IBI

TOPEKA METRO

Response to RFP TO-22-09

Electric Vehicle Fleet Study

Submitted to Topeka Metro
by IBI Group Architects, Engineers and Landscape Architects

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ORIGINAL

COVER SHEET

Proposer Information

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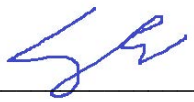
Signature 

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1 PROJECT UNDERSTANDING, APPROACH, AND METHODOLOGY

1.1 Project Understanding

IBI Group understands that Topeka Metro received a $1.7 million zero-emission and low-emission transit buses grant from the Federal government to procure three Proterra buses and related charging infrastructure that will enter service in 2023. We further understand Topeka Metro is considering transitioning to an entirely electric vehicle fleet and needs to assess the implications of this transition and how to leverage best practices to cost effectively transition.

Topeka Metro correctly observes that transition to an electric fleet is more than just a simple one for one replacement of diesel vehicles for electric vehicles, and likely will requires in addition to depot charging infrastructure some combination of additional infrastructure (on-route charging), changes in fleet size, and changes in operations policies. Full transition to a Battery Electric Vehicle (BEV) fleet will be a multifaceted undertaking for Topeka Metro, as the capabilities of BEVs on the market and the infrastructure to support their operation differ substantially from those of conventional fossil fuel powered vehicles. Existing transit operations and capital works were typically built for supporting fossil fuel propulsion technology at all levels; from day-to-day service planning to generational investments such as facility design.

We share an understanding with Topeka Metro that finding an optimal path forward through a rapidly evolving technology landscape requires studying the problem from multiple angles: vehicle and charger capabilities, local infrastructure context, financial impacts, and projected future demands on Topeka Metro to provide service to its ridership. Our project team is highly qualified to advise on BEV fleet transition at every level from facilities to supporting infrastructure to service operations. We bring breadth and depth of experience spanning every aspect of the transit industry and utility provisioning to help Topeka Metro make the optimal decisions.

Our team has decades of collective experience consulting on transit planning, facilities, technology systems and associated servicing across North America, including experience with the provisioning and outfitting of electrification and alternative fueling infrastructure. Our team guides projects from design through procurement to commissioning, operation, and retrofit. We bring intelligent, data-driven planning and comprehensive knowledge to help plan the considerable shift Topeka Metro envisions for sustainability and operations.

Throughout this assignment, our team will work closely with Topeka Metro to ensure that all analyses, recommendations, and plans are based on the needs and constraints specific to Topeka Metro. We will also work with external stakeholders such as the local utility to ensure that all plans developed in this assignment reflect the broader local and regional context. for instance, we are aware that the 2019 Topeka Metro Reimagined Study discussed relocating Topeka Metro's riverfront administrative and maintenance facility. Throughout this proposal we will refer to a generic bus garage and maintenance facility that can either be the existing riverfront location or a new site. Any potential for relocation will be discussed as part of the project kick-off and continuing through the project as more details are understood.

1.2 Methodology

1.2.1 Project Management

Kick-off and Project Plan

The project will commence with a virtual on-site kick-off meeting following the official Notice to Proceed (NTP). The meeting will allow IBI Group project team to meet with the Topeka Metro Project Manager and key stakeholders ("core project team") to confirm the project's objectives, priorities, work products, project management expectations, key schedule drivers, project risks, and work plan. IBI Group also will engage technical staff to develop a project timeline and draft a project plan to govern the project. This will include the following key elements:

- Project Plan with details on staffing, communication, deliverables, quality assurance framework, and risks.
- Project Schedule including a Work Breakdown Schedule for our project management work, progress reporting, and task/work tracking.

Project Communication

Regularly scheduled bi-weekly progress virtual meetings with live web-based desktop sharing (e.g. MS Teams) are effective. IBI Group will update Topeka Metro staff on progress, solicit any required inputs from Topeka Metro project team and staff, discuss and review draft deliverables, and discuss any deviations to the project schedule. Depending on the needs of any specific task, IBI Group can create either a meeting agenda or a project status report card for discussion at the bi-weekly meetings.

Cost Management

Control of project costs is the responsibility of our Project Manager. Costs are tracked by our Project Management Accounting System (BST10) and monthly Status Reports will be provided by our Project Manager for Topeka Metro review. Key to the success of this project will be managing the roles and responsibilities of each design team member and their interaction with each other, Topeka Metro, and other stakeholders. Mechanisms for budget tracking start with the allocation of staff and their charge rates to the project tasks during the proposal preparation. The efforts are monitored on a per-task basis and compared to the timesheet information for each team member. Our PM will compare the estimates with the actual charges and identify any deviations on a task-by-task basis identifying any potential issues. Remedial measures focus first on internal discussions analyzing scope and balance of work with project staffing the problem areas.

1.2.2 Task 1 – Existing Conditions Assessment

The Existing Conditions Assessment will consist of stakeholder interviews, document review, and preliminary analysis. The results of the existing conditions will be summarized into an Existing Conditions Report. The Existing Conditions Assessment will focus on six areas:

- Regulation, policy, and standards
- Facilities
- Electrical Services

- Fleet Inventory
- Topeka Metro Policies and Practices
- Industry Scan

Regulation, Policy, and Standards Assessment

IBI Group will review relevant Federal, State, and local rules, regulations, and policies related to electric vehicles that apply to Topeka Metro. These policies as well as relevant industry standards including Open Charge Point Protocol (OCPP), Society of Automotive Engineers (SAE), and Controller Area Network (CAN) will be summarized. The goal of this subtask is to identify critical standards, regulations, and policies that Topeka Metro should be aware of when proceeding with BEVs.

Topeka Metro Policies and Practices

IBI Group will conduct interviews with stakeholders approved by the Topeka Metro Project Manager. We will also review relevant Topeka Metro documents including collective agreements, pull-out sheets, and schedules. The objective of this subtask will be to understanding Topeka Metro operations and practices with a focus on:

- Honoring labor agreements with transit staff;
- Identifying any priority routes or services that have additional constraints;
- Identifying potential modifications to the complete transit planning process (routing, scheduling, and run creation practices);
- Identifying potential changes to yard management processes (fueling, parking, washing, and pull-out); and
- Maintaining and strengthening positive customer experience by minimizing any adverse impacts to reliability, travel times, and other factors that Topeka Metro wants considered.

This assessment will identify potential changes required both for a fully electric fleet as well as a mixed electric and diesel fleet, concentrating on the ¼ electric and ½ electric ratios noted by Topeka Metro. These observations will be revisited in subsequent tasks as refined scenarios are developed and the anticipated impacts on Topeka Metro practices can be more precisely defined.

Facility Assessment

IBI Group will review all available and relevant documentation provided by Topeka Metro regarding the Quincy Street Station (QSS) and riverfront administrative and maintenance facility. This will include all available site and building drawings and onsite servicing plans, to review the structural capability to accommodate mounting for potential charging equipment, and the utility and space resources currently available. This will also include the layout of maintenance and storage areas for Topeka Metro vehicles. Historical power usage and reliability trends will also be reviewed to establish the baseline power usage in the context of current capacity, in advance of recommending future upgrades. Depending on whether Topeka Metro has active plans to relocate the riverfront facility the team may instead conduct the review on the preliminary plans for a new administrative and maintenance facility.

Pending COVID-19 restrictions, IBI Group will visit Topeka Metro to observe operations in real-time and compare/clarify elements noted when reviewing site documentation. The documentation review and site visit activities will involve ongoing discussion with Topeka Metro personnel regarding site constraints and existing needs.

Electrical Service Assessment

In conjunction with the Facility Analysis, IBI Group will assess the power services, including current/historical conditions and future options to support electrification. For the current/historical component, the team will assess the capacity of the power grid connections to feed Topeka Metro's facilities, review historical power supply and reliability needs, and investigate any upgrades already in planning that may affect this project.

Fleet Assessment

Required fleet details include current fleet count broken down by vehicle size/capacity and a retirement timeframe. Understanding vehicle types will enable us to identify appropriate and equivalent BEV characteristics to use in modeling and facility planning work.

Industry Scan

The team will evaluate commercially available and soon-to-launch alternatives for vehicle and charging technologies, accounting for Topeka Metro's vehicle replacement timelines. We will identify vendors for BEVs, charging equipment, and other relevant deployment items (e.g. charging management software solutions), with consideration of how different available vehicle and charging technologies could support Topeka Metro's operational, maintenance, and facility needs. The following key attributes will factor into our scan:

- Physical space requirements;
- Workflow and usage characteristics for charging operations using alternative charging power levels, number of buses connected per charger, and dispenser types (e.g. plug-in chargers, drop-down pantographs);
- Charging system maintenance needs;
- Life cycle vehicle maintenance needs (e.g. battery replacement in mid-life overhauls);
- System standardization and supplier-agnostic compatibility;
- Smart power consumption and charging opportunities, including charge management software and data integration;
- System scalability/phasing to support a mixed fleet transitional period (in the context of the current fleet replacement timeline);
- Scalability to protect for future transit system growth; and
- Forward compatibility with future supplier market evolution.

The industry scan will also identify best practices identified through other deployments focusing on areas such as partnerships, contracts, operational changes, and phasing.

Task 1 Deliverables

Existing Conditions Report – We will package and deliver all findings from Task 1 to Topeka Metro in this report, including a period of review and feedback.

1.2.3 Task 2 – Route Modeling

Our standard modeling and schedule optimization methodology consists of 3 main steps:

1. **Baseline State Assessment** – projecting how BEVs would perform on current services
2. **Battery Energy Demand Redistribution** – adjusting trips among runs to better balance battery energy demand
3. **Mitigation Scenarios** – Assessing a mix of alternative mitigations for remaining incompatible runs (Note: this will be conducted during Task 4 – Scenario Evaluation)
    - Revising runs to break up residual long/demanding service
    - Opportunity on-route charger investigation
    - Other mitigation strategies

Modeling Inputs

We collect a variety of inputs to support modeling, ensuring that our work always applies directly to the local context. Each transit agency and urban region has its own characteristics that influence the ease of transition to BEVs, which our methodology accounts for.

Agency data: We typically obtain the following information from an agency:

- Full schedule data from before the COVID-19 pandemic (ideally Fall 2019 schedules)
- Ridership data (as detailed as possible by route and time of day)
- Annual fuel consumption (separate data for fixed-route and paratransit if available)
- Annual mileage (separate data for fixed-route and paratransit vehicles if available)

We will also leverage the existing fleet data gathered as part of the fleet assessment work in Task 1.

Using this data, we develop state-of-charge profiles at the individual run level, and aggregate energy requirements at the network level, using our purpose-built modeling tools. Our team has developed Python-based web applications in-house with various specialized modules for data import and cleaning, integrations with public data libraries, parametric analysis, and scenario simulation.

We typically import a dataset in the General Transit Feed Specification (GTFS) standard, which we observe Topeka Metro already maintains at https://www.topekametro.org/gtfs. If adjustments to the GTFS dataset are necessary to account for data quality needs, we use our in-house tools to efficiently implement these changes.

Trip profiles: The GTFS schedule dataset contains information including the trip structure of all runs, and horizontal distance travelled in revenue service. We then build in deadhead data to complete the picture of total distance

traveled, as well as pull-out and pull-in times from the bus maintenance facility. Once the horizontal trip patterns (the latitude-longitude traces that trips follow) are defined, we apply elevations to all points to generate full terrain profiles. Our tools perform this function automatically by cross-referencing the latitude-longitude coordinates in the GTFS shape file with open-access topographic datasets. We can also apply road features such as speed limits, traffic lights/stop signs, pedestrian crossings, and bus stops to the trip profiles if desired by Topeka Metro.

Vehicle and charger characteristics: Our tools support parameter definition for various vehicle properties including:

1. Battery storage capacity, charging rate, and discharge limits
- Battery degradation trends based on age and discharge cycles
- Bus dimensions and empty weigh
- Passenger loading
- Traction motor size and gear ratios
- Cabin heating method and auxiliary device ratings

We also support parameter definition for charger properties including power rating and parallel or sequential charging capacity. These configurable parameters allow us to simulate any BEV and charger model on the market with our tools, for efficient assessment of multiple alternative scenarios.

Weather data: Our tools incorporate weather data for the Topeka area to identify seasonal variations that may affect range, for example due to HVAC loading or changes in rolling resistance.

Modeling Step 1: Baseline State

Step 1 simulates how BEVs would perform if dispatched on all current services without on-route charging or other mitigation measures. Modeling the energy consumption of all current services based on the expected performance of applicable BEV models will enable us to understand the gap between expectations of bus performance built into current schedules and the capabilities of current BEVs on the North American market, which is the first step toward achieving full transition compatibility.

Modeling all services from the outset will enable us to classify services by their relative ease of transition, to support later development of the ¼ electric, ½ electric, and full electric scenarios noted by Topeka Metro. We will identify all runs that can be transitioned to BEV operation as-is, and all runs that will require mitigation strategies to be compatible. The exact nature of the mitigations is explored in the subsequent steps.

Modeling Step 2: Battery Energy Demand Redistribution

Step 2 involves revising Topeka Metro's runs to redistribute trips from long, all-day runs to short runs, to make optimal use of stored energy in bus batteries before considering fleet expansion or opportunity charging. This step is important because many agencies structure fixed-route runs into two categories: core, all-day runs (sometimes lasting 15-18 hours) and much shorter rush-hour tripper runs. This is an efficient approach to structuring diesel-based service, however it is not optimal for current BEV technology due to range constraints. We have found with other clients that rush hour trippers are consistently overrepresented in the portion of BEV-ready services – they are often the only runs in the entire schedule compatible with BEVs without mitigation. The short durations of these runs

also typically result in BEVs returning to the bus maintenance facility with high surplus stored energy that could be used to support other services.

