and ensure interpretability. • Integrate methodological advancements for continued improvements. • **Skills**: Statistics, algorithm optimization, model development/training, feature engineering.
Mobility Data Analyst	• Analyze multimodal transportation datasets to support operational improvements and multimodal integration. • Evaluate operational performance of emerging modes (e.g., ride-hailing, microtransit, micromobility). • **Skills**: Statistics, time series/spatial analysis, data integration, data visualization, data and analysis interpretation and communication.

Example Job Titles	Example Responsibilities and Skills
Demand Forecasting and Modeling Analyst	• Support data collection (surveys, traffic counts, transit ridership, land use, etc.) • Develop and validate travel demand models to support planning and investment decisions. • Communicate findings to broad audiences using maps, charts, dashboards, reports, etc. • **Skills**: Travel demand modeling, econometrics, traffic simulation software utilization.

Marketing & Communications

Marketing and communications work in tandem to promote products and services to specific audiences. In the context of ITS, these 'products' and 'services' refer to advanced transportation technologies (e.g., pedestrian safety systems, automated vehicles) and emerging mobility solutions (e.g., on-demand ride-hailing). Effectively communicating the benefits and functions of these complex technologies is essential to promote greater adoption and build public trust. Therefore, professionals within these roles must grasp the technical details well enough to clearly communicate capabilities and benefits to broad audiences, which could include transportation professionals evaluating potential ITS solutions or the general public who must interact with a mix of established and newer technologies while navigating daily life.

Entry-level positions in marketing and communications often require a four-year degree in fields like communications, journalism, public relations, business, economics, and psychology (human decision-making and behaviors). Some exposure to transportation systems and related technologies through individual classes would also be beneficial. However, other pathways are possible by acquiring expertise through on-the-job training and/or targeted coursework. High-level skills that support success in ITS marketing and communications roles include strategic messaging, audience analysis, social media management, graphic design, stakeholder engagement, and written and verbal communications (i.e., translating complex topics to broad audiences). Potential employers include technology developers, government agencies (federal, state, and local), state/local DOTs, and professional associations. A career in ITS marketing and communications is ideal for those interested in translating complex ideas into clear, engaging messages that improve understanding and promote technology adoption and public trust across broad audiences. **Table 5** provides a few examples of marketing and communications jobs, including some high-level responsibilities and examples of relevant skills.

Table 5. Example Jobs in Marketing and Communications

Example Job Titles	Example Responsibilities and Skills
Outreach and Communications Specialist	• Develop and implement communication strategies for ITS projects and deployments. • Create outreach materials and organize events (public meetings, workshops). • Communicate technical information to broad audiences using press releases, social media, project fact sheets, infographics, among others. • **Skills**: Public relations, stakeholder engagement, community outreach, public speaking.

Example Job Titles	Example Responsibilities and Skills
ITS Marketing Professional	• Develop and implement marketing strategies to promote ITS products, services, and internal initiatives. • Conduct market research, develop value propositions, collaborate with technical teams, and build internal advocacy for ITS programs. • Analyze engagement data and modify strategies. • **Skills**: Strategy development, market research/analysis, content creation.
Digital Marketing Manager	• Plan and implement digital campaigns to raise awareness of ITS products and services. • Manage online presence (e.g., websites, social media, digital ads). • Tailor messaging to distinct audiences and track metrics to evaluate campaign effectiveness. • **Skills**: Digital marketing, social media management, data analysis.
Content Strategist	• Develop content that communicates ITS benefits (case studies, blog posts, white papers, social media posts). • Align content with broader branding, outreach, and strategic goals. • **Skills**: Storytelling, interdisciplinary coordination, audience analysis.

Software & Cybersecurity

Software engineering and cybersecurity roles involve building and securing the digital infrastructure underpinning the operation of modern transportation networks—including vehicles, users, and infrastructure. Software engineers design, develop, and maintain software for applications and technology such as traffic signal systems and other ITS technologies, connected vehicle platforms, and shared mobility applications. Cybersecurity professionals work to safeguard these systems' operations, code, and the data they generate from risks like hacking, data breaches, and service disruptions. Both fields are essential for ensuring the safe deployment of new technologies, maintaining system reliability, and building public trust. A strong and secure digital infrastructure is also critical to unlocking additional benefits from emerging transportation technologies, such as connected and automated vehicles (CAVs) and V2X.

Entry-level roles in software and cybersecurity typically require a four-year degree in computer science, software engineering, cybersecurity, or related field. However, many entry-level coding and/or cybersecurity analyst jobs do not require a degree if specific skills can be acquired through experience, specific coursework (online, community college), and certifications. High-level skills that support success in software and cybersecurity include programming/system design, systems-oriented thinking, threat modeling, communications, and knowledge of secure coding practices. Potential employers include ITS technology developers, government agencies (federal, state, and local), state/local DOTs, and MPOs/RPOs. A software or cybersecurity career would be a good fit for individuals who are passionate about building software and securing digital systems that are critical to today's transportation networks and will continue to shape the future of transportation. **Table 6** provides a few examples of software and cybersecurity jobs, including some high-level responsibilities and examples of relevant skills.

Table 6. Example Jobs in Software Engineering and Cybersecurity

Example Job Titles	Example Responsibilities and Skills
ITS Software Engineer	• Develop software for ITS systems, such as traffic signal controllers, connected vehicle applications, traveler information systems, among others. • Integrate real-time data from sensors, vehicles, and infrastructure. • Build and maintain backend services and application programming interfaces (APIs) for ITS platforms. • **Skills**: Database design/management, software development, hardware-software integration.
Security Architect	• Design secure ITS platforms, connected vehicle systems, and smart infrastructure systems. • Develop encryption, authentication, and data integrity protocols. • Conduct threat and penetration testing. • **Skills**: Communications protocols and implementation, systems architecture development, network security testing and enhancement.
Cybersecurity Analyst	• Monitor and identify threats and vulnerabilities in ITS networks. • Develop risk assessments and response plans. • Ensure compliance with cybersecurity standards/frameworks. • **Skills**: Network security assessment, vulnerability assessment, penetration testing, digital forensics, risk assessment, security auditing.
Mobility Application Developer	• Design front- and backend systems for traveler-facing applications (e.g., ride-hailing, micromobility, payment, trip planning). • Integrate multimodal data sources and real-time information for improved user experience. • **Skills**: Mobile applications, API integration, user interface development, user experience (UX) enhancement.
Embedded Systems Developer	• Develop and program embedded systems used in vehicles, roadside units, traffic signal controllers, among others. • Ensure interoperability and compliance with communications protocols. • **Skills**: C/C++ programming, digital electronics, microcontrollers/microprocessors, hardware-software integration.