This imbalance in residual stored energy represents an inefficiency at a system-wide scale that our methodology works to remove prior to considering infrastructure-based mitigations. Our approach identifies best-fit candidate matches of runs to facilitate trip redistribution. These matches tend to involve runs that coincide at similar locations and times, and for which redistributing trips would result in a net reduction in energy demand imbalances.

Taken together, the findings from Steps 1 and 2 of the modeling effort will provide an indication of the degree of BEV deployment achievable with Topeka Metro's existing schedules, without fleet expansion or on-route charging infrastructure. It will be seen how this portion of service compares to the ¼ electric, ½ electric, and full electric scenarios identified by Topeka Metro for investigation. (From our past electrification feasibility assessment experience, it is unlikely that all services will be found compatible at this initial stage.) We will consolidate these findings into a technical memorandum.

Task 2 Deliverables

Route Modeling Technical Memorandum – We will package and deliver all findings from Task 2 to Topeka Metro in this memorandum, including a period of review and feedback. The focus will be on identifying runs that are BEV-compatible without fleet or infrastructure expansion, and those that would require additional mitigation measures.

1.2.4 Task 3 – Alternative Mitigations

Gap Analysis and Alternatives Development

Using the findings of the Existing Conditions Assessment and route modeling, the team will study where Topeka Metro's current infrastructure and service may be challenged to support a BEV fleet in its current state, and the scope of upgrades necessary to address these gaps. Future state scenarios will be based on energy consumption projections and trends observed at other agencies that have begun transition to BEV fleets.

Areas of focus in the Gap Analysis will include:

- The space requirements for charging and vehicle servicing at existing facilities, during both a mixed fleet transition period and for a fully BEV future state; and
- The electrical capacity and reliability at Topeka Metro facilities and whether it will support the daily charging needs for a BEV fleet.

Once we develop an understanding of these gaps, IBI Group will propose potential alternative mitigation strategies and corresponding advantages and disadvantages. These alternatives will be tailored to Topeka Metro and may include:

- On-route charging
- Scheduling or operations changes (focusing on internal aspects such as the vehicle runs while minimizing public-facing changes)

- Increased fleet size
- Different vehicle battery capacities and charging systems
- On-site backup energy storage and generation

Working with Topeka Metro, IBI Group will develop initial BEV operational scenarios for vehicle maintenance, dispatching, and transit service delivery based on combinations of the alternative mitigation strategies, starting from current services as the baseline. The guiding principles will be to:

- Prioritize runs and routes for fleet transition based on operational feasibility and cost effectiveness;
- Identify opportunities to adjust the transit planning process (routing, scheduling, and run creation practices) that will optimize these factors for BEV technology;
- Maintain and strengthen positive customer experience by minimizing any adverse impacts to reliability, travel times, and other factors that Topeka Metro wants considered; and
- Honor labor agreements with transit staff.

These scenarios will consider the state of fleet electrification (three BEVs, ¼ runs electric, ½ runs electric, and all runs electric). A focus will be to develop scenarios that are phased to avoid stranded assets or multiple rounds of upgrades.

The identified gaps and proposed alternative mitigation strategies to investigate will be summarized in a Gap Analysis and Mitigation Alternatives technical memorandum provided to Topeka Metro for review and refinement through an Alternatives Workshop.

Alternatives Workshop

The focus of this subtask will be to provide a broader group of internal stakeholders approved by the Topeka Metro project team with an update on the work completed up until this point regarding the gap analysis and possible mitigation strategies, solicit refinements, and to identify priorities that will guide the rest of the work. To support a productive meeting that meets the expectations of the steering committee, IBI Group will work closely with our Topeka Metro project manager to develop presentation materials, discussion questions, and identify the best techniques to most productively interact with the group present.

Key to this workshop will be to comparatively weigh the benefits and drawbacks of the alternative mitigation strategies from a variety of stakeholder perspectives: planning, operations, vehicle maintenance, and facility maintenance. Depending on Topeka Metro's preference, we can use various techniques to gain these perspectives from the various stakeholders including a Strengths, Weaknesses, Opportunities, and Threats (SWOT) discussion or structured brainstorming. The key to these techniques is to provide the structure needed to maintain group focus and reach consensus while providing an open conversation to share ideas and perspectives.

These discussions will allow us to identify preferred alternatives and any additional constraints not identified during the work to date. After completing the workshop IBI Group will summarize the key discussion items into an update of the Gap Analysis and Mitigation Alternatives technical memorandum.

Task 3 Deliverables

Gap Analysis and Alternative Mitigations Technical Memorandum – We will identify gaps and alternative mitigations to enable conversion of services that were not found to be compatible in Task 2.

Alternatives Workshop – We will present the findings from all tasks so far for Topeka Metro stakeholders to discuss. We will develop presentation materials and provide meeting minutes. We will collect feedback to confirm scenarios to carry forward to Task 4, and to refine the Technical Memorandum.

1.2.5 Task 4 – Scenario Evaluation

This task will continue the modeling work with Step 3 – Mitigation Scenarios, to identify specific requirements such as infrastructure quantities, followed by a financial analysis. The objective of Task 4 is for Topeka Metro to select a preferred final-state transition scenario.

Modeling Step 3: Mitigation Scenarios

Step 3 targets the remaining runs that cannot be made compatible through shifting some trips to other runs alone. Possible reasons where redistribution of trips between runs will not be sufficient are if the run is simply too long for other runs to be able to assist enough, or because there are not enough scheduled runs nearby with surplus stored energy. In these cases, the two primary strategies are to split the run and introduce new vehicles (sometimes increasing total fleet size) or to introduce opportunity chargers at strategic locations (and assess associated layover requirements). Each of these alternatives has merit based on factors including (but not limited to):

- Charging rate of intended vehicles
- On fleet storage and maintenance capacity
- On-street layover duration, frequency, and location
- Transit network layout
- Existing power grid and connection opportunities along the transit network.

The eventual recommended solution may involve one of these strategies, or a mix depending on operational and cost considerations. There can be a tipping point in terms of cost, where an on-route charger or additional new vehicles become less expensive in the context of the overall rollout, and this can vary within the same transit agency's service area. As part of all assessments, we evaluate in-depot charging activities for feasibility and resulting energy demand, accounting for any offset that might be seen by on-route charging.

We use our modeling tools to assess each scenario developed as part of Task 3, managing large amounts of data, and attempting possible alternative combinations of infrastructure adjustments, to identify which approach is optimally cost-effective and accommodates future growth.

Run splitting: We examine opportunities to split runs into two or more parts compatible with BEV energy storage capacity and range limits, served by separate buses. New runs often require additional buses be dispatched in service, which can result in an increase in total required fleet size depending on how many spares are available to be

swapped out. Sometimes it is possible to split runs so that one BEV can take two runs in the same day – one in the morning and one in the afternoon/evening with a midday charging session. When this is feasible, it can help reduce fleet expansion requirements.

On-route charging: If on-route charging is part of the scenarios approved by Topeka Metro for further study, we would investigate preliminary candidate locations for opportunity chargers, starting from the perspective of transit operations. We can use our modeling tools to assist in developing long-list and short-list candidate locations. These sites would then be investigated as part of the Infrastructure Analysis subtask below.

We prioritize existing end-of-trip layover points for this assessment, to avoid inserting mid-trip layovers that would impact the passenger experience. Assisted by our tools, we identify transit network locations with high concentrations of terminating trips and end-of-trip layovers on runs that require support to be compatible with BEVs. Locations fitting these criteria tend to be most likely to see high charger utilization, for optimal return on investment. They are also likely to be the most stable nodes in the network over time. Opportunity chargers can involve significant capital expenditure, so it is important to avoid stranding assets in the future by focusing on sites with high likelihood for ongoing use.

In-depot charging: We model bus depot charging activities at all hours, to determine possible quantities and configurations of chargers that would enable the entire fleet to be charged overnight, as well as any midday charging that may be required. This will be conducted in conjunction with the run splitting and on-route charging elements so that all strategies cohesively support one another.

Bus depot modeling accounts for utility billing factors including minimizing the peak power requirement, flattening power demand spikes, and optimizing according to time-of-use pricing variability. We can simulate various end goals for charging fleets overnight. Whether Topeka Metro wishes to assign vehicles to specific runs the following day long in advance, or have all vehicles to charge to similar states-of-charge for maximum interchangeability at the time of pull-out, our tools can generate resulting plans for comparison.

Infrastructure Analysis

Our team will assess charging infrastructure alternatives in parallel with the modeling component. A coordinated effort between our facility and operations experts will develop optimized infrastructure installation locations, considering locations within the Operations Facility and on-route candidate sites.

Our team will review all available documentation provided by Topeka Metro regarding the current riverfront administrative and maintenance facility including relevant site and building drawings and site servicing plans. This will establish the capacity of the riverfront facility to accommodate potential charging equipment, and what alterations to parking and vehicle flow may result from BEV implementation. Given that the facility includes a mix of indoor and outdoor areas, the utility, space, and potentially structural aspects of the facility will require investigation. Historical power usage and reliability trends will also be reviewed to establish the baseline facility power usage, in advance of considering future upgrades.

Specific charging technologies will be investigated for their feasibility in the local context (e.g. space considerations at the maintenance facility), the relative operational constraints they impose, and the cost-benefit trade-off associated with mitigation options for these constraints. For example, time and charger availability are some of the most critical operational factors, since delivering a full charge at the moderate power level most compatible with sustained charging on current bus batteries (approximately 150 kW) takes significantly longer than diesel fueling.

Plug-in cables and overhead downward-deploying pantographs are emerging as the two most common charging methods in North American transit markets. Each option comes with relative benefits and drawbacks that our team will investigate:

- Pantograph chargerscan automatically connect once the bus is below and keep ground space clear, if they can be mounted on existing ceilings or outdoor gantries. However, they are more expensive than plug-in chargers and in indoor settings can impose significant structural loads on ceiling/roof elements.
- Plug-in chargers tend to be less expensive than pantographs; however, they consume more ground space at each parking space, and require manual plugging and unplugging.

As part of this work our team will consult with the local utility regarding capacity of the power grid serving the riverfront facility with special attention to resiliency and reliability considerations, and identify any upgrades already being planned that may affect this project.

Financial Analysis

We will develop a Financial Analysis for the future state including shortlisted mitigation scenarios. The Financial Analysis will contain comprehensive capital and operational cost components, as the extended service plan will impact both aspects. Key impacts to be costed will include the following, and depending on the identified deployment scope additional factors way also be considered:

- Capital:
    - Initial, all-inclusive initial purchasing cost of BEVs, factoring in potential changes to fleet size;
    - All-inclusive initial purchasing cost of charging equipment and supporting power infrastructure;
    - Facility modifications (including space conversion, and maintenance retooling);
    - Property impacts (e.g. siting transformers, potentially deploying on-route chargers and associated impacts to terminal/layover space requirements);
- Operational:
    - Driver staffing (temporary changes during transition and on a permanent basis) based on projected adjustments to service schedules developed during route modeling
    - Maintenance staffing based on BEV maintenance bets practices and potential changes to maintenance windows due to charging needs and modified pull-in/pull-out times;
    - Administrative and change management costs associated with transitioning to BEVs, such as technician training;
    - Vehicle performance monitoring during transition;
    - Service planning support (during transition and possible permanent changes);
    - Energy consumption to support all service, factoring in electricity billing formulas and possibly multiple charging sites with separate billing; and
    - Lifetime maintenance cost projections for vehicles and charging equipment, including on-going needs and mid-life renewal costs (e.g. battery replacement).

The BEV scenarios will be compared with the purchase of conventional vehicles and associated operating costs as a "base case." Time-of-use energy pricing and spikes in power demand will pose cost (and infrastructure capacity) risks, and this can be addressed through also deploying software for active management of charging. Our team will investigate opportunities to coordinate and flatten/redistribute charging activities (e.g., charging management systems, in-service state of charge monitoring, facility batteries, photovoltaic generation) and the associated net cost saving opportunities.

Recommended Scenario Workshop

We will present and discuss the findings of the scenario modelling and financial analysis in a collaborative workshop with Topeka Metro stakeholders. IBI Group will provide recommendations and identify tradeoffs related to cost, operational changes, and service changes. We will identify the preferred implementation approach, including the overall portion of the fleet to transition to BEVs and the supporting infrastructure approach. This will set the direction for Implementation Plan development in Task 5.

Similar to the Alternatives Workshop, IBI Group will work closely with our Topeka Metro project manager to develop workshop materials and identify the best techniques to use with the group involved. Following the workshop IBI Group will summarize the key discussion items and decisions into a Technical Memorandum.

Task 4 Deliverables

Scenario Evaluation Technical Report – We will package and deliver all findings from Task 4 to Topeka Metro in this report, including the modeling of mitigation scenarios, and the infrastructure and financial analyses addressing all scenarios.

Recommended Scenario Workshop – We will present the findings from Task 4 for Topeka Metro stakeholders to discuss. We will develop presentation materials and provide meeting minutes to support the workshop. We will collect feedback to confirm the preferred scenario to carry forward to Task 5, and to refine the Technical Memorandum.

1.2.6 Task 5 – Implementation Plan

BEV Implementation Plan

Our team, in consultation with Topeka Metro stakeholders, will develop a comprehensive BEV Implementation Plan addressing the elements discussed below. With the grant that Topeka Metro received to deploy a pilot fleet of three BEVs, the Implementation Plan will consider the requirements for these buses, and how Topeka Metro can position its efforts and investments to support future expansion up to possible full conversion.

Procurement Financing and Investment Timing – Determining when to invest in a range of capital projects and equipment purchases will require coordination to support ongoing transit service and take advantage of market developments and funding opportunities. Phasing and conversion planning, as determined in the previous tasks, will be important factors for timing capital investments that will unlock the capabilities of BEV service beginning from the first day of implementation, and avoid stranding existing assets during the transition to BEV operations.

For example, future BEV operating ranges are expected to improve as the technologies continue to mature, and as these range advancements will likely involve battery capacity increases correspondingly more charging would need to be delivered within the available charging intervals. Given the rapid advancement of BEV technology, it is in the best interest of Topeka Metro to time the purchase and deployment of new technologies for when they are needed. This will ensure that Topeka Metro benefits from the cutting edge of innovation, rather than purchasing technology too far in advance that could already be superseded by the time it enters use.

We will incorporate the intended Topeka Metro fleet replacement timeline to develop investment strategy alternatives (e.g. timing of specific purchases). We will investigate funding options and associated application requirements as part of this effort. We will also refresh our recommendations on funding source opportunities from the Task 4 Financial Analysis as needed.

Our team understands the complete technology ecosystem of a BEV network, and the directions that the industry is moving based on technology innovation and market demand. Our practical experience in transit operations and in facility development/retrofitting will be leveraged to develop a strategy that takes full advantage of these advancements, ensuring that Topeka Metro receives the best value for money from all investments.

Facility Retrofit – Staging and mixed fleet support will be key to a BEV fleet transition, given the fundamental differences in space utilization and maintenance workflow that may result. Our team recognizes the 24/7 nature of vehicle operations and maintenance. A future solution will need to be in place to enable the intended timelines for fleet replacement and future growth, and so as not to disrupt operations during implementation.

We will help Topeka Metro find appropriate and cost-effective measures for facility conversion that avoid or minimize disruption to operations while maintaining desired bus maintenance and storage capacity. Our recommendations will include an optimized timeline for various fleet and infrastructure upgrades, to ensure that new assets are utilized efficiently and achieve best value for money.

We have experience developing staging plans and completing projects that require staging in active operational bus garages while continuing to support facility operations during the transition period, such as through our recent project supporting the deployment of depot charging infrastructure with GoRaleigh. We will apply our experience in the context of Topeka Metro facilities to ensure that our recommendations are feasible and take optimal advantage of existing resources.

Apart from project implementation timelines within the riverfront administrative and maintenance facility Topeka Metro may also need to contend with project costs and timelines for electric grid improvements at other sites, as managed by the local utility. We will provide support to review relevant elements of the conversion and phasing plans with the local utility to confirm implementation timelines for necessary grid connection improvements.

Service Planning and Operations – In concert with the strategic recommendations on facility and fleet conversion, we will work with Topeka Metro stakeholders to plan for transit operational changes. Using the projected Topeka Metro fleet replacement timeline, and our findings from all tasks, we will develop phased recommendations for public-facing route changes that prioritize positive customer experience, effective introduction of BEVs, and cost-effective implementation. Based on the schedule for BEV acquisition, we will identify the optimal services (whether whole routes or individual runs) that may be provided by these new vehicles at each stage of the plan.

For example, we typically suggest beginning the transition to BEVs on services that are lower-demand, making use of these vehicles with little to no change to operations. This initial roll-out of BEVs will allow staff to gain familiarity

with the new buses and collect performance data prior to testing their range capabilities on more demanding services, and prior to relying on BEVs to provide core service .

People Change Management (PCM) – Training and certifying staff to maintain and operate a new BEV fleet and the supporting infrastructure will be essential for a successful transition. Our team has experience developing and guiding PCM programs as part of transitioning transit fleets, technology systems, and governance models (e.g. implementing public-private partnerships), with specific areas of experience including business process analysis and re-engineering, and operational readiness planning. As part of developing the Implementation Plan, the team will work with Topeka Metro stakeholders to identify and plan for:

- Roles and responsibilities in the future state;
- Required certifications and collective bargaining impacts;
- Hiring and training timelines; and
- Employee communications.

These transition elements will be informed by the recommended technology solution, physical construction and equipment procurement timelines, and phasing strategy. These transitions will also focus on the impact of a mixed diesel and electric fleet.

Final Report and Presentation

The Final Report developed for Topeka Metro will compile information from Tasks 1 to 4 in one document. It will outline the existing conditions as identified in Task 1 and Task 2 as well as the alternatives and scenarios identified as part of Task 3 and Task 4, including refinements developed through subsequent tasks. It will also contain the full BEV Implementation Plan. Together, this information will present a robust rationale for selecting the preferred BEV implementation option through stated assumptions, modeling methodologies and results, and resulting design and rollout recommendations.

A complete draft version of the Final Report will be provided to Topeka Metro, followed by a period of review and feedback. Comments and adjustments will be made as needed before the final version of the Final Report is issued. A presentation will be developed based on the content prepared for the Final Report.

Task 5 Deliverables

BEV Implementation Plan – We will develop and deliver the BEV Implementation Plan for Topeka Metro to review and provide feedback prior to incorporation into the Final Report.

Final Report and Presentation – We will incorporate all feedback from Topeka Metro and merge all project documentation into the Final Report and Presentation.

2 TEAM QUALIFICATIONS AND EXPERIENCE

IBI Defining the cities of tomorrow

60+ GLOBAL OFFICES
3,000 Difference-makers and counting

OUR MISSION

Defining the Cities of Tomorrow

We define how cities look, how cities feel, and how cities work.

OUR VISION

We are the global partner to plan, design, build, and sustain the cities of tomorrow.

We are holistically minded, design inspired, and technology-driven.

OUR VALUES

Integrity We do what is right.

Partnerships We work together.

Excellence We pursue design excellence.

Innovation We embrace ingenuity.

Community We build community.

LEGAL

IBI Group Architects, Engineers and Landscape Architects
Legal business name

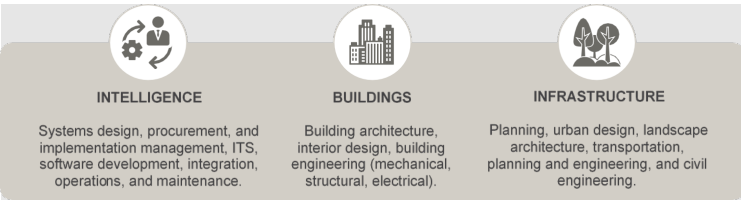
Corporation
Firm organization

1974
Year organized

2.1 Brief Overview of IBI Group

IBI Group is a leading international professional services firm with an emphasis on technology and systems, architecture, planning, and engineering. From transit planning to using advanced technology to improve transit operations, high-rises to industrial buildings, schools to state-of the-art hospitals, transit stations to highways, airports to toll systems, bike lanes to parks, we design every aspect of an integrated city for people to live, work, and play. We understand not just the technologies, but how to apply them in a way that provides visible, tangible benefits for the public, decision makers, and stakeholders.

Our expertise is organized under three core disciplines.



The integration of these disciplines allows IBI Group to provide comprehensive professional services for creating sustainable social and economic environments, while project management services ensure quality control and cost efficiency in project implementation.

Our collaborative and combined approach focuses not only on creating the best solutions today, but also creating the right solutions for tomorrow. We believe cities must be designed with intelligent systems, sustainable buildings, efficient infrastructure, and a human touch. At IBI Group, we're defining the cities of tomorrow.

2.2 Why IBI Group?

IBI Group's global consulting practice is multi-disciplinary and includes professionals in the disciplines of architecture, structural, mechanical, and electrical engineering, civil engineering, land use planners, transit operations planners, and transit technology specialists. We have a strong track record with public and stakeholder consultation, resolving issues and respectfully negotiating best outcomes to expedite planning approval and other processes.

Mobility Electrification Practice

Our Mobility Electrification Team brings experience in transit fleet electrification spanning North America, from the perspectives of transit planning, fleet, facilities, and transit technology. Each of these respective disciplines has over 20 years of experience delivering successful projects. Transit electrification has been part of our work for over five years as it has grown in commercial viability and public interest.

Our electrification experience spans a range of agency sizes and complexities, from small urban fleets of 10-30 vehicles to fleets of 250+.Our recent and ongoing transit electrification projects in North America include GoRaleigh, Spokane Transit Authority, Chattanooga Area Regional Transportation Authority, Grand River Transit, Hamilton Street Railway, Sarnia Transit, Belleville Transit, and Brantford Transit. A more detailed description of recent experience is provided in our project references.

Transit Operations and Maintenance Facilities – In over 20 years of delivering successful facilities projects, we have developed an in-depth understanding of transit and maintenance facility layouts, operations, activities, schedules, character, and needs. We draw on many lessons learned based on engagement and feedback from a variety of municipal clients. Our knowledge and expertise in this area allows our team the ability to quickly assess ideas and customize operations and maintenance facilities to the needs of our clients. We understand the needs of people who work and operate out of the facility. This encompasses the physical environment (building that houses the operations and surrounding area), as well as the equipment and tools that make maintenance activities (including charging/fueling) easier and cost-effective.

Transit Planning – Detailed BEV range analysis leverages all the expertise that goes into day-to-day service planning and scheduling, but also the ability to step back, see the big picture, and recognize new patterns of opportunity in the local geography of transit operators. IBI Group has been at the forefront of transportation and transit network planning in North America since its founding in 1974. We boast an integrated international team across the US and Canada, with the needed range of technical specialists and one of the largest dedicated transportation planning practices. IBI Group's experience in transit network planning and transit service planning includes network design, modal evaluation, alternative network evaluation, technical assessments of network and route level performance, and preparing inputs to the local or regional business case processes.

Transit Technology – IBI Group's Transit Technology team has been advising agencies on effectively applying diverse types of commercially available technology for over 30 years. Our end-to-end project management and consulting approach to the effective use of technologies enables us to provide valuable services. These include but are not limited to strategic planning, alternatives assessment, business cases, system design, procurement, implementation, and business process re-engineering. These are applied throughout a project's lifecycle to ensure the delivery of high-quality products that address an agency's needs and vision. We can offer these services cost effectively because of our current extensive experience providing similar services to many agencies in the US and

Canada, all of which benefit from our broad understanding of the vendor data/technologies and of transit operations.

Key Differentiators

Experienced Project Management – Our Project Manager, Mackenzie de Carle, is qualified to meet the needs of Topeka Metro and available throughout the duration of the project. Mackenzie brings his experience with more than 20 transit agencies and has served as project manager on multiple complicated planning and technology projects. Mackenzie will draw upon his previous experience to deliver a quality project on time and on budget. He will keep the Topeka Metro team engaged and will conduct focused, agenda-driven meetings with relevant stakeholders to obtain understanding, identify the path going forward, confirm submittal requirements, and obtain prompt sign-off. Mackenzie recognizes the immense value in engaging the Topeka Metro and its internal stakeholders by obtaining their buy-in, and timely comments and approvals. In addition to formal milestone reviews, he will provide ongoing opportunities for review and comments.

Joining Mackenzie on the project management team are Santosh Mishra as Project Director, and Doug Parker, Randy Knapick, and Ola Ferm as Subject Matter Experts. They bring decades of experience in transit planning, operations, technology, and facilities. Our project management team will share our prior experience with transit electrification projects and learn about the unique practices of Topeka Metro. We will work with relevant user groups to focus on the transition and design to ensure our recommendations meet your needs.

Integrated Multi-Disciplinary Team – IBI Group is a full-service firm, able to draw on deep internal staff resources to fulfill each aspect of this project. Our team includes professionals from civil and transportation engineering, through to architecture and electrical engineering. Our proposed team has collaborated frequently and successfully on multi-disciplinary transit fleet electrification projects and will continue its strong track record with this assignment. This proposed team has been working in these capacities on the current transit fleet electrification projects discussed above. We involve senior staff experienced in transit operations, maintenance, and storage facility projects from project start through completion. Our Project Manager and proposed discipline leaders will be responsible for daily progress on the study components, providing continuity throughout and the capacity to respond to issues as they arise.

Approach Rooted in Collaboration – We partner with Client stakeholders to establish mutual trust and are always open to suggestions. As designers, we will bring our transit planning, operations, technology, and facility knowledge and expertise to the project. At the same time, we recognize that Topeka Metro is leading this transition, so we must internalize your needs and develop our deliverables to reflect that. Our approach ensures that stakeholders are involved in shaping the study's important strategic directions.

Enthusiasm and Creativity – Along with our thorough understanding of the technologies and challenges, IBI Group professionals bring enthusiasm and creativity to everything we do every day. We solve complex design problems in creative ways, while at the same time monitoring Client issues, schedule, and cost.

Technology Enabled Decision-Making – IBI Group's origins and identity lie at the intersection of the built environment with technology enabled spatial intelligence. We engage a multi-disciplinary approach that leverages technology to engender better design solutions – be that in terms of creativity, efficiency, or effectiveness – and underlies our processes. As a full-service firm, IBI Group provides a full suite of services enabled by technology.

Internal tools are available to support further added value for subsequent design projects for Topeka Metro that implement the transition, including our proprietary InForm and botIBI platforms. These tools streamline consultant collaboration, project communications and approval processes, and garner stakeholder feedback more effectively. InForm analyzes space use and can provide suggestions in space and master planning.

Peer Reviewers – IBI Group will continuously review quality issues with the project team. In addition, design documents will be reviewed on an ongoing basis and prior to milestone submissions by peer reviewers. These are senior professionals with a wealth of expertise in the field. Quality review meetings with Topeka Metro at the milestone dates will also emphasize achieving quality through better understanding of the project and creating opportunities to flag any issues. Any quality deviations from the established project criteria will be documented and corrective action will be taken as required.