Engineering

Engineering is an applied field that leverages scientific principles, mathematics, and practical knowledge to design, build, and augment structures, machines, systems, and processes to address real-world challenges. The three most relevant engineering disciplines for ITS are civil, electrical, and systems engineering. Civil engineers, particularly those specializing in transportation, plan, design, and manage the transportation system that includes roadways, transit systems, and ITS infrastructure (e.g., traffic signals, sensors). Electrical engineers develop the physical and digital components of ITS, including controllers, sensors, and communications devices. Finally, systems engineers are responsible for the development of systems engineering documents for projects and overseeing the integration of ITS software, hardware, and communications technologies to ensure the system functions as designed. Together, these engineering disciplines form the foundation of ITS development and deployment.

Systems engineers and other professionals also play a vital role in developing ITS standards that help contribute to the development of interoperable and scalable technology solutions.

Entry-level positions in engineering typically require a four-year degree from a college or university. For civil engineering, because their designs affect public safety and well-being, additional requirements are needed, such as graduating from an Accreditation Board for Engineering and Technology (ABET)-accredited university and passing the Fundamentals of Engineering (FE) exam. The licensure career path (i.e., obtaining a Professional Engineering [PE] license), which allows experienced engineers to approve design drawings, requires several years of work experience (varies by state) and then passing the PE exam. In many states, continuing education is also required to maintain PE licensure. Electrical and systems engineering licensure is often less critical for ITS work, but it can still help accelerate career advancement. Other engineering disciplines, such as mechanical, industrial, environmental, civil with a structural focus, automotive, among others, also provide relevant knowledge for ITS careers; however, they offer fewer opportunities compared to the examples mentioned above. Potential employers include consulting firms, ITS technology developers, government agencies (federal, state, and local), state/local DOTs, MPOs/RPOs, professional associations, and standards development organizations (SDOs). An ITS engineering career is well-suited for individuals who enjoy applying science and mathematics to design practical, real-world systems that enhance roadway safety and improve transportation efficiency. **Table 7** provides a few examples of engineering jobs, including some high-level responsibilities and examples of relevant skills.

Table 7. Example Jobs in Engineering

Example Job Titles	Example Responsibilities and Skills
Civil (Transportation) Engineer	• Design and integrate ITS infrastructure, including traffic signals, sensors, dynamic message signs, with greater transportation system. • Apply ITS solutions to improve traffic flow and enhance roadway safety. • Perform traffic data collection and analysis using modeling and simulation tools and software. • **Skills**: Traffic flow analysis, modeling/simulation software, GIS, spatial analysis, transportation planning principles.
Electrical Engineer	• Design electrical systems for ITS devices. • Develop and configure ITS devices that are used to monitor and manage transportation systems. • Ensure devices are properly integrated with the roadway infrastructure. • Perform testing, calibration, and maintenance of field equipment to ensure proper functioning and reliability. • **Skills**: Circuit/signal design, power systems, network/sensing hardware, computer programming.

Example Job Titles	Example Responsibilities and Skills
Systems Engineer	• Develop systems engineering documents including ConOps, requirements, design, architecture, and testing documents. • Develop and contribute to ITS Standards to ensure interoperable technology deployments • Define overall structure and functional components of ITS projects that are needed to meet performance and operational goals. • Lead system integration and ensure that assorted ITS components work together as one unified system. • Manage verification, validation, testing, and maintenance to ensure that system performs as intended and meets user requirements. • **Skills**: Stakeholder requirements analysis, system integration, validation and testing requirements development and management.
Network Engineer	• Design and maintain network architecture that reliably connects field devises with central management systems (long-term evolution [LTE], cellular-V2X, wireless, fiber). • Diagnose communications issues and ensure reliable operations for mission-critical systems, such as traffic signals and emergency response technologies. • **Skills**: Network architecture design, communication protocols, wireless communication technologies, routing/switching configuration, cloud networking.

Research

Research roles in ITS are broad and span from advancing capabilities for specific ITS devices (e.g., cheaper, more accurate sensors) to developing innovative ITS integrations that balance traffic congestion with safety. Research topics also extend well beyond science and engineering. For example, psychology and human behavior research are critical areas within ITS as human decision-making and behaviors ultimately govern how transportation systems and technologies are used and operated. Within the ITS field, the research track has two primary trajectories: 1) foundational research in academia or government laboratories and 2) research and development (R&D) for a technology company or original equipment manufacturer (OEM). The first pathway focuses on advancing foundational knowledge within very specific areas and communicating findings through publications and at conferences. This type of research tends to be more theoretical with mid- and longer-term implications. The second pathway focuses on applied research with the ultimate goal of deploying technologies in the near- to mid-term. Automated vehicle research is one example of industry R&D work that includes many different research opportunities (e.g., computer vision, sensor fusion, trajectory prediction, scenario planning).

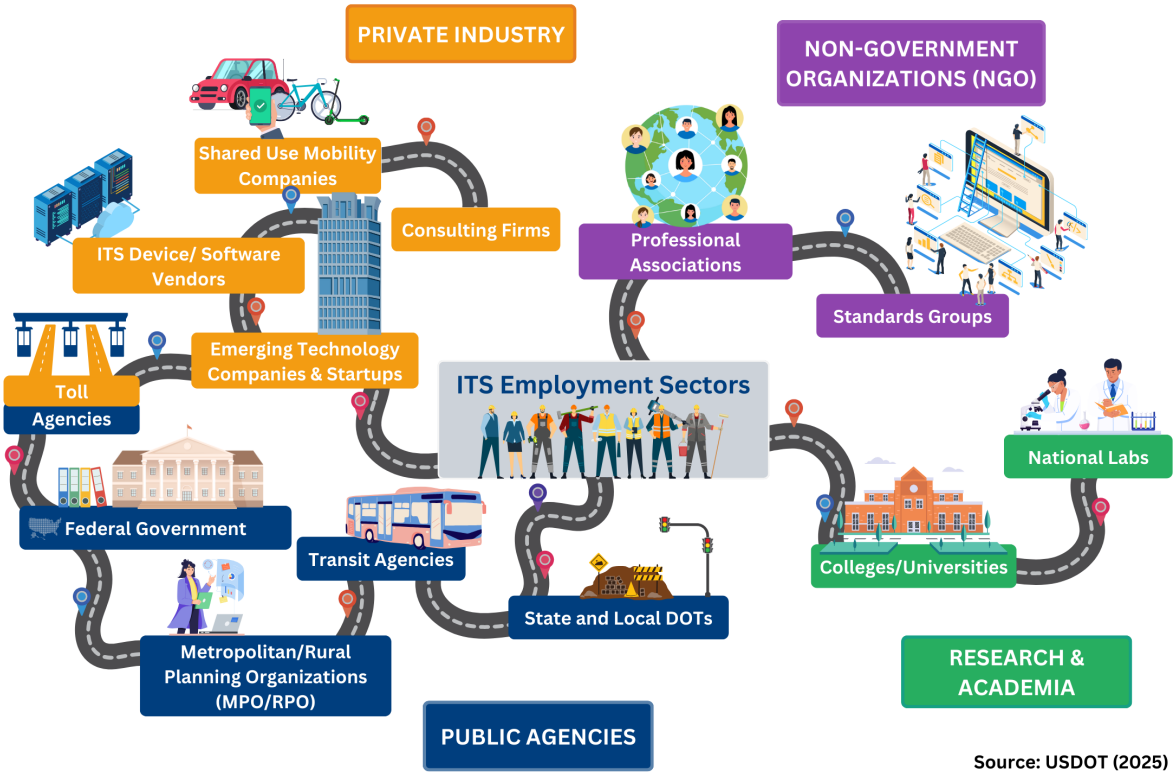
Research positions require workers at the forefront of their respective fields to help advance the latest ITS methods, approaches, and applications. Therefore, it is common for academic and research-focused national lab positions to require graduate school degrees for entry-level positions (e.g., Master of Science [MS], Doctor of Philosophy [PhD], or Doctor of Engineering [DEng]). Industry R&D teams have less rigid requirements but still seek significant expertise, which often requires a graduate school degree. Potential employers include national labs, colleges/universities, ITS technology developers, and non-government organizations. An ITS research career is well suited for those who enjoy investigating how technologies, systems, and human behaviors interact, and who want to shape the future of mobility through evidence-based insights. **Table 8** provides a few examples of research jobs, including some high-level responsibilities and examples of relevant skills.