2.3 Corporate Qualifications and Experience

GoRaleigh Transit Electric Charging Infrastructure

GoRaleigh, Raleigh, NC

GoRaleigh retained IBI Group to support development of a battery electric bus (BEB) pilot, to be operated with on-property charging at the Poole Road transit facility. Support includes assessing the opportunities for BEBs to be incorporated into existing transit service, provisioning, placement, and procurement support for charging infrastructure to service the BEBs, and associated procurement of operations management software to coordinate charging.

The project includes elements of facility needs assessment and fleet transition. The facility is an existing site previously designed by IBI Group, which GoRaleigh is now retrofitting to enable electrification. Modifications include space requirements assessment for charging infrastructure and space programming considerations. Fleet transition elements include assessing vehicle capabilities, maintenance needs, charging activity planning, and service dispatching. The charging infrastructure provisioning for the facility was developed based on a combined result of the facility constraints, vehicle technology assessment, and review of GoRaleigh services and charging activity demands.

Hamilton Transit Maintenance and Storage Facility

City of Hamilton, ON

IBI Group was first retained by the City of Hamilton to provide complete architectural and engineering design and future construction contract administration services for a new Maintenance and Storage Facility (MSF) for buses operated by Hamilton Street Railway (HSR). The facility is sited on a 25-acre brownfield site amalgamated from several individual lots. The building is designed to be approximately 430,000ft2 including maintenance and indoor storage for a fleet of approximately 300 standard and articulated buses. The total value of the MSF design and construction project is approximately CA$190,000,000.

Stemming from the larger MSF development effort, IBI Group's Scope of Work was expanded to include a study of opportunities related to fleet propulsion technology transition. HSR currently operates a fleet of 51% Compressed

Natural Gas (CNG) buses and 49% diesel, with the remaining diesel fleet planned for retirement. Propulsion technology options in the study included:

- 100% CNG conversion of the diesel fleet;
- 100% Battery Electric Bus (BEB) conversion of the diesel fleet; or
- A mix of CNG and BEB conversion (exact mix determined through the study).

Under a full BEB transition scenario, a mix of MSF and on-route charging would be considered. Under a mixed CNG/BEB transition scenario, only MSF based charging would be considered. The study contained two phases: a transition alternatives evaluation, and facility implementation planning.

Phase 1 started with a technology alternatives review examining the state-of-industry of both technology options, and an energy requirements analysis of all service blocks planned to run from the new MSF. A charging infrastructure assessment then examined the charging infrastructure required under both conversion options that included BEBs. A greenhouse gas emissions impact projection and life cycle cost of ownership were developed for all propulsion technology options, and a recommended transition strategy was provided to the City, along with a proposed approached to fleet procurement. The mixed CNG/BEB transition option was recommended.

Phase 2, currently underway, involves developing adjustments to the MSF design to accommodate BEB chargers and dispensers from Opening Day, including site servicing, structural support for equipment, and equipment placement.

Electric Bus Needs Assessment

City of Brantford, ON

The City of Brantford has retained IBI Group to conduct a feasibility study to assess and recommend an approach to transition the city's conventional and specialized transit fleet to fully electric buses. The project includes several tasks:

- **Facility Assessment:** Conducting a current state assessment of Brantford's Transit Service Centre and a technology alternatives investigation to establish the technical conditions shaping the options moving forward, and conducting a gap analysis to produce a recommended upgrade plan.
- **Electrical Service Assessment:** Understanding the existing facility power supply capacity and the needed upgrades to the local distribution system.
- **Route Modeling:** Analyzing Brantford Transit's routes for suitability for electric bus implementation and identifying any service delivery constraints, including a review of Brantford Lift (specialized transit) scheduling and service.
- **Comparative Analysis and Alternative Scenario Development:** Conducting a technology scan and development of conceptual battery-electric bus operational scenarios and charging plans to optimally support requirements for vehicle maintenance, dispatching, and transit service delivery.
- **Recommended Implementation Plan and Cost:** Includes a recommended approach, schedule and timeline, as well as a high-level operations plan, GHG emissions impacts, risks, and mitigation strategies

Sarnia Transit Zero Emission Bus Fleet Transition Place

City of Sarnia, ON

The City of Sarnia, Ontario retained IBI Group to conduct a feasibility study for a full conversion to electric vehicles for the Sarnia Transit fleet (approximately 30 vehicles in total), including conventional fixed route buses, specialized transit vehicles, and support vehicles. Aspects of the study consider whether to pursue Battery Electric Buses (BEBs) or Fuel Cell Electric Buses (FCEBs) based on:

- Operating cost analysis;
- Logistics of converting the existing transit maintenance facility and surrounding infrastructure; and
- Implications of vehicle capabilities for transit service design.

The project examined high-level operating cost projections for each technology alternative based on the current fleet size and service plan, with respect to aggregate energy consumption for propulsion and auxiliary needs such as heating and air conditioning. To develop integrated transit service and infrastructure recommendations, the team reviewed all scheduled transit services and the current maintenance facility. Two parallel gap analyses targeted facility equipment and supporting infrastructure, and the compatibility of either a BEB or FCEB fleet to complete all current scheduled services. Proposed operational scenarios were developed with schedule modifications and midday charging/refueling sessions. Facility layout alternatives were developed to accommodate storage and charging/refueling for all vehicles. Finally, IBI Group developed a Transition Plan that merged fleet, infrastructure, staff, and operations into one vision for the transition. For the project duration, IBI Group has worked closely with Sarnia Transit stakeholders to ensure all analyses, recommendations, and plans are based on the needs and constraints specific to Sarnia and reflect the broader local and regional context.

Northfield Garage Electrification Pilot Assessment

Region of Waterloo, ON

IBI Group was retained by the Region of Waterloo to complete the new GRT Northfield Operations and Maintenance Facility, as GRT continues to expand services to increase the use of public transit within the Region. The new facility is approximately 350,000 sq. ft. and accommodates both regular (41ft) and articulated (62ft) vehicles. IBI Group services have included the facility design and were extended to support its construction phase.

Throughout the process, there has been an effort to enable this facility to support a transition to a Battery Electric Bus (BEB) fleet. The Region's expectations for the likelihood and timing for such a transition has evolved since the start of the design process. This has been a combined effort involving IBI Group transit planning, operations, and technology staff with facility design architects and engineers. BEB provisions included in the original design anticipated a potential need to support fleet electrification, even though the Region had not yet defined such an initiative. Just as construction began, the Region began planning a BEB pilot program to be deployed out of this facility. IBI Group conducted an electrification study, including investigating potential provisions to incorporate into

the design during the construction phase to support a future large-scale transition to BEB service. A review was carried out to:

- Understand the operational impact for bringing BEBs into service;
- Understand infrastructure requirements to support full electrification;
- Identify anticipated BEB fleet operational implications;
- Outline the scalable electrification infrastructure phasing strategy; and
- Establish budgetary expectations for future work.

Based on the findings from this initial assessment, IBI Group construction phase services were extended to include: More specific analysis on which runs could be supported by BEB technology anticipated for the pilot. This forms the basis for identifying overall power requirements and how many BEBs can be most effectively supported by each charger. Identify locations for the chargers and lane-side charging infrastructure, including incorporating provisions into the design as the construction proceeds.

Belleville Transit Fleet Transition Plan

Siemens Canada and Belleville Transit

Siemens Canada and Belleville Transit were planning a full transition to a battery electric bus (BEB) fleet (approximately 15 vehicles in total) and retained IBI Group to advise on BEB fleet transition. IBI Group assessed and recommended an approach to a full fleet electrification transition. There were two phases to this work:

1. Power Requirements Analysis: This phase assessed which blocks in the existing schedule were expected to be operable without on route charging, and determined the share of blocks that would remain feasible for operation considering available charging time between service days.
2. Block Study: This phase involved re-blocking Belleville Transit's existing services to take advantage of charging opportunities and evaluate how many vehicles would be required under four alternative weather and utilization scenarios.

2.4 References

CITY OF RALEIGH GORALEIGH TRANSIT ELECTRIC CHARGING INFRASTRUCTURE
Gil Johnson
Gil.Johnson@raleighnc.gov
919-744-9363
P.O. Box 590, Raleigh, NC 27602

CITY OF SARNIA SARNIA TRANSIT ZERO EMISSION BUS FLEET TRANSITION PLAN
Andrew Epp
andrew.epp@sarnia.ca
519-332-0330 Ext. 3200
255 Christina Street North, Sarnia, ON N7T 7N2

CITY OF HAMILTON HAMILTON FLEET ELECTRIFICATION STUDY
Shaba Shringi
Shaba.shringi@hamilton.ca
905-546-2424 ext. 3142
28 James Street N, 5th Floor, Hamilton, Ontario L8R 2K1

SIEMENS CANADA AND BELLEVILLE TRANSIT BELLEVILLE TRANSIT FLEET TRANSITION PLAN
Ray Little
ray.little@siemens.com
705-323-4155
1577 North Service Rd E, Oakville, ON L6H 0H6

2.5 Team Qualifications and Experience

Our project team is composed of dedicated professionals with experience in each of the specialties required for this assignment. Key to our team is a dedicated point of contact, Mackenzie de Carle, and technical leads for each of the primary subject areas. The proposed team organization is shown in Figure 1.

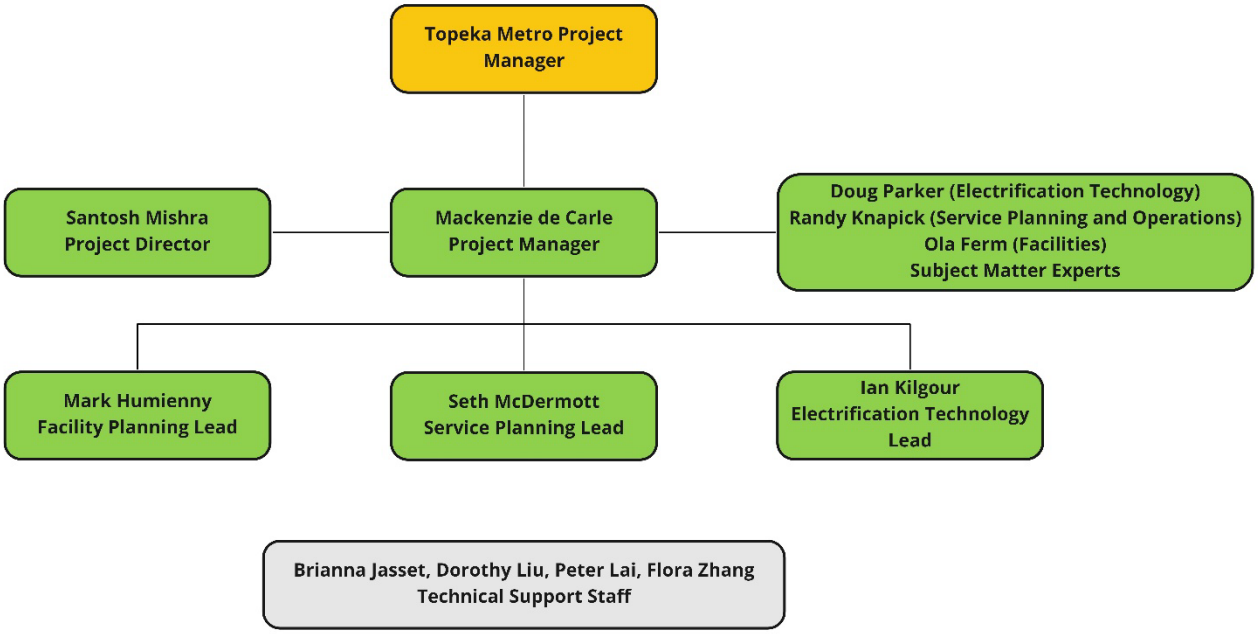


Figure 1. Project Team

SANTOSH MISHRA, PROJECT DIRECTOR

Santosh is a Practice Lead with IBI group with 18 years of experience. Santosh specializes in transit technology consulting for all transit modes and, to date, he has assisted 50+ multimodal agencies, including federal, state, and local DOTs. His work encompasses planning, procurement, and implementation of a full range of transit technologies that address the specific needs of all business functions of a transit agency.

MACKENZIE DE CARLE, PROJECT MANAGER

Mackenzie is a Transit Technology Specialist with extensive experience developing transit technology strategies, concepts of operations, specifications, white papers, needs assessments, implementation support, transit planning, and analytics. He brings his experience with transit planning, transit technology strategy, and systems engineering to problems including customer information, fleet electrification, and transit data standards.

DOUG PARKER, ELECTRIFICATION TECHNOLOGY EXPERT

Doug is highly experienced with over 33 years working in Transit Technology and Mobility Electrification. Doug has led the majority of IBI Group's Mobility Electrification projects and leads this cross-disciplinary global practice within IBI Group. He recently led the mobility electrification aspects of the projects for Raleigh, Sarnia, Hamilton, Region of Waterloo, and Belleville.

RANDY KNAPNICK, SERVICE PLANNING AND OPERATIONS EXPERT

Randy helps transit agencies address the opportunities and challenges of our evolving mobility environment through technology, infrastructure, and operational strategies. Randy brings a perspective that spans IBI Group's three core disciplines—Infrastructure, Buildings, and Intelligence—to develop integrated approaches to Bus Rapid Transit. Randy has a proven ability to work with multiple disciplines on complex and inter-related technical, policy, and design issues to maximize agency and customer benefits.

OLA FIRM, FACILITIES EXPERT

Ola has superior concept design skills with a diverse background in project types with a specialty in vehicular/transit operations and maintenance facilities. Ola brings together big picture thinking with broad technical experience with sustainable design and managing an interdisciplinary team. He brings analytical, organizational, and leadership skills with demonstrated experience in achieving aggressive goals.