Table 8. Example Jobs in Research

Example Job Titles	Example Responsibilities and Skills
Professor	• Identify research needs and gaps, develop novel research ideas, obtain funding, and execute research plans. • Communicate research findings to broad audiences (e.g., local transportation professionals, students, politicians). • Mentor students and other young researchers. • Participate in community outreach activities. • **Skills**: Experimental design, teaching and mentorship, technical writing, verbal communication, project management.
Lab Research Scientist	• Conduct research in areas that align with government goals and objectives. • Communicate research findings to broad audiences (e.g., local transportation professionals, students, politicians). • **Skills**: Experimental design, technical writing, verbal communication, project management.
Emerging Technologies Developer	• Design products and technical solutions based on findings from research, experimentation, and prototyping. • Collaborate with interdisciplinary teams to ensure that products address real-world needs and are technically feasible. • Collect and analyze data to evaluate performance and inform product modifications. • **Skills**: Experimental design, prototype/pilot study design, testing, validation, results analysis and communication.

Chapter 3. ITS Opportunities by Sector

ITS offers a variety of career opportunities across employment sectors due to its wide reach touching on policy, planning, research and development, operations and management, and standards development, among others. These opportunities generally fall into four main job sector categories: 1) private industry, 2) public agencies, 3) non-government organizations (NGOs), and 4) research & academia. Some examples of areas that can be pursued in each sector are shown in **Figure 3**. And while this chapter highlights the differences in ITS work across sectors, professionals often move between them over the course of their careers.



Source: USDOT, 2025

Figure 3. Example ITS Employment Opportunities by Sector

Public Agencies

Numerous opportunities exist for ITS professionals within public agencies at local, state, regional, and national levels. Local and state agencies are more focused on ITS deployment, operations, and maintenance. Regional agencies are more involved in longer-term, system-level planning including coordination of various ITS technologies and strategies across jurisdictions. National agencies focus on strategic planning, stakeholder collaboration, and policy development to support longer-term ITS goals. Examples of specific agencies and example ITS roles/responsibilities are listed below.

- **Transit Agencies** are responsible for providing and managing public transit services within their jurisdictions (e.g., city, county, region). Transit agencies typically operate several modes including buses, subways, trains, ferries, and/or paratransit to ensure safe, efficient, and affordable mobility options for residents and travelers. ITS professionals working at transit agencies are responsible for designing, implementing, and managing transit technology systems. Examples of transit technologies include:
    - AVL and APC systems monitor real-time transit vehicle locations and count boarding/departing riders at every stop, respectively. Real-time location information helps estimate arrival times. Ridership patterns across time and space help inform future planning and investment.
    - Traveler information systems provide information to travelers about routes, stops, timetables, multimodal integration/planning, and real-time arrivals and alerts to improve rider experience.
    - Digital fare collection systems are electronic systems and/or integrated apps that improve payment processes for travelers (smartphone payments, single payments for multiple modes) and operators (less time spent idling to collect cash).
    - Transit signal priority and intermittent bus lanes help reduce transit delays and improve travel time reliability by adjusting traffic signal timing to help them move through intersections more efficiently and dynamically reserving lanes for bus traffic only, respectively.
    - CAVs, V2X, and Mobility-as-a-Service will impact transit planning, operations, and management in different ways, requiring strategic integration strategies.
- **Toll Agencies/Authorities** are responsible for funding, operating, and maintaining toll facilities (roads, bridges, and tunnels). This includes toll collection, infrastructure planning, construction and maintenance, operations, governance, public outreach, and technology implementation. Responsibilities for ITS professionals within a tolling authority could include:
    - Design and deploy complex tolling systems. The tolling industry has largely transitioned to technology-driven solutions, which require upkeep, maintenance, and further innovation to keep operations/maintenance costs low. These systems require ITS specialists to deploy, integrate, analyze, and maintain various components/systems.
    - Develop software for toll transaction processing and enforcement. The structured and repetitive nature of toll collection and enforcement makes it well-suited for computer automation.
    - Implement new technologies to improve system performance. For example, small cameras coupled with advanced computer vision algorithms can be more cost-effective than installing physical tolling plazas/gantries.
- **Metropolitan Planning Organizations (MPOs)/Regional Planning Organizations (RPOs)** are responsible for coordinating regional transportation and land use planning. MPOs focus on urbanized areas with populations greater than 50,000 people, while RPOs focus on rural/less-populated areas. ITS professionals working for an MPO/RPO are responsible for aligning regional ITS strategies with longer-term planning goals and objectives. Example roles and responsibilities are as follows:
    - Coordinate ITS strategies across jurisdictions that include both the design and implementation of established ITS solutions and the integration of emerging technologies (e.g., V2X, CAVs).
    - Develop longer-term ITS strategies/plans in alignment with long-range transportation plans and Transportation System Management and Operations (TSMO) strategies.
    - Evaluate regional ITS systems and recommend improvements related to system integration, safety, efficiency, and cost-effectiveness.
    - Identify ITS funding opportunities and coordinate application development to support ITS deployments.
    - Leverage ITS data to support planning tasks.

- **State/Local DOTs** are responsible for planning, constructing, operating, and maintaining transportation systems and components (e.g., bridges, roads, transit, bike/pedestrian infrastructure, smart and connected infrastructure) within their jurisdictions. ITS professionals employed by state/local DOTs are responsible for implementing, operating, and maintaining various technology systems to ensure network safety and efficiency. Every state DOT is organized differently, but ITS opportunities usually reside in the following divisions: Engineering/Design (most common), Planning, Operations, Safety, and Technology/Innovations. Examples of technologies, infrastructure components, and roles most relevant to ITS at a state/local DOT are as follows:
    - Traffic signal systems include several ITS technologies, such as signal priority, adaptive signal timing, emergency vehicle preemption, pedestrian/bicycle signal systems, among others. Such systems can be adjusted/tuned in real-time to meet various system objectives.
    - Vehicle automation and connectivity are affecting transportation system operations and management. Strategic integration of such technologies is critical for safe and efficient deployment.
    - State/local DOTs are responsible for their own ITS deployments, which requires an experienced workforce to plan and install specific ITS components (e.g., sensors, cameras, detection systems, DMS) in the field. ITS design, implementation, and maintenance can also be contracted out; however, in-house ITS expertise is still needed to manage procurement of these services.
    - Operations and maintenance strategies are constantly evolving as new approaches are developed to collect, process, and analyze data from ITS in real-time.
- **Federal Government Agencies and Research Laboratories** are responsible for providing a national vision, coordinating with stakeholders to develop standardized and consistent development/deployment frameworks, supporting state/local agencies through funding opportunities and regulatory guidance, and conducting foundational research to guide current and future activities. Examples of groups working on ITS topics within the federal government are as follows:

On the Job with Travis Boone
Traffic Systems Engineer, Local DOT

"You know when there's a crash on your route to work and you're bracing for a 20-minute delay—but then it clears up in 10? That's the kind of stuff I help make happen. I was the first onsite consultant for my city's DOT, helping launch our traffic incident management program. Today, I spend my days overseeing our TSMO program. I make sure our ITS field devices are connected to our inventory system, I'm involved in our traffic signals and ITS program, and I lead a CAV integration initiative. Through my work, I incorporate emerging transportation strategies and applications such as adaptive traffic signal control, V2X connectivity, and intersection safety systems. I'm excited to see how these new technologies can make an impact! I know what I do improves my community's roadway safety and reduces delays—I can literally see the fruits of my labor during my work commute."

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    - United States Department of Transportation (USDOT) is the primary federal ITS agency, with various offices leveraging different forms of ITS for specific modal goals/objectives. For example, the National Highway Traffic Safety Administration (NHTSA) is responsible for setting and enforcing vehicle safety standards, which are important for in-vehicle technologies. The Federal Highway Administration (FHWA) works directly with state DOTs to improve highway safety and efficiency using ITS technologies. The Federal Motor Carrier Safety Administration (FMCSA) focuses on commercial trucking ITS use cases. Finally, the ITS Joint Program Office (JPO) spans the modal offices, and is the primary office for ITS research, development, and deployment within the broader USDOT. A full list of operating administrations within the USDOT can be found here: USDOT Operating Administrations.
    - Turner Fairbank Highway Research Center (TFHRC) is a USDOT research facility in McLean, Virginia that conducts research and development to advance existing and evaluate emerging

highway technologies. The three main research focus areas are: 1) infrastructure (materials, structures, testing/evaluation), 2) operations, and 3) safety.

- Volpe National Transportation Systems Center is a USDOT research center in Cambridge, Massachusetts that conducts multimodal research to advance technology and innovation for the public good. Specific areas of focus include safety, security, efficiency, mobility, global competitiveness, and innovation.
- United States Department of Energy (USDOE) focuses on energy issues such as energy efficiency, energy independence, nuclear infrastructure, and national energy security. The transportation group within the USDOE (Vehicle Technologies Office) has grown in recent years as the transportation sector has become the largest U.S. energy consumer (U.S. Energy Information Administration, 2023). The Vehicle Technologies Office funds and conducts research on innovative, energy-efficient, and affordable transportation solutions that include ITS technologies.
- Federal Communications Commission (FCC) is responsible for regulating communications (interstate/international) by radio, television, satellite, and cable while promoting public safety and ensuring competitive markets. Within these areas, the FCC is also responsible for regulating ITS communications and allocating spectrum for V2X communication technologies (FCC ITS).

Private Sector

The private sector provides broad ITS career opportunities that include ITS hardware and software development, emerging transportation technologies (CAVs, shared-use mobility), and ITS consulting services for design, implementation, and operations. Working in the private sector generally involves working directly with state-of-the-art technologies for near- to mid-term deployment (hardware and software). Examples of private sector employers are listed below.

- **Consulting Firms** help public agencies, private companies, and other relevant stakeholders design, implement, and evaluate ITS solutions based on their subject matter expertise. ITS specialists can work within larger internal transportation design groups as subject matter experts or interface with external stakeholders seeking to implement or evaluate specific ITS projects. Consulting firms provide broad exposure to various ITS projects, making them interesting opportunities for individuals seeking to work on different projects and gain valuable experience across ITS. Example ITS opportunities and roles within a consulting firm are as follows:


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Purpose in Practice: Anthony Lubbock
Software Developer, Consulting Firm

"I have always loved video games—Roblox was my favorite when I was a kid. I got really into it, programming mods, or modifications, to the game's behavior for my friends so that we could teleport or give ourselves glowing, animated fox tails. It was silly, but I enjoyed being known as the 'techy' one. My father was a physics major; he graduated before there were degrees in computer science or software engineering but worked in early computer programming. As I grew up, my interest shifted from video games to computers. While earning my bachelor's degree in computer science, I got an app development internship and learned I could make it a real career. Now, I create traveler information apps using public, real-time data on traffic, transit, work zones, and detours—which help reduce delays and improve travel time reliability. This career combines my interest in programming, visuals, and design with my desire to have a positive impact on the world."

  - ITS planning and policy include developing ITS strategic plans, ITS architectures, and/or technology integration strategies/regulations (e.g., automated vehicles, delivery drones, ride-hailing).

  - Technical design and technology integration include preparing Concept of Operations/System Requirements documents, design documents for individual ITS components (sensor networks, adaptive traffic signal control, DMS, etc.), software and data management platforms to collect, process, and analyze real-time ITS data.
  - Monitoring and evaluation to determine how well ITS solutions are performing relative to baselines. Tasks in this area focus on analyzing historical and real-time data to quantify important transportation objectives, such as safety, delays, and travel time reliability.
  - Stakeholder engagement and coordination with local stakeholders (first responders, MPO/RPO, transit agencies, etc.) related to ITS technologies/goals and regional/national stakeholders to ensure that ITS solutions cooperate and interoperate across jurisdictions.