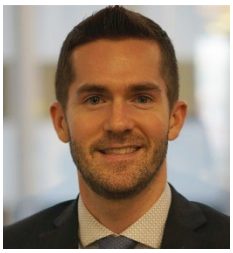
MARK HUMIENNY, FACILITY PLANNING LEAD

Mark is an experienced architect skilled in master planning, programming and building design. He has designed and managed a diverse range of project types, including fleet maintenance and operations facilities, electric vehicle infrastructure, CNG and LP fueling stations. Mark is a LEED-Accredited professional with experience in achieving LEED-certified projects where sustainable design is key project goal. He has served as an adjunct faculty member at North Carolina State University's College of Design, where he taught analysis of environment and context as a design determinant.

SETH MCDERMOTT, SERVICE PLANNING LEAD

Seth is a Transit Technology and Electrification Specialist in transportation engineering with over 6 years of experience, with a focus on leveraging Intelligent Transportation Systems (ITS) solutions and BEV operations to enhance urban mobility. He has extensive consulting experience for agencies across North America on multidisciplinary electrification feasibility studies, ITS deployments, operational readiness planning, and business process re-engineering.

IAN KILGOUR, ELECTRIFICATION TECHNOLOGY LEAD



Ian is an Electrical Engineer and ITS Specialist bringing significant experience in fleet electrification, industrial networking, telecommunications systems, and advanced traffic management systems. He has 16 years of experience working on numerous projects within these multiple sectors across North America. He has been responsible for both field installation, facility relocation and integration activities, as well as design and pre-design tasks including needs assessments, cost-benefit analyses, and concepts of operation.

FLORA ZHANG, TECHNICAL SUPPORT STAFF

Flora is a Transit Technology Analyst passionate about using technology to develop sustainable solutions in the public transit sector. Flora has three years of experience in working with transit technology, including reviewing operations, vehicle replacement plans, and emissions reductions potential as part for battery electric bus transition feasibility assessments. Flora has also supported numerous deployment projects for transit technology systems including CAD/AVL, scheduling, and dispatch systems.

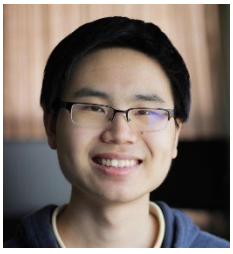
BRIANNA JASSET, TECHNICAL SUPPORT STAFF

Brianna is a Transit Technology Analyst with professional experience with transit technology strategy and requirements related to transit management systems, fare collection, and fleet electrification. In addition, she has experience collecting and analyzing data on emerging transit technologies.

DOROTHY LIU, TECHNICAL SUPPORT STAFF

Dorothy is a Transit Technology Analyst with a keen interest in transit planning and operations. She is passionate about expanding public transportation's role in climate change mitigation, both through fleet electrification and through assisting transit agencies in designing and acquiring better technologies to improve services.

PETER LAI, TECHNICAL SUPPORT STAFF



Peter is a Transit Technology Analyst Intern with an interdisciplinary background in technology and transportation. He has contributed to transit fleet electrification studies for agencies across North America, developing software for route energy modeling, charging simulations, and scheduling optimization.

Appendix A

Resumes

Santosh Mishra

Associate Director | Practice Lead-Mobility Technologies

Santosh is a Practice Lead with IBI group with 18 years of experience. Santosh specializes in transit technology consulting for all transit modes and, to date, he has assisted 50+ multimodal agencies, including federal, state and local DOTs. Santosh's work encompasses planning, procurement and implementation of a full range of transit technologies that address the specific needs of all business functions of a transit agency. Also, Santosh is currently involved in various fleet electrification projects.

Apart from transit technology deployments, Santosh has significant expertise in large transportation data (transit and non-transit) acquisition, management and utilization. Santosh also has significant experience in transportation technology research and evaluation and has led several tasks related to recent USDOT research and demonstration projects and was recently appointed to the panel of the Transit-IDEA (TCRP J04) program.

Education

M.S., Civil Engineering, University of Illinois, Chicago, 2005

B.E. (Hons.) Civil Engineering, Birla Institute of Technology and Science, Pilani, India, 2001

Experience

2016–Present
IBI Group, Boston, MA, Associate Director

2005–2015
TranSystems, Boston, MA, Senior Transportation Planner/Analyst

2004 (Summer)
Chicago Transit Authority, Chicago, IL, Research Intern-Bus Ops and Data Services

2001–2003
Citigroup, Mumbai, India, Software/Database Development Team Lead

2000 (Fall)

RITES Ltd. (A Division of Indian Railways), New Delhi, India, Design Intern

Memberships

Panel Member, TCRP- J04 (IDEA Program)

APTA Information Technology Committee

APTA Emerging and Innovative Technologies Subcommittee

APTA Research and Technology Committee

ITS America/APTA Public Transportation Systems and Services Committee

Representative Experience

TCRP J04/Transit IDEA (T-96) –Multi-stage Planning for Electrifying Transit Bus Systems with Multi-format Charging Facilities (2020-Present)- Santosh is serving as the panelist on the Expert Review Panel advising the team developing a mathematical model for selecting optimized strategies for phased roll-out of BEBs at HART and PSTA

Tulsa Transit ITS Strategic Plan, Tulsa, OK (2018-2019)- Santosh managed development of an ITS strategic plan for Tulsa Transit which involved conducting needs assessment, gaps analysis, development of organizational and technical recommendations and a phased implementation plan.

DC Circulator Technology Assistance and Program Management Support, Washington, DC (2019-Present): Santosh is leading IBI Group's effort in providing continued support to DC Circulator on 1) planning and deployment of next generation technologies; and 2) oversight of operations and maintenance of deployed technologies and recommending improvements. As part of this effort, Santosh is also managing the development of an Electric Vehicle and Diesel Vehicle performance comparison tool.

Earlier, Santosh managed multiple tasks for DC Circulator: 1) ITS design for new vehicle procurements, including 14 Proterra vehicles; and 2) development of a technology strategy; 3) deployment of CAD/AVL technologies; 4) rollout of public W-Fi; and 5) deployment of BusETA.

Go Raleigh Fleet Electrification Support: Santosh is advising the team helping Go Raleigh with charging system deployment and electric vehicle procurement as part of the overall facilities program.

Transit Management Technologies (TMT) Consulting, Worcester Regional Transit Authority (WRTA), Worcester, MA (2009-2014)–Santosh assisted the WRTA in planning, design, procurement and implementation of fixed-route and paratransit technologies as part of a multi-year TMT program. Further, Santosh assisted WRTA in post-deployment assessment of TMT technologies and recommended staffing and technical improvements.

As part of this project Santosh also oversaw deployment of 7 Proterra vehicles, which were among the first few BEB deployments in the US.

WMATA Bus Readiness Assessment, Washington DC (2019): Santosh managed a comprehensive assessment of all technologies deployed on WMATA vehicles, central environment, at garages and at offsite locations. The purpose of this assessment is to understand how current technologies are being utilized and if those are meeting agency needs, particularly in the context of ongoing Bus Transformation Project (BTP).

Stride/405 BRT Project Delivery/Systems Engineering, Seattle, WA (2020-Present): Santosh is currently leading transit technology efforts related to conceptual phase of design and construction of a new Stride BRT service scheduled to be launched in 2025. At least 50% of the BRT fleet will be electric and the project involves identifying systems element relevant to BEBs.

Fairfax ITS Consulting, Fairfax County Department of Transportation, Fairfax Connector, Fairfax County, VA (2011-present) – Fairfax Connector is deploying a range of transit technologies under a multi-year program. As project manager, Santosh advised the Connector with the development of specifications and procurement for CAD/AVL, APC and real-time information systems, and is currently managing the technology deployment at the Connector.

SolTrans AVL/APC Assessment, Vallejo, CA (2020-Present). Santosh is managing the team conducting an assessment of existing AVL/APC system deployment at SolTrans to recommend a plan for improvements to the system for better performance and data quality. This includes evaluation of data from 2 BYD electric vehicles.

LexTran ITS Consulting (2019-Present): Santosh was a technical advisor to the team conducting an assessment of existing fixed –route technologies and supporting systems, including radios, to develop recommendations for improvements. Currently, he is advising the team with implementation of recommendations.

HART ITS Consulting, Tampa, FL (2018-Present): Santosh is leading an ITS Strategic Plan development and transit technology replacement project for HART. This involves conducting a comprehensive review of all business functions and developing a five year master plan. Also, this project involved supporting the design, procurement and deployment of a new CAD/AVL and related systems.

Westchester Systems Integration Consulting, White Plains, NY (2017-Present): Santosh is currently managing a multi-year study that involves evaluating existing communications and CAD/AVL systems, development of recommendations and assisting with procurement and implementation of recommended technologies.

ITS Consulting, Ann Arbor Area Regional Transit Authority, Ann Arbor, MI (2013-Present)- Santosh has been leading the planning, procurement and deployment tasks related to a CAD/AVL and real-time information system implementation at AAATA. This new system is replacing a 15 year old CAD/AL system. The CAD/AVL system will use a voice-over IP-based closed-mic voice communication system.

Big Blue Bus ITS Strategic Plan, Santa Monica CA (2018-Present): Santosh was a technical advisor to the team that conducted an assessment of current fixed-route and demand response technologies and developed a comprehensive technology strategy for Big Blue Bus. Currently, Santosh is advising with implementation of some of the recommendations.

SRTA Transit Management Technology-Southeastern Regional Transit Authority, New Bedford, MA (2014- Present)-Santosh led the development of a technology strategy for SRTA to assist its planning, operations and other business units with deployment of new technologies. Further, Santosh developed functional specifications for three technology bundles, which include: maintenance management system, fuel management system and transit management technologies and assisted with procurement. Currently, Santosh is managing the implementation of technologies.

Mackenzie de Carle
Transit Technology Specialist

Mackenzie is a Transit Technology Specialist with experience in public transit and traffic operations as well as Intelligent Transportation System (ITS) solutions. Mackenzie has worked with more than 20 transit agencies where his experience includes the development of transit technology strategy, ConOps, specifications, white papers, needs assessments, implementation support, transit planning, and analytics. Mackenzie's work takes a systems engineering approach with a focus on developing a deep understanding of the client's needs and supporting design and implementation of technologies based on those needs. Mackenzie brings his experience with the assessment of electric vehicle monitoring and charging technology and procurement. Mackenzie has applied this knowledge to developing business cases and supporting technology procurements for electric vehicle equipment. Mackenzie also has deep experience with transit technology planning and roadmaps as well as procurement, deployment and operations for a variety of transit technologies. As part of this work Mackenzie has identified users needs, led prioritization workshops, and helped assess the tradeoffs between alternatives including capital and operating cost, agency funding, useful life of existing components, interdependence of different technologies, and the state of the industry.

Representative Experience

Sound Transit I-405 Stride BRT Phase 3 Bus System Requirements, Seattle, WA (2020-ongoing) – IBI Group is subcontracted to WSP to assist with the development the bus operations and systems requirement for a new bus rapid transit corridor. Mackenzie is leading the development of the farebox and battery electric bus charging system requirements and is supporting the development of the core ITS and bus surveillance system requirements. These RFP packages will provide Sound Transit with an integrated set of on-board vehicle and central system technology. As part of this work Mackenzie has developed the system architecture diagrams and requirements describing how bus electrification technology is connected with other Sound Transit systems including scheduling, operations management, field equipment, asset management, and reporting.

District Department of Transportation (DDOT) ITS Assistance (2018-ongoing) – IBI Group has been tasked with assisting DDOT with the implementation of their new CAD/AVL system, as well as a real-time passenger information system. A sub-task of this assignment focuses automating data extraction and developing a data storage system of vehicle data for both electric and diesel buses. Mackenzie conducted an industry scan to determine the best technology products for data collection. As part of this he conducted a benefit-cost analysis of a smart charging product that had the potential to reduce utility costs for the bus fleet by 30% to 40%.

Rockford Mass Transit District (RMTD) ITS Implementation Assistance Services, Rockford, IL (2021-ongoing) – IBI Group is supporting RMTD with project management and technical advising

Education

Bachelor of Applied Science in Civil Engineering (Honors), University of Toronto, Toronto, ON, 2018

Experience

2018–Present
IBI Group, Boston, MA, Transit Technology Specialist

2016–2017
IBI Group, Toronto, ON, Transportation Analyst

2015 (Summer)
Dillon Consulting Ltd, Toronto, ON, Engineering Intern

2014 (Summer)
WSP (Previously MMM Group), Toronto, ON, Construction Inspector

Awards and Publications

1st Place Undergraduate Student Presentation, 2017 Institute of Transportation Engineers (ITE) for Southwest Ontario

during the deployment of a suite of ITS technologies including CAD/AVL, scheduling, real-time passenger information, and Voice-over-IP (VoIP). Mackenzie serves as the project manager for this project.

Lextran Technology Consulting Services, Lexington, KY (2019-ongoing) – IBI Group has been tasked with supporting Lextran review their existing technology systems and create a technology roadmap. This includes evaluating alternatives to Lextran's radio system which is no longer supported, real-time passenger information, and CAD/AVL system. Mackenzie serves as the deputy project manager. In this role he has led the on-site interviews and stakeholder workshops and has documented the existing conditions and available alternatives for eight key technology areas.

Lextran Accelerating Innovative Mobility (AIM) FTA Initiative, Lexington, KY (2020-ongoing) – The goal of the project is to use advanced technologies to improve the mobility options available to university students and staff to ensure their safe and reliable trips across the campus using a mix of scheduled and on-demand public transit services and related modes. IBI Group led the writing of the grant that awarded Lextran over $400,000 in FTA funding. Mackenzie led the writing of the grant and is now leading the project management and ConOps work.