- **ITS Device Vendors** design and manufacture specific ITS devices/components that support the greater ITS ecosystem. Examples of devices include sensors, traffic signal controllers, roadside units, and dynamic message signs. Example ITS roles within device companies are listed below.

  - Hardware designers create and test physical components of electronic ITS devices (circuit boards, microchips, processors, sensors).
  - Software developers write computer code that collects, interprets and transmits hardware information to relevant systems and stakeholders.
  - Product managers develop design criteria for various ITS devices based on market needs. These positions typically interface between clients and software teams.
  - Sales representatives bring the products to market. A strong understanding of the underlying technologies and applications is required to communicate the benefits of ITS devices to broad audiences.

- **ITS Software Vendors** write computer code to coordinate ITS components, collect/analyze data, enable new capabilities (e.g., electronic tolling and adaptive traffic signal controls), and model/simulate transportation systems. Example software applications include:

  - Traffic signal timing requires software to simulate and optimize signal timing based on goals/objectives, manage and implement timing plans in real-time though a centralized system, and/or deploy adaptive signal timing algorithms that adjust timing plans according to real-time conditions.
  - ITS devices require central management software where data is collected and visualized to support operational decisions. These systems also allow TMC operators to control and monitor ITS field devices such as DMS and CCTV cameras.
  - Transportation network modeling/simulation tools use software systems to model and simulate traffic scenarios based on mathematical/physical/psychological/statistical representations of various driving/travel behaviors. These same platforms are used to evaluate traffic impacts (delays, safety, throughput) resulting from different ITS solutions/technologies (e.g., CAVs, V2X).
  - Monitoring and performance evaluation requires sophisticated algorithms to collect and fuse data from multiple sources for real-time analysis and decision-making.
  - Fleet management software tracks and optimizes vehicle fleet movements by integrating network data and providing drivers with routing recommendations. Examples include ride-hailing algorithms that match drivers to passengers and recommend routes and delivery fleet software that optimizes delivery plans based on current and predicted conditions.
  - Automatic incident detection and response leverage distributed sensors and AI to quickly detect incidents and alert authorities. Advanced algorithms are needed to process information and detect incidents in real-time.

- **Emerging Technology Companies/Startups** develop new technologies to fill gaps and address shortcomings within the transportation network. In many cases, ITS plays a central role in enabling new technologies and service models. Examples of emerging transportation technologies include:
    - Ride-hailing services have grown rapidly in the last 10-15 years due to the convenience of door-to-door mobility. ITS roles within a ride-hailing company include data analysis, fleet optimization, and automated vehicle integration.
    - Automated vehicles are becoming a reality with new commercial ride-hailing and freight deployments in 2024 and plans to expand their footprint in 2025 and beyond (Waymo, 2025). Automated vehicles require complex sensor stacks, on-board processors, and sophisticated algorithms to make decisions in real-time. ITS roles include both software/hardware development, policy/government relations, operations, and technology integration.
    - Shared micromobility is a growing form of mobility that includes bike sharing (pedal, e-bike) and scooter sharing. Such forms of mobility require advanced technologies for tracking, interacting with/charging customers, implementing policies (e.g., sidewalk speed limits), and refueling. ITS jobs include software/hardware development, policy, operations, and multimodal integration.
    - On-demand mobility is broad term that includes all types of on-demand transportation services including ride-sharing, ride-hailing, car-sharing, and microtransit. On-demand mobility leverages smartphones and cellular networks to connect travelers (demand) and drivers/vehicles (supply) in real-time based on supply availability. Advancements in AI/ML have improved these technologies to be more efficient, reliable, and cost-effective. ITS roles include fleet management and software solutions that implement advanced AI/ML and optimization techniques to improve service quality and lower costs.

- **Research Organizations** conduct applied research, develop new technologies, and provide independent testing services. These organizations often partner with government agencies, industry, and academia to design, evaluate, and deploy emerging ITS solutions, ranging from connected and automated vehicles to traffic management systems. Job opportunities in these organizations include research scientists and engineers, program and project managers, data analysts and transportation systems modelers, and policy and/or technical advisors.

Non-Government Organizations (NGOs)

NGOs operate independently outside of the government, and are typically mission-driven institutions focused on addressing social, technological, political, and humanitarian issues. In the context of ITS, NGOs typically focus on promoting ITS policies (e.g., CAV safety, intelligent mobility), designing standards to ensure interoperability, and developing research agendas to address gaps/challenges associated with ITS and their deployment. The following section highlights a few types of relevant ITS NGOs. The types of roles within these organizations range from technical experts for standards development to advocacy/policy professionals tasked with educating stakeholders and policy makers to facilitate ITS technology development, deployment, and adoption. Volunteer-led consortiums and/or industry groups were not included because these groups employ very limited or no full-time staff.

- **ITS-Specific Associations** advance ITS initiatives by representing member interests, shaping policy, facilitating collaboration across organizations, and promoting best practices. Example roles within these organizations include technical project managers, outreach coordinators, strategic partnership directors, public policy specialists, and analysts. Many larger organizations also have ITS-focus areas; however, their mission/vision are much larger than ITS alone.
- **Transportation Associations** serve as hubs for advocacy, research, technical guidance, and professional development, playing a key role in promoting innovative solutions and technologies that

support safer, more efficient transportation systems. The following examples are grouped by their primary mission to highlight the broad roles these organizations play.

  - **Professional Associations** advance the transportation profession by providing a platform for knowledge sharing, professional development, and technical guidance. These organizations organize conferences and training programs, contribute to standards development, and foster collaboration across the transportation community to improve system performance. Example roles within these organizations include program managers, technical advisors, policy analysts, communications and outreach specialists, and government relations professionals.
  - **Research and Technical Groups** conduct research, develop innovative technologies, and provide evidence-based guidance to improve transportation system performance. They conduct studies, pilot projects, field tests, and simulations to evaluate emerging ITS technologies. Job opportunities within these organizations include research scientists, engineers, data analysts, traffic modelers, technical program managers, standards or technical advisors, and communications and outreach specialists.
  - **Issue-Driven Associations** focus on specific sectors (e.g., public transit), modes (e.g., freight), and challenges (e.g., V2X adoptability, roadway safety). They advocate for policies, regulations, and funding that address specific issues, raise awareness among stakeholders, and provide research, guidance, and best practices related to their specific focus area. Example roles within these organizations include policy analysts, government affairs specialists, research and technical staff, communications and outreach coordinators, and program and project managers.

- **Standards Development Organizations (SDOs)** develop and maintain technical specifications that ensure interoperability, safety, and consistency across technologies and platforms. These groups bring together public and private sector stakeholders to achieve consensus on data formats, communication protocols, hardware components and equipment, software components, and system architectures. Key roles within standards groups often include technical committee chairs, standards developers, program managers, policy and regulatory liaisons, stakeholder engagement specialists, and systems engineers.

Academic & Research

The following section highlights some research-focused career opportunities (e.g., government, foundations, nonprofits). Different from private industry R&D, publicly-funded research programs at universities and/or national labs tend to address more foundational research questions to inform technologies of the future. The following examples provide further details about career opportunities in academia or government research.


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Purpose in Practice: Alyssa Morgan
Project Manager, ITS Professional Association

"I did not stumble into project management—it's the culmination of years and years of getting to know individual elements of the transportation network and how ITS fits in. I come from a long line of engineers: Both of my parents were engineers, as were my grandfathers on both sides of the family. After getting my civil engineering degree, I quickly got a job in highway design and traffic management. It was here that I was introduced to ITS. Many jobs and years later, I am now the project manager for ITS projects, managing ITS implementations from design to deployment. I pride myself on being able to simultaneously look at the big picture and the details and then connect the dots. The growth of the ITS field excites me, and I feel like I'm continuing the work of many generations within my family."

- **Colleges/Universities** provide opportunities for those interested in foundational and/or emerging ITS research and want to have a high-level of control over their research agenda. Teaching-focused roles are also available to educate the next generation of ITS professionals. Additional details are provided for the two different academic career tracks.
    - Research: ITS research is broad and covers many disciplines including electrical/computer engineering, civil/transportation engineering, computer science, public policy, urban planning, psychology/human behavior, architecture, and more. In other words, ITS-specific research can be pursued from many different perspectives in the academic setting. In general, engineering disciplines focus on the technical details of the specific technologies and how they are integrated into the transportation system. Planning and behavioral topic areas focus more on their impacts on people and how society responds to these new technologies. A career in academic research also typically requires educational and outreach components. For example, at a research-focused university, a professor might be expected to spend 60% of their time on research, 30% on teaching, and 10% on outreach. The research and teaching allocations might be switched for university faculty more focused on undergraduate education. In general, this career path is best suited for individuals who are passionate about exploration and experimentation, who want to be experts in very specific fields/disciplines, who are passionate about shaping the future of ITS, and who enjoy mentoring and educating the next generation of ITS professionals.
    - Teaching: Teaching opportunities also exist at many institutions of higher education that do not require a research component. However, most of these positions will teach ITS more broadly and will be housed in civil/transportation engineering departments. For a teaching professional, most of their time will be spent developing course plans, teaching students, grading assignments, and hosting office hours. This career path is best suited for individuals who want to teach students about ITS subjects and are not as interested in pursuing a research agenda.

- **University Affiliated Research Centers** serve as hubs for interdisciplinary collaboration, bringing together experts in engineering, computer science, human factors, and public policy to develop, test, and evaluate new ITS technologies. These centers often conduct large-scale field experiments, simulations, and pilot deployments of emerging ITS solutions, including CAVs, traffic management systems, and smart infrastructure. In addition, they offer technical support to government agencies, participate in standards development, and prepare the next generation of transportation professionals. Example roles within these organizations include research scientists, engineers, data analysts, traffic modelers, technical program managers, technical advisors, and communications and outreach specialists.
- **Non-Profit Research Organizations** carry out applied research and development across a variety of ITS technologies. They bring together interdisciplinary teams to design, test, and evaluate emerging ITS solutions. Unlike university-affiliated research centers, their primary mission is centered on

On the Job with Andrea Newman
Research Scientist, National Lab

"Imagine sitting behind the wheel of a high-tech driving simulator, tracking real human reactions to flashing crosswalks, sudden obstacles, or autonomous vehicle behavior. As a research scientist, I help turn those reactions into data that create safer, smarter roads. It's where psychology meets engineering (referred to as human factors)—and it's what I do every day. A typical day for me is spent in the office developing and calibrating simulation environments to model real-world transportation challenges like distracted driving or pedestrian-vehicle conflicts. After collecting and analyzing human response data (like reaction time and eye movements), I translate my findings into recommended system improvements. A majority of my time is spent doing research and analysis, but I also author publications and collaborate with other professionals to discuss my findings and identify impactful future research topics. At the end of the day, I know my work leads to safer travel for pedestrians and bicyclists."

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research rather than education, and they operate as independent institutions. These organizations typically emphasize practical, solution-oriented research with a focus on technologies that can be deployed in the near to mid- term. Example roles within these organizations include research scientists, engineers, data analysts, traffic modelers, technical program managers, technical advisors, and communications and outreach specialists.

- **ITS Testing Facilities** serve as controlled environments where emerging ITS technologies can be safely developed, tested, verified, and validated prior to deployment on public roads and other infrastructure. These facilities provide realistic settings to evaluate higher-risk technologies, such as connected and automated vehicles. These facilities also support collaboration among government agencies, academic institutions, and private companies, helping to accelerate the transition of ITS research into practical, real-world applications. Example roles within these organizations include research and test engineers, systems integration engineers, field technicians, operations managers, safety officers, program managers, facilities managers, and communications and outreach specialists.

Chapter 4. Emerging Trends and Future Opportunities

Emerging technologies and service models are changing the way people and goods move throughout the transportation network. ITS plays a critical role in supporting these new technologies and service models through infrastructure and operations support. Therefore, the role of ITS and potential job opportunities within the ITS field continues to expand and change. The following section dives into four broad categories of emerging trends that will play significant roles in future transportation systems. Their possible impacts on shaping the future ITS workforce are also discussed. Each section concludes with examples of emerging ITS roles that could result from this trend. Many of the emerging roles highlighted at the end of each section are accessed through, at a minimum, a four-year college/university degree. However, many new technical school and certificate programs are also being developed to train the next generation of technicians, mechanics, and operators on emerging technology subjects. The subsequent sections were informed by the following sources: *Workforce Gaps & the Future of Intelligent Transportation Systems* (Intelligent Transportation Society of America, 2024), *Modernizing the Transportation Workforce: Enhancing Public Sector Skills for Automation and Electrification* (Government Technology, 2023), *Transportation Workforce of the Future* (Transportation Research News, 2019), and *Developing Trends Facing the Transportation Industry* (Institute of Transportation Engineers, 2024).

Artificial Intelligence (AI) and Machine Learning (ML)

AI is a technology area that enables computer systems to simulate human learning, reasoning, and decision-making. Machine learning is a subset of AI focused on using advanced algorithms to detect patterns in large data sets, allowing machines to learn and adapt. Advancements in computing power, mass data storage, and algorithms have led to an explosion in the use of AI/ML across nearly all economic sectors for a variety of applications, such as process automation and real-time decision-making (Rashid & Kausik, 2024). The growing complexity of modern transportation systems, along with the surge in data collected from distributed sensors and connected vehicles/infrastructure, present significant opportunities for AI/ML across planning, design, operations, monitoring, and maintenance functions (Institute of Transportation Engineers, 2024). Harnessing AI/ML with ITS data can help unlock significant benefits for transportation safety and efficiency.