Transportation Research Board TCRP G-18: Improving Access and Management of Transit ITS Data, Washington D.C. (2020-Present) – IBI Group has teamed with EBP and Foursquare ITP to develop standards for ITS data focused on automatic vehicle location (AVL), automatic passenger counters (APC), and automatic fare collection (AFC). The first phase focuses on conducting a literature review, industry interviews, and workshops to develop an understanding of existing state of ITS data standards. In the second phase the team will develop ITS data standards. Mackenzie has supported with the literature, led interviews, and participated in workshops. Mackenzie is now serving as the Deputy Principal Investigator as the team develops the data standard.

Southeastern Regional Transportation Authority (SRTA) Transit Technology Consulting, New Bedford, MA (2018-ongoing) – IBI Group has been tasked with supporting SRTA in procuring and deploying a series of transit ITS projects: CAD/AVL, maintenance management, and fuel management. Mackenzie is the Project Manager leading the testing and implementation support for the fixed-route and paratransit vehicles as well as the customer information systems.

Bay Area Transportation Authority (BATA), Transit Technology Review, Traverse City, MI (2020-ongoing) – IBI Group was tasked with conducting a review of BATA's technology systems and developing a strategic roadmap for future strategic technology improvements within six months. Mackenzie supported the development and review of the existing conditions assessment and industry scan and served as the task lead for the options analysis and implementation strategy. In this role Mackenzie led workshop to align stakeholders around a set of core needs and understand the tradeoff with different technology alternatives.

Hillsborough Area Regional Transit Authority (HART) CAD/AVL, and ITS Study, Tampa, FL (2018-ongoing) – IBI Group has been selected by the HART to provide consulting services for the planning and deployment of next generation ITS technologies. HART is a multi-modal service provider including fixed-route, paratransit, light rail, and flex route services. Mackenzie helped produce the needs assessment, alternatives analysis, and the functional requirements for the CAD/AVL system. As part of the needs assessment and alternatives analysis, IBI Group was responsible for reviewing all HART's on-board equipment including farebox, camera system, headsigns, and APC system for all HART modes.

Ann Arbor Area Transportation Authority (AAATA), CAD/AVL Replacement, Ann Arbor, MI (2019-ongoing) – AAATA is currently underway on an effort to modernize their fixed route and paratransit service, including an upgrade to their CAD/AVL system and customer-facing technologies. This includes the upgrading of their Voice-over-IP (VoIP) communication system and acquiring a disruption management system. Mackenzie helped with the development of requirements and testing for these systems.

Douglas J Parker, P. Eng.
Director, Sr Practice Lead, Transit Technology

Mr. Parker is a transportation systems engineer and planner, specializing in assisting public transit agencies with applying advanced technology. He help leads the transit technology, data and electrification consulting practice.

His 33 years of experience spans all public transit modes, including rail, fixed route bus, bus rapid transit, demand responsive transit, microtransit, micromobility, rural transit, and ferries. It also spans the full range of transit technologies, including those in support of planning, operations management, customer information, revenue management, security, business intelligence, vehicle automation, and alternate propulsion.

This has involved extensive practical work with transit agencies in program development, funding, design, procurement, implementation assistance, operations/maintenance and adapting agency organization/procedures to get the best value. It has also involved supporting deployment of the offerings from most major transit technology vendors. Mr. Parker has been involved with numerous planning, research and evaluation efforts including regional deployment program development, architectures, evaluations, and several Transit Cooperative Research Program projects.

Education

M.A.Sc., Transportation Engineering, University of Waterloo, 1989
B.A.Sc., Civil Engineering (Management Science minor), University of Waterloo, 1988

Experience

1989–1999, 2009–Present - IBI Group
1999–2009 - Transystems

Memberships and Industry Involvement

Professional Engineer, Ontario
Canadian Urban Transit Research and Innovation Consortium (CUTRIC)
- Member Designate

Center for Transportation and the Environment
Canadian Urban Transit Association (CUTA)
- Technical Services Committee (Vice-Chair)

Ontario Public Transit Association (OPTA)
- Confernece Planning Committee

American Public Transportation Association (APTA)
ITS Canada
- APTS Committee
- CEAS Committee

Toronto Railway Club

Recent Experience

Sound Transit, Seattle Region, WA (2021-Present) **- STRIDE BRT Charging Management System –** These BRTs and associated support infrastructure are beng developed from the outset to support a Battery Electric Bus fleet, and this is to include a comprehensive energy/charging management system. Mr. Parker is leading the effort to develop specifications for procuring this system and its integration with other systems.

Brantford Transit, Brantford, ON (2021-Present) **– Transit Fleet Electrification Transition and Implementation Plan** – This project is assessing alternatives to conduct a multi-year battery bus transition across the entire fleet including the use of both depot and enroute charging, service blocking changes, and potential complementary role for fuel cell technology. A key intial step is to evaluate the power requirements for the fixed route and specialized transit service blocks. And we are reviewing the existing Operations and Maintenance Facility to identify the key opportunities and constraints for retrofitting the facility to support the needed infrastructure changes, including for the electrical grid interface/service. Alternative implementation and phasing scenarios are being identified and examined, leading to a recommended and costed implementation/transition schedule. Mr. Parker is the Project Director.

Hamilton Street Railway, Hamilton, ON (2021-present) **- Fleet Electrification Alternative Scenarios Analysis** – This project is considering alternative electrification scenarios for the new Maintenance and Storage Facility: (1) full CNG, (2) electrification using Battery Electric Buses for blocks that can be covered with depot charging alone, (3) electrification using Battery Electric Buses for blocks based on assuming additional measures such as reblocking. These alternatives will be assessed regarding the benefits and required facility changes. A package of updates are being prepared to the MSF design. Doug is leading this incremental effort to our overall MSF design project.

Chattanooga Area Regional Transportation Authority (CARTA), Chattanooga, TN (2021-present) **– Electrification Feasibility Assessment** – CARTA has in recent years started to operate battery electric buses using some depot charging and onroute inductive charging. This project is assessing what charging infrastructure additions would be needed to transition increasingly more of the fleet to battery electric over future years. And when additional constraints related to

aspects like facilities and grid connections would need to be addressed to support such expansion. Mr. Parker is the Project Director for this effort.

Region of Waterloo, ON (2020-present) **– Fleet Electrification Charging Infrastucture Design -** Mr. Parker helped support designing the initial stages of charging infrastructure for the Grand River Transit Northfield garage. Our support focused on estimating the potential for managed charging to reduce peak power demand for charging, and on charting a future staged infrastructure rollout sequence for supporting the projected increasing size of Battery Electric Bus fleet. This progressed into supporting incorporation of the initial stages of this charging infrastructure into the facility during its construction.

GoRaleigh, Raleigh, NC (2020-Present) **– Fleet Electrification Charging Infrastructure Design** – IBI Group designed the retrofit into an existing Operations and Maintenance Facility of the charging infrastructure needed to support the GoRaleigh procurement of its initial set of Battery Electric Buses. We also prepared specifications and are now assisting with procurement and implementation for an electrified fleet real-time operations management system. Mr. Parker is a Senior Advisor.

Sarnia Transit, Sarnia, ON (2021) **– Transit Fleet Electrification Transition and Implementation Plan** – IBI Group developed a comprehensive plan for long term transition of the Sarnia Transit fleet to electric vehicles. This addressed the implications for transitioning the fleet and the Operations and Maintenance Facilities. The primary focus was on specific plans for enabling the funded Battery Electric Bus purchases through 2027. We determined charging infrastructure, power demands, grid interface upgrades, and facility transition/upgrades needed. For longer blocks, longer term rollout options were identified including potential use of onroute charging and fuel cell technology. Mr. Parker was the Project Director.

Belleville Transit, Belleville, ON (2021) **– Transit Fleet Electrification Transition Analysis** – IBI Group worked with Siemens Canada and Elexicon to develop an overall package of Battery Electric Buses, charging infrastructure, facility upgrades, utility interface upgrades, and power pricing needed to transition Belleville Transit over the near term to a 100% electrified fleet. IBI Group analyzed the estimated power requirements for all Belleville Transit blocks. To identify for various potential bus configurations some feasible combinations of depot charging, on-route charging, and reblocking to enable 100% electrification. Mr. Parker is the Project Director.

Societé de Transport de Montréal, Montréal, Québec (2019-2020) **– Detours Management Operations Enhancements** – IBI Group worked with STM and their CAD/AVL vendor INIT to assess and provide recommendations to help enable effective detour management operations under the extensive on-street construction conditions. The work involves assessing both how STM dispatchers are using the current system capabilities as well as system enhancement proposals from INIT. Our recommendations encompass what system enhancements would be most needed and also what changes to STM procedures would help get the most benefit from their system. Mr. Parker is the Director for this project.

London Transit Commission (LTC), London, ON (2014-2016) **– Technology Strategy –** We completed a comprehensive renewal of the LTC plan for strategic technology deployment over the upcoming several years. This plan was considered current technology and how it is being used, gaps relative to capabilities LTC needs, and mature technologies available to address these gaps. The plan established a future integrated systems vision and the basis for implementing a sequence of projects to build towards this.

Rochester-Genesee Regional Transportation Authority (RGRTA), Rochester, NY (2014-2016) **– Transit Technology Roadmap –** Mr. Parker led this effort to establish a strategic plan for the integration and expansion of transit technology at RGRTA to best address its needs. This included a comprehensive review of how existing technologies were being used and gaps to address with technology enhancements. Based on this assessment, coupled with assessment of state of the practice available mature technologes, we help build consensus on a longer-term integrated systems vision RGRTA will build towards, and also a sequence of projects to do so.

Randy J. Knapick AICP
Director, Mobility Strategy and Technology

Randy J. Knapick helps transit agencies address the opportunities and challenges of our evolving mobility environment through technology, infrastructure, and operational strategies. Mr. Knapick brings a perspective that spans IBI Group's three core disciplines—Infrastructure, Buildings, and Intelligence—to develop integrated solutions to transit fleet electrification challenges. Randy has a proven ability to work with multiple disciplines on complex and inter-related technical, policy, and design issues to maximize agency and customer benefits.

Representative Experience

Raleigh Battery Bus Charging Infrastructure Design – Go Raleigh Transit (City of Raleigh), Raleigh, NC – Technology/operations advisor for installation of new 150kW depot chargers to support Go Raleigh's first battery-electric bus fleet. Supported equipment layout based on operational needs, procurement of vehicle chargers and dispensers, and charge management system specification.

Sound Transit Battery-Electric Bus Rapid Transit Technology and Operations – Sound Transit, Seattle, WA – Senior project advisor helping to develop operational strategies and technology to optimize BRT quality of service in Sound Transit's first BRT corridors, including systems to support deployment of a battery-electric bus fleet. The I-405 corridor project is primarily a freeway-running BRT, including high occupancy toll and shoulder-running segments. The SR522 BRT project uses an arterial-running configuration, including Business Access Transit lanes.

Moran Station Park and Ride Design and Battery-Electric Bus Charging – Spokane Transit Authority, Spokane, WA – Project Manager for design implementation of a new park and ride facility that will serve as the terminus and en-route charging location for a new STA High Performance Transit battery-electric bus route. Coordinated with the agency, utility, and power equipment suppliers to incorporate provisions for fleet electrification. The facility opened to the public in spring of 2020.

Queensgate Transit Hub – Electric Bus Charging Readiness – Ben Franklin Transit, Richland, WA – As part of an IBI transit center design team, advised the designers and client on incorporating readiness for en-route battery electric bus charging at the facility, including operations/vehicle movement, charger placement, and provisioning for power equipment within an enclosed equipment yard.

MD 355 "FLASH" BRT Design Review and Preliminary Engineering Program Management – Montgomery County Department of Transportation, Montgomery County, MD – Team leader for a comprehensive review of planning, operations, infrastructure, technology, and transit-oriented development strategy for a proposed $700 million New Starts BRT project northwest of Washington, D.C.

Reimagine RTS – Community Mobility Zone Strategy — Regional Transit Service, Rochester, NY – Project Manager to develop new mobility options (microtransit, mobility as a service, and demand-responsive) to replace existing RTS fixed route service with an operating

Education

M.S. Transportation, Massachusetts Institute of Technology (USDOT Fellowship Recipient)

B.S. (Civil and Environmental Engineering/Certificate in Transportation), University of Pittsburgh

B.A. (B.Phil. Urban Planning and Design), University of Pittsburgh

Experience

1999–Present
IBI Group, Portland, OR, Director, Mobility

1998
City of Pittsburgh, Department of City Planning Transportation Section

Memberships

APTA Systems Engineering, Former Subcommittee Member

TRB Committee on Regional Transportation System Management and Operations (2010-2013)

American Planning Association, Oregon Chapter

ITS Massachusetts (Board Member, Past President, former Vice President, Technical Committee Chair, and Annual Meeting Chair)

Registrations

American Institute of Certified Planners (AICP), Certificate #018598

model that is more financially sustainable and suited to community needs and dispersed travel patterns.

Washington/Western and River Corridors Bus Rapid Transit Projects – Capital District Transportation Authority, Albany, NY – As part of an IBI Group planning, engineering, and urban design team, Randy advised CDTA and the project team on FTA Section Small Starts strategy and application process for two candidate projects. Assisted CDTA with the development of strategies to maximize project competitiveness and analyze financial and project sequencing scenarios.

Silver Line Phase BRT Technology, Operations, and Design Services – Massachusetts Bay Transportation Authority, Boston, MA – IBI Project Manager for transit operations planning and ITS design for a US$1 billion underground BRT project downtown Boston. Coordinated transit operations analysis with the development of preferred alignment alternatives and project strategy. Served as an advisor on technology and vehicle propulsion technology for the dual-mode diesel/trolleybus fleet.