As AI/ML system deployments become more widespread, the roles and responsibilities for some ITS positions will evolve to leverage the strengths of both humans and AI/ML. AI/ML systems excel in processing and analyzing large volumes of complex data to generate insights, automate processes, and support real-time decision-making. AI/ML systems are also highly effective at performing repetitive, cognitive tasks, such as document review, gathering feedback from stakeholders, and incident detection. Humans, on the other hand, excel at tasks that require intuition/reasoning, applying previous experiences to new situations, and engaging directly with broad stakeholder groups. These two skillsets are complementary and applicable to many ITS roles. Using TMC operators as an example, AI/ML systems can perform streamlined observation and incident detection while operators manually verify the information and coordinate a response. In this role, human responsibilities shift from continuous observation to overseeing, validating, and interpreting AI/ML systems. New data skills (collection, storage, management, validation, and interpretation) and a general understanding of AI/ML processes will benefit

positions that interact with AI/ML systems. AI/ML also provides new opportunities for workers with backgrounds in statistics, data science, data management, machine learning, optimization, and data visualization. Three example emerging roles within this area are highlighted in **Table 9**.

Table 9. Example Emerging ITS Roles in AI/ML

Emerging Roles	Description
AI/ML Research Engineer	Develop scalable machine learning pipelines that train, tune, and validate AI/ML models for specific applications. Example tasks could include developing/validating models for: • Incident prediction, detection, and response. • CAV perception, trajectory prediction, and controls. • Signal timing optimization and automation **Skills**: Statistical methods, model optimization, model development/training, feature engineering.
Smart Mobility AI/ML Research Scientist	Develop AI/ML systems that evaluate and optimize various aspects of emerging mobility operations (e.g., ride-hailing fleets, automated vehicles, micromobility). Specific tasks could include: • Demand prediction • Optimal strategies for bikeshare redistribution • Supply/demand equilibrium through pricing • Predictive maintenance **Skills**: Statistical methods, model optimization, data wrangling, transportation planning principles.
Computer Vision Engineer	Develop AI/ML models to detect and track objects (e.g., pedestrians, vehicles, cyclists, animals) from camera feeds. Such models can be used for intersection safety systems, vehicle/pedestrian counting, incident detection, CAV perception systems, warning systems, etc. **Skills**: Image processing, neural networks (methods/software).

Automation

Vehicle and infrastructure automation technologies and capabilities have grown in recent years due to advancements in AI/ML methods, computation, and data availability. As of 2025, commercial driverless fleets (ride-hailing, freight, and delivery) are deployed in various cities and states, which adds new complexities for established ITS jobs (e.g., operations, incident response) and provides new opportunities to those with expertise that can help advance automation technologies (e.g., computer vision, trajectory prediction). Infrastructure owner operators (IOO) are also leveraging various forms of automation to analyze system data and make decisions in real-time. Examples of automated infrastructure systems include adaptive traffic signal control, TMC automation (e.g., real-time incident detection, automated re-routing, and dynamic speed limits), and smart tolling and pricing (adjusts roadway pricing in real-time based on levels of congestion). These new technologies alter roles/responsibilities for current positions and create new opportunities for those with skill sets traditionally outside of ITS (e.g., AI/ML, computer vision, predictions, controls).

Specific roles in automated transportation fall into two general categories: 1) technology development and 2) system management, operations, and maintenance. The first category primarily covers roles at technology companies focused on developing automated vehicles or infrastructure technologies (e.g., real-time tolling, dynamic parking fees/enforcement). These types of roles demand specific technical skills to support technology development (software, sensors, hardware integration, etc.). The second category is focused on automating specific transportation operations and maintenance tasks. This includes aggregating data from infrastructure/vehicle sensors, determining the best course of action based on data analysis, and executing recommended actions to improve system performance, all in real-time. These types of roles require some background knowledge in traffic management and operations and experience implementing relevant real-time decision-making algorithms. It is important to note that significant overlap exists between Automation and AI/ML because automated systems rely on many AI/ML architectures to analyze complex data, perceive the surrounding environment, predict behaviors on nearby infrastructure users, and make decisions. Three example emerging roles within this area are highlighted in **Table 10**.

Table 10. Example Emerging ITS Roles in Automation

Emerging Roles	Description
Automated Vehicle Engineer	Design, develop, test, and validate automated vehicle technologies. Specific responsibilities could include: • Designing sensing/perception systems – develop/integrate sensor systems and implement computer vision models • Localization & mapping – high-definition map creation and updating, sensor fusion for improved localization • System integration – software/hardware integration • Testing – simulation and real-world testing, validation under various scenarios and edge cases. **Skills**: Software development, sensor fusion, control systems.
CAV Policy & Planning Specialist	Develop policy/regulatory frameworks and design integration plans that support safe and effective automated vehicle deployments. Specific focus areas could include: • Policy development – draft/advise on policy related to testing regulations, data privacy, safety standards, etc. • Research/Planning – analyze impacts of AV technologies based on their capabilities using modeling/simulation approaches to inform decision making. • Stakeholder engagement – facilitate engagement events to educate stakeholders and improve trust around automated vehicle technologies. **Skills**: Cost-benefit analysis (project/area specific), economic impact modeling (broader impacts to jobs, income, tax revenues, etc.), technology assessments, data analysis.
ITS Automation Engineer	Automate operational/management processes, such as traffic signal timing, ramp meters, variable speed limit controls, and variable message signs based on real-time information. **Skills**: Data analysis, AI/ML, software development, control systems.

Connectivity

V2X connectivity enables road users (e.g., cars, trucks, cyclists, pedestrians) to communicate with one another and with roadside infrastructure to enhance safety and efficiency. From a safety perspective, V2X enables 360-degree situational awareness, supporting proactive interventions such as collision alerts, pedestrian detection, and hazard warnings. This real-time data exchange also powers a wide range of ITS technologies and management strategies focused on network efficiency and reliability. For example, traffic signals can dynamically adjust their timing based on current traffic flow, while vehicles can engage in more efficient driving behaviors, such as platooning or coordinated lane changes. The real-time, network-wide exchange of information is a critical capability supporting many emerging transportation technologies (e.g., automated vehicles, predictive maintenance, dynamic routing), and is reshaping how transportation systems are designed, operated, and experienced.

V2X technologies are also reshaping existing and creating new roles within the ITS field. As vehicles and infrastructure become more interconnected, traditional roles such as traffic engineers, transportation planners, and maintenance personnel must now integrate digital tools, data analytics, and real-time communication protocols into their workflows. For example, traffic engineers might be responsible for managing adaptive signal control systems informed by V2X data, while modeling/simulation practitioners must now consider connected vehicle data and capabilities for realistic traffic studies. V2X technologies are also providing new opportunities in system integration, cybersecurity, and data management. V2X system architects, connected vehicle analysts, and cybersecurity specialists are now essential to ensure secure and efficient communications between system components. Additionally, roles in cloud/edge computing and AI/ML are becoming more important as V2X technologies generate vast amounts of data. In conclusion, V2X is driving a shift toward a more interdisciplinary ITS workforce—blending transportation expertise with skills in software engineering, data science, communications, and systems integration—to support the safe and efficient deployment of V2X solutions. Three example emerging roles within this area are highlighted in **Table 11**.

Table 11. Example Emerging ITS Roles in Connectivity

Emerging Roles	Description
Telecommunications Engineer	Design, deploy, and maintain communications infrastructure (wired, wireless) that enables real-time and secure data exchange between various ITS components (vehicles, infrastructure, non-motorized road users, cloud services). **Skills**: Network protocols, signal processing, system integration.
V2X Systems Engineer	Design, integrate, test, and manage complex communications systems between vehicles, infrastructure, pedestrians, and networks. Responsible for developing overall architecture that defines how each of the different components will interact. Focus areas include reliability, interoperability and compliance with relevant standards. **Skills**: Networking and communications, systems integration, lifecycle planning/analysis.
V2X Security Architect	Design secure communications protocols and hardware/software integrations for vehicle on-board units and roadside units. This role includes ensuring compliance with previously developed V2X standards. **Skills**: Network security, vulnerability assessment, penetration testing, digital forensics, risk assessment, security auditing.

Shared Use Mobility

New digital technologies—including GPS, smartphone mobile apps, real-time data analytics, cloud computing, and wireless communications—have led to the rise of new mobility services and business models such as ride-hailing, micromobility, and microtransit. Enabled by ubiquitous smartphones and real-time connectivity, these services have changed how people plan, access, and pay for travel. Their flexibility and convenience has driven substantial growth over the last decade (National Association of City Transportation Officials, 2023; Uber, 2025). While such services might not fall within the traditional definition of ITS, they play critical roles in modern, data-driven transportation systems. For example, emerging mobility services generate rich data that can be used to inform traffic management strategies, planning, and coordination with public transit. When integrated with ITS and other modes, they also support efficient and reliable multimodal travel. In conclusion, emerging mobility services are evolving into essential elements of ITS, and with strategic coordination, they can complement and enhance existing ITS and transportation networks as a whole to further optimize overall system performance.

These newer mobility services/models are also changing the transportation landscape by introducing new mobility providers with different operational goals and objectives. This changing landscape alters how transportation networks are designed, operated, and managed. For example, planners and engineers will have to consider private fleet behaviors in their ITS designs (e.g., curb management, micromobility safety systems). At the same time, it will be important to build partnerships and leverage the rich data collected by mobility providers to inform planning and design. From an operational perspective, multimodal integration is critical. This includes multimodal planning, schedule coordination, integrated payments, and real-time information, all of which require ITS. This added complexity requires a more holistic and coordinated approach that integrates new technologies and balances additional stakeholder perspectives. Using transit operations as an example, subsidized first/last mile ride-hailing services are now an option to connect transit riders to destinations, if services are coordinated and fares are integrated. Therefore, an understanding of how these new mobility services operate and can be integrated with existing systems is critical for mobility planning roles. Emerging mobility service models also provide new opportunities to individuals with varied backgrounds and areas of expertise. Private companies require roles across the ITS spectrum—planning, operations, government relations, business, among others—to develop and implement short- and long-term mobility business strategies. Public agencies also need experts to coordinate with these new mobility providers to ensure safe and efficient integration. Three example emerging roles within this area are highlighted in **Table 12**.

Table 12. Example Emerging ITS Roles in Shared Use Mobility

Emerging Roles	Description
Shared Mobility Operations Manager	Oversee day-to-day operations, logistics, and performance of the shared mobility fleet (e.g., bikeshare, ride-hailing, e-scooters) to ensure efficiency, reliability, and compliance. Specific responsibilities could include using fleet data to optimize performance, managing field staff, tracking key performance indicators (ridership, delays, customer satisfaction), and ensuring regulatory compliance (data reporting, local rules, safety standards). **Skills**: Multimodal integration, data analysis, data visualization.
Policy & Partnerships Manager	Build relationships with public agencies and advocate for favorable policies that influence positive outcomes for the company and users. Develop mutually beneficial partnerships and aligning business objectives with local transportation goals/needs is critical for gaining trust and scaling services. **Skills**: Stakeholder engagement, communication, data analysis.

Emerging Roles	Description
Smart Mobility Algorithm Designer	Develop algorithms to optimize fleet operations for on-demand service providers (e.g., ride-hailing, delivery, on-demand mobility) that could include: • Routing • Demand prediction • Pricing • Real-time delivery schedules • Determine optimal fleet mix **Skills**: Model optimization, operations research, AI/ML, programming.

Chapter 5. Conclusion

The ITS field offers a wide range of opportunities for individuals with different backgrounds, interests, and experiences, spanning both technical and non-technical areas. Technical roles, more focused on technology development, testing, implementation, and maintenance, include positions in engineering, software development, cybersecurity, operations, data science, and ITS research and development. Non-technical roles, which involve more direct interactions with people and travelers, include marketing, communications, policy, and planning. The rapid deployment of emerging transportation technologies are also attracting new types of workers to ITS, including technical experts advancing vehicle automation and connectivity, policymakers shaping regulatory frameworks, and engagement specialists communicating technology benefits and impacts to the public. This evolution is helping create a more exciting and dynamic ITS field, providing numerous opportunities for individuals passionate about enhancing safety, mobility, and daily travel experiences. This document highlights common educational pathways for building skills to succeed in these areas, while also emphasizing the value of transferable skills from other sectors, such as communication, strategic thinking, and stakeholder engagement, that can support successful transitions into ITS careers.

ITS also offers career opportunities across multiple employment sectors, reflecting the field's broad reach in policy, planning, operations, research, engineering, and technology development. In the public sector, professionals can work at local, state, regional, or federal agencies, focusing on ITS deployment, system-level planning, operations, maintenance, and policy development. The private sector provides roles in hardware and software development, emerging mobility technologies, consulting, and start-up innovation, often involving near- to mid-term technology deployment. NGOs, including transportation associations and standards groups, offer positions in policy advocacy, stakeholder engagement, and technology interoperability and standardization, which are all critical for safe and effective ITS deployment. Finally, academic and research careers in ITS encompass both foundational and applied work, ranging from university teaching to federally funded laboratory projects and technology R&D. Collectively, these opportunities illustrate the interdisciplinary nature of ITS and the multitude of pathways available for professionals with a wide range of skills, experiences, and interests. This document describes the broad opportunities available within each sector, emphasizing the differences between each sector to help guide prospective ITS workers.

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