Emerging Technology Impact Assessment – Oregon Transportation Commission - Oregon Department of Transportation (ODOT) – Serving as a subject matter expert for a study of the statewide policy and organizational impacts of emerging transportation technologies (including rideshare, mobility as a service, autonomous vehicles, freight technology, and others) in Oregon.

Portland Union Station Revitalization and Multi-Modal Transportation Assessment – Prosper Portland, Portland, OR – Project Manager for the revitalization of Portland's historic 1896 intercity passenger railroad terminal. Responsible for technical coordination of architectural, rail operations, engineering, and environmental assessment teams. Working with the Federal Railroad Administration, historic preservation authorities, Amtrak, freight railroads, and other stakeholders on a variety of complex design and operational issues, including platform level boarding, historic preservation, structural/seismic/systems upgrades, rail operations modernization, multi-modal transportation analysis, and economic revitalization.

Spokane Transit Facilities Master Plan – Spokane Transit, Spokane, WA – Led a team preparing transit fleet estimates and facilities requirements to support anticipated STA growth and analysis of OMF facilities expansion alternatives.

SMART1 Enhanced Transit Corridors Study – Syracuse Metropolitan Transportation Council, Syracuse, NY– Strategy and implementation plan advisor for an alternatives analysis of regional Bus Rapid Transit corridors, including proposed connections between Downtown Syracuse, Syracuse University, and other neighborhoods and activity centers.

Bhubaneswar Smart Cities Initiative – Public Transport Vision and Strategy – Bhubaneswar Smart Cities Ltd., Bhubaneswar, India – Public Transport lead for the development of a comprehensive Smart Cities program in Bhubaneswar, the winner of India's prestigious national Smart Cities initiative.

Organizational Assessment of Capital Program Delivery – Metropolitan Atlanta Regional Transportation Authority (MARTA), Atlanta, GA – Assessed functional competencies, processes, and organizational issues to improve delivery of MARTA's increasingly technologically-focused capital program.

Division Corridor High Performance Transit Study – Spokane Regional Transportation Council, Spokane, WA –Transit Lead for a multi-modal transportation and land use study for a future battery-electric BRT corridor with Business Access Transit (BAT) lanes.

J. Ola Ferm, NCARB
Associate Director - Buildings

Ola is an award-winning architect with over 26 years of experience leading major project teams and project development of public works facilities and transit facilities. He has superior concept design skills with a diverse background in project types with a specialty in vehicular/ transit operations and maintenance facilities. Ola brings together big-picture thinking with broad technical experience with sustainable design and managing an interdisciplinary team. He brings analytical, organizational, and leadership skills with demonstrated experience in achieving aggressive goals. Ola is well-placed to facilitate the overall vision and strategy for this project type based on an operational understanding.

Education

Bachelor of Architecture, North Carolina State University, 2002

Bachelor of Environmental Studies, Environmental Design in Architecture, North Carolina State University, 1994

Experience

2016-Present
IBI Group, Raleigh, NC,
Associate Director, Buildings

1994-2013 Williard Ferm Architects, Raleigh, NC,
Principal in Charge of Public Sector Work Architect

Registrations

Registered Architect:
North Carolina
Tennessee
Utah
Washington
West Virginia
Florida

Certifications

NCARB (#89287)

Memberships

APWA (American Public Works Association)

Representative Experience

GORaleigh Transit Operation Center, City of Raleigh, Raleigh, NC: The complex is composed of multiple buildings ranging from administration, maintenance, and operational support. The facility is designed to host a bus fleet of 200 including articulated busses. This FTA funded project was completed in 25 months from programming thru occupancy. In addition to receiving a LEED Platinum rating, the facility also received the APWA Project of the year recognition as well as the Sir Walter Raleigh Award for community appearance.

GORaleigh CNG Facility Upgrades, City of Raleigh, Raleigh, NC: Expansion of the existing diesel fuel station to accommodate CNG fueling and modifications to the service garage for CNG compatibility.

GORaleigh Electric Bus Charging Infrastructure, Raleigh, NC: Analyze, design, obtain permit approval, prepare construction documents for the new GORaleigh Electric Bus Charging Infrastructure and modifications to its bus maintenance facility.

Anaheim Transportation Network Operations Center, Anaheim, CA: Programming, operational planning, and design support for the implementation of an electric fleet of 80 transit buses as it relates to the design and construction of a new maintenance building.

Fairfield Public Works Maintenance & Administration Facility Master Planning, Fairfield, CA: Programming, and facility master planning for the implementation of an all-electric bus fleet of 60 transit buses and an all-electric public works fleet.

Los Angeles Public Works Maintenance & Administration Facility Master Planning, Los Angeles, CA: Programming and facility master planning for re-aligning 51 existing public works facilities including LAPD, LADOT, BSS, and LASAN.

Los Angeles Mariana Service Center, Los Angeles, CA: Programming and facility master planning for a satellite campus serving Street Services (BSS) and Sanitation (LASAN).

Valley Transportation Authority, San Jose, CA: Operational documentation and planning, for three separate bus transit operation and maintenance centers and one light rail operations and maintenance center.

Sound Transit Stride BRT , Bothell, WA: Start of Service planning for a new BRT corridor connecting all of I-405. Scope of service includes assisting Sound Transit with operational planning, contract operator procurement as well as defining policies and procedures along with general workforce readiness.

Orange County Transit Authority, Orange, CA: On-Call for design support and programming for the implementation of a hydrogen (fuel cell) bus fleet along with required changes in building infrastructure.

SFMTA Potrero Yards, San Francisco, CA: P3 pursuit for a multi-story operations and maintence center hosting a fleet of 210 electric articulated busses. The development is enhanced by incorporating joint development as well as housing vertically and horizontally on the same city block.

Hamilton Transit Maintenance and Operation Center, Hamilton, ON: Design for a 430,000 sf operations and maintenance storage facility, including a paint booth and body shop, fueling and washing lanes, offices, operations and dispatch area, meeting rooms and training spaces, as well as provisions for future electric fleet of buses.

Yonge North Subway Extension, Toronto, ON: Owners technical advisor for Infrastructure Ontario (IO) and Metrolinx. Project Lead for light rail maintenance and storage facilities for the 7 km north extension linking Toronto with the York region.

Facilities Study for Public Works Operations & Maintenance Service Centers, City of Asheville, Asheville, NC: Programming, site selection and master planning/conceptual design services for its new public works operations and maintenance service center.

Facilities Study for Operations & Maintenance Service Center, City of Asheville, Asheville, NC: Programming, site selection and master planning/conceptual design services for its new public works operations and maintenance service center.

Waste ReSources Facility - Carpenter Road Site Development Design, City of Olympia, Olympia, WA: A two-phase site master planning and development project. The first phase includes a newly located Waste ReSource Facility to include offices, shops, enclosed storage and uncovered storage areas, covered and uncovered vehicle parking areas, public, vendor, and staff parking areas, and would be enclosed with secure perimeter fencing and access control gate. The second phase includes a fuel island, tippingwall, and truck scales.

WSDOT Olympic Region Maintenance & Administration Building, Graham, Seattle, WA: Design-build project that includes the design and construction of a 110,000 sf of total building space that includes; administration building, shops building, vehicle maintenance building, vehicle wash bay, fuel island, and electric vehicle charging stations.

Piney Plains Bus Transportation Facility, Wake County Public Schools, Cary, NC: Master Planning and design o**f** a regional maintenance and operation center for a fleet of 250 school buses.

Middle Creek Regional Transport Center, Wake County Public Schools, Cary, NC: Programming, master planning, design and engineering services for a new regional transportation center including office and meeting space for central administration, customer service, operations, and maintenance.

Mark Humienny AIA, LEED AP
Senior Project Manager/Associate Principal

Mr. Humienny is an experienced architect skilled in master planning, programming and building design. He has designed and managed a diverse range of project types, including fleet maintenance and operations facilities, electric vehicle infrastructure, CNG and LP fueling stations, commercial offices; university, municipal and laboratory facilities; as well as warehouse and distribution structures. Mr. Humienny is a LEED-Accredited professional with experience in achieving LEED-certified projects where sustainable design is key project goal. He has served as an adjunct faculty member at North Carolina State University's College of Design, where he taught analysis of environment and context as a design determinant. His approach to planning and design stresses the integration of building, site, and urban context with an emphasis on creating pedestrian-friendly environments.

Representative Experience

Operations & Maintenance Facilities

Public Works Space Needs Assessment, Garner, NC - Project Role: Project Manager. Space needs assessment of the Public Works Department, Police Department's evidence storage, and the Town's long-term storage. Site analysis to assess the physical condition of the public works property, and to determine the potential for improvements and/or building expansions. Parametric Design Analysis to analyze a multitude of parameters to quickly determine optimal efficiencies and locations. Master planning of operations complex expansion, including phased additions, renovations and demolition.

GoRaleigh Transit Operations Center CNG Facility Upgrades, Raleigh, NC - Project Role: Project Manager and Lead Architect. Expansion of the existing diesel fuel station to accommodate CNG fueling and equipment. Modifications to the service garage for CNG compatibility. Coordination with utility companies.

GoRaleigh Transit Operations Center Electric Bus Charging Infrastructure, Raleigh, NC - Project Role: Project Manager and Lead Architect. Design of new electric bus charging infrastructure for City's battery electric bus fleet at existing transit operations center. Evaluated current operations and fleet movement to determine prime location for overnight charging. Coordinated with local AHJ to obtain permits and inspections. Worked closely with Proterra and Siemens to coordinate the interoperability between the buses and chargers. Overseeing the implementation of energy management software by INIT.

WSDOT Olympic Region Maintenance & Administration Facility, Graham, Lacey, WA - Project Role: Design Manager. Design-build project with Graham Construction for the design and construction of 110,000 sf of total building space that includes: administration building, shops building, vehicle maintenance building, vehicle wash bay, storage building, and electric vehicle charging stations.

Fleet Maintenance Expansion, Fayetteville Public Works Commission, Fayetteville, NC - Project Role: Project Manager and

Education

Master of Architecture, Minor in Urban Design, North Carolina State University, Raleigh, NC, 1992

Bachelor of Science in Architecture, University of Virginia, Charlottesville, VA, 1983

Experience

2000-Present
IBI Group, Raleigh, NC, Senior Project Manager/Associate Principal

1996-2000
Davis Kane Architects, Raleigh, NC, Project Manager/Architect/Associate

1993-1996
Edwards Associates, Raleigh, NC, Project Manager/Architect/Associate

1992-1993
Cline Davis Architects, Raleigh, NC, Project Architect

1984-1990
Davis & Carter, McLean, VA, Project Architect

Memberships

American Institute of Architects

NC Urban Design Assistance Team

AIA Educational Outreach Committee Chair

NC Building Code Ad-hoc Committee on Accessibility

Registrations

North Carolina

South Carolina

Washington

Certifications

LEED Accredited Professional

National Council of Architectural Registration Boards

Lead Architect. Master Planning, programming, and design for a fleet facilities expansion and renovation to maintain a diverse municipal fleet of 1,589 vehicles. Brought building up to current codes with new life safety systems, including sprinkler and fire alarm systems. Incorporated new vehicle lifts and other service equipment, and modernized its offices, technician support spaces, machine shop and welding bay.

Public Works Facility, Rolesville, NC – Project Role: Project Manager and Lead Architect. Programming, site feasibility study, and design of a new public works maintenance facility. Currently under design, this new structure is proposed as a pre-engineered metal building with a storage mezzanine above the office areas. Includes a carpentry shop, facilities workshop, hi-bay storage, small engine repair and vehicle maintenance bays. Site includes bulk storage material bins.

WCPSS Bus Operations Center, Cary, NC – Project Role: Project Manager. Programming, site feasibility study, and design of an operations and administration headquarters and bus maintenance facility for the Wake County Public School Systems. Adaptive re-use and expansion of a former Ford automotive service center. Includes and new fleet re-fueling station.

Solid Waste Services Planning, Raleigh, NC – Project Role: Project Manager. Concept planning and schematic design, code evaluations, budget estimating, scheduling and capital improvement planning for slow-fill compressed natural gas (CNG) fueling and a new heavy equipment vehicle shop and fleet fueling station.

NE Equipment Maintenance Facility, Charlotte, NC - Project Role: Design Architect. Design consultant for the programming and design of a new 27,000sf fleet maintenance garage. Lead design through design development phase and provided cost estimating, and code consulting to FWA Group Architects.

Operations Center Feasibility Study – Wake Forest, NC – Project Role: Architect – Programming, site evaluation, and cost estimating for relocation of town operations center to new site. Major facility designs included fleet maintenance, administration, warehouse, and yard storage. Project included in depth study of area development and its impact on current site, which houses Public Utilities, Wake Forest Power, Environmental Services and Public Works.

Operations Center Expansion- Union County, NC – Project Role: Project Manager and Lead Architect – Redevelopment and expansion of Public Works Operations Center, involving demolition and re-construction of several buildings, as well as new buildings for administration, workshops and warehouse. Created a detailed phasing plan that allowed for ongoing operations throughout construction.

Northeast Remote Operations Facility - Raleigh, NC – Project Role: Project Manager and Lead Architect – Site evaluation, site planning, building assessment, and design for a new operations facility for the City. Aggregated several properties containing vacant industrial buildings to develop a new multi-building campus housing Vehicle Fleet Services, Parks & Recreation, and Street Maintenance. Included both conventional and alternative fueling.

City of Rock Hill – Public Services Center – Rock Hill, SC – Project Role: Project Manager and Architect – Programming, site selection, and master planning of new city public services and operations center.

Town of Cary – Operations Center Interior Renovation– Cary, NC – Project Role: Project Manager and Lead Designer – Interior space planning and office alterations at award-winning William M. Garmon Public Works Operations Center.

Town of Cary – Operations Center Warehouse – Cary, NC – Project Role: Project Manager and Architect – New 8,000 sf storage building at William M. Garmon Operations Center.

Seth McDermott EIT
Transit Technology Specialist

Seth McDermott is a Transit Technology Specialist in transportation engineering, with a focus on leveraging Intelligent Transportation Systems (ITS) solutions and Zero-Emission Bus (ZEB) operations to enhance urban mobility and public transportation. His experience includes extensive consulting work for agencies across North America on multidisciplinary electrification feasibility studies, a wide variety of ITS deployments empowering transit operations, operational readiness as part of major operations program delivery, and business process re-engineering to help agencies derive the best value from their investments.

Education

University of Toronto – BASc Civil Engineering, 2017

Experience

2015-Present

IBI Group, Toronto, ON, Transit Technology Specialist

Memberships

Engineer-in-Training, Professional Engineers Ontario

His ITS consulting experience includes Computer-Aided Dispatch and Automatic Vehicle Location (CAD/AVL), yard management, vehicle charging management, smart revenue management, multimodal trip planning and payment, dynamic platform allocation, fixed-route and demand-response scheduling, on-board passenger information, in-vehicle security, and data visualization.

Mr. McDermott has supported projects through their entire life cycle, from conducting needs assessments and market research, to specification development, to full support through procurement, design, testing, and system acceptance.

Representative Experience

GoRaleigh, Raleigh, NC – Electric Bus Pilot and Charging Infrastructure (2020-Present) – GoRaleigh is procuring BEBs for use in a pilot demonstration beginning in early 2021. Mr. McDermott supported the provisioning effort by assessing charging demands necessary for the pilot service to operate, based on GoRaleigh's existing service design including route and block characteristics. Mr. McDermott additionally developed specifications for an electric fleet Operations Management System that will facilitate optimizing charging based on inputs from various planning data and real-time feeds.

Hamilton Street Railway (HSR), Hamilton, ON – Fleet Transition Study for Hamilton Transit Maintenance and Storage Facility (2021-Present) – HSR is developing a second conventional bus MSF to enable fleet expansion. It is designed to support the existing CNG/RNG fleet, and is provisioned to facilitate introducing BEBs. Mr. McDermott led a service power analysis as part of a fleet transition study, evaluating charging and energy consumption scenarios for BEB service that may be based out of the new MSF. The analysis included evaluating HSR routes and blocks for compatibility with BEB battery ranges, modelling a charging schedule required to support this service, reviewing charger system configurations to promote reliability and operational flexibility, and developing a life cycle cost analysis for the future suite of technology.

Brantford Transit, Brantford, ON – Electric Bus Needs Assessment and Feasibility Study (2021-Present) – IBI Group is developing an assessment of the compatibility of BEBs with Brantford Transit's current operations as the agency pursues a full fleet transition. The study is addressing the implications of a fleet transition on the current Maintenance and Storage Facility (MSF), the supporting electricity grid, and the potential for BEBs to cover all Brantford Transit services. Mr. McDermott is the Project Manager and is involved in all aspects of the project.

Chattanooga Area Regional Transportation Authority (CARTA), Chattanooga, TN – Electrification Feasibility Study and Business Case (2021-Present) – IBI Group is developing an assessment of the compatibility of BEBs with CARTA's current operations. CARTA is a North American leader in electric transit, having operated an electric downtown shuttle since the 1990s. Now CARTA is investigating transitioning the full conventional fleet to electric. The goal will be to

produce supporting materials enabling CARTA to apply for a Federal Transit Administration Low-No Grant in 2022. Mr. McDermott is the Project Manager and is involved in all aspects of the project.

Sarnia Transit, Sarnia, ON – Electric Bus Feasibility Study (2021-2021) – IBI Group developed a plan for long term transition of the Sarnia Transit fleet to electric vehicles, with both battery electric and fuel cell electric buses under review. The study included an operating cost analysis, a review of power requirements for all current service blocks and future operational scenarios, facility infrastructure requirements, propulsion technology recommendations, and finally a transition plan. Mr. McDermott was the Project Manager and was involved in all aspects of the project.

Grand River Transit (GRT), Region of Waterloo, ON – Northfield Drive Bus Maintenance and Storage Facility (2020-Present) – GRT is developing a third conventional bus MSF on Northfield Drive in Waterloo, to expand fleet capacity, provide more efficient coverage to the northern part of its service area, and support the introduction of articulated and electric buses. Mr. McDermott evaluated vehicle specifications against route and block characteristics, modelling the charging schedule required to support this service, and reviewing charger systems and configurations to promote reliability and operational flexibility, with consideration toward futureproofing for a fully electric fleet.

Belleville Transit, Belleville, ON – Fleet Electrification Study (2021-2021) – Belleville Transit intends to transition its fleet to fully electric. IBI Group is working with Elexicon (the local power utility) and Belleville Transit to study the effect of transit operations on power requirements and charging opportunities for the new fleet. Mr. McDermott supported the data review as a subject matter expert, implementing IBI Group's service block analysis methodology.

Metrolinx, Toronto, ON – On Corridor Program (OnCorr) (2020-Present) – Metrolinx is planning a substantial service expansion to provide frequent two-way all-day rail service across its passenger rail lines. Elements of this program include transitioning multiple aspects of operations, maintenance, and capital works from a variety of in-house teams and separately managed contracts to a new wide-ranging 25-year DBOM partnership, and electrification of the substantial portions of the passenger rail network. Mr. McDermott is supporting the operational readiness workstream to prepare for the assumption of duties by the future private-sector partner. Mr. McDermott is also supporting development of the performance management regime, which will be used to manage the activities performed by the future private partner, including supporting business units in developing and testing failure criteria.

Grand River Transit (GRT), Region of Waterloo, ON – Electronic Fare System (2015-Present) – GRT implemented an electronic fare management system to coincide with the opening of the ION LRT system and bus network restructuring. The system consists of onboard, wayside, and garage equipment for LRT and bus, a central back-end, and an interface with the existing CAD/AVL system. IBI Group was retained following the contract award to review the design and support the testing and system acceptance process. Mr. McDermott contributed to the design review of fare system components to assess system compliance and refined the vendor's test procedures for establishing system acceptance. Mr. McDermott has since assumed the role of project manager, leading the later phases of IBI Group's system acceptance testing support to GRT in the field.

Metrolinx, Toronto, ON – Terminal Management System (2016-2021) – Metrolinx implemented a Terminal Management System at the new Union Station Bus Terminal in Downtown Toronto, to assign buses to platforms dynamically in real-time, provide corresponding driver- and customer-facing information, manage layovers, and control traffic flow within the facility. IBI Group performed solution support, liaising between the project management, solution design, and business lines to develop the system concept and functional requirements, support procurement, and assist in the design and testing. Mr. McDermott developed the business case, wrote functional requirements and business rules based on wide-ranging consultation with business lines, developed procurement materials, supported business process reengineering, and refined hardware provisioning.

Ian Kilgour, P.Eng.
Associate - Intelligent Systems Manager

Ian is an Electrical Engineer and Intelligent Transportation Systems Specialist bringing significant experience in fleet electrification, industrial networking, telecommunications systems and advanced traffic management systems. He has 16 years of experience working on numerous projects within these multiple sectors across North America. He has been responsible for both field installation, facility relocation and integration activities, as well as design and pre-design tasks including needs assessments, cost-benefit analyses and concepts of operation.

Representative Experience

Raleigh Battery Bus Charging Infrastructure Design – Go Raleigh Transit (City of Raleigh), Raleigh, NC – IBI Group is the technology/operations advisor for installation of new 150kW depot chargers to support Go Raleigh's first battery-electric bus fleet. IBI Group supported equipment layout based on operational needs, procurement of vehicle chargers and dispensers, and charge management system specification. Ian helped review yard layout plans in order to optimally position charging infrastructure to best suit the needs of the agency's operational environment.

VIA Metropolitan Transit Network Engineering Services, San Antonio, TX (2017-present) - IBI Group was contracted by VIA to assist in the efforts related to the upgrade of the existing San Antonio metro area networking infrastructure from a 1 GB technology backbone to a 10 GB backbone and to provide WAN integration service for dual BGP peered Internet Service Providers. Mr. Kilgour played a key role providing professional network engineering services, network technical review, design and implementation services. with the intended goal of upgrading the current network service level to 10 Gbps backbone while meeting all of VIA's 24/7 operational requirements and industry best practices.

SANDAG Regional ARC-IT Update, San Diego Association of Governments (SANDAG), CA (2021) – Mr Kilgour assisted in strategic ITS planning for SANDAG related to the update of the San Diego County Regional ITS Architecture to conform with the recently announced 5 Big Moves of the San Diego Forward Regional Plan, which includes vehicle electrification plans for the region. Work under this contract included the facilitation of several large scale project workshops which brought together stakeholders from different agencies and jurisdictions. The workshops were developed as interactive and valuable experiences, from which all stakeholders were asked to provide input on the ITS issues and needs facing the region. Input from the workshops aligned with best practices in the industry served as the foundation for development of a long-term list of potential ITS projects for the region. The output of this project is an updated Regional ITS Architecture v9 for San Diego County.

Big Blue Bus Transit Technology Roadmap, Santa Monica, CA (2018-2019) – IBI Group has developed a 5 year forward facing roadmap for systems and technology implementation at Big Blue Bus, which includes reviews of Information Technology, Fleet Electrification, Operations, Planning & Scheduling, Customer Service & Engagement, Finance and Maintenance systems. The roadmap includes a Needs Assessment, Analysis of Systems Options and Roadmap Development. Ian was Deputy Project Manager and Communications Systems Lead for the project.

Education

B.A.Sc. (Electrical Engineering), University of Waterloo [Ontario, Canada], 2006

Experience

2016–Present
IBI Group, San Diego, CA, Associate – Intelligent Systems Manager

2011–2015
IBI Group, Montreal, QC, Transportation Systems Engineer

2006–2010
IBI Group, Toronto, ON, Transportation Systems Engineer

2004 & 2005 (Fall)
IBI Group, Engineering Support Intern

2004 (Winter)
MD Robotics Shuttle Remote Manipulator System, Engineering Support Intern

2003 (Summer)
Stuart Energy Systems Advanced Engineering Group, Engineering Support Intern

Memberships

Professional Engineers Ontario

Cisco® Certified Entry Networking Technician

Languages

English (Fluent)

French (Fluent)

Spanish (Intermediate)

Long Beach Transit Mobile Gateway Router, Long Beach, CA (2017–Present) – IBI Group developed specifications for a new on-board Mobile Gateway Router on LBT's fleet of buses, in order to help consolidate a number of existing ITS subsystems resident on the vehicles, including the Trapeze CAD/AVL system and security digital video recorders. The new Mobile Gateway Router will function as the heart of the bus-to-field communication network, harmonizing the flow of data through consolidated wide area network links. Following completion of the design, IBI Group's scope includes procurement and integration support. Ian is acting as lead for on-board vehicle communications on the project.

Los Angeles County MTA (Metro) ATMSv2 CAD/AVL Scope & Specifications – Los Angeles, CA (2019-Present) – IBI Group is leading the concept of operations and specification development for implementation of Metro's new on-board architecture updates and CAD/AVL system upgrades for its 2,500 bus and 600 vehicle rail fleet. This includes integration of new Mobile Gateway Routers on the bus fleet, new CAD/AVL equipment, and new IoT Smart Gateways on the agency's rail vehicles. Ian is supporting the on-board vehicle and communications systems aspects of the project.

Foothill Transit CAD/AVL, West Covina, CA (2014–Present) – IBI Group, as the prime consultant, is providing comprehensive technical advisory services for the replacement of Foothill Transit's CAD/AVL and radio system, which includes the addition of a new Mobile Gateway Router which will support multi-carrier cellular links for data and voice while on-route. IBI Group has led the specifications and RFP development, assisted Foothill Transit with Vendor procurement, including proposal and interview evaluation and recommendations, and is also leading the implementation and testing efforts. Ian has been supporting the implementation, including system documentation review, and plays a key role in the oversight of installation, testing, and final acceptance going forward.

CAD/AVL Implementation– Alameda-Contra Costa Transit District (2016-Present) – IBI is working with a team of industry-leading experts to provide technical support services for the evaluation, procurement, contract negotiations and installation of a new CAD/ AVL system for AC Transit. As part of this project, AC Transit is replacing their Mobile Access Router and redesigning their data communications to more effectively transfer data between the vehicle and central system. Ian has been leading the study to consider options for a voice fallback system as the primary voice system moves over to VoIP over commercial cellular, with options including membership in the regional P25 (EBRCS) system, or construction of a new AC Transit owned DMR.

RTC of Southern Nevada CAD/AVL Replacement – Las Vegas, NV (2018-present) - IBI Group is providing comprehensive technical advisory services for the replacement of RTC's current CAD/AVL system, including a Communications System Assessment to determine the potential releveraging of existing mobile gateway router and regional P25 system (SNACC) membership. The firm has performed a Needs Assessment, developed a ConOps and completed a comprehensive set of system and contractual requirements for the replacement. IBI will continue to support the agency through the procurement process and provide subsequent implementation support. Ian has been acting as Deputy Project Manager supporting all aspects of the project from biweekly progress meeting management to targeted development of the Communication System requirements.

New MTO Central Region COMPASS Traffic Management Centre (CRCTMC), Ministry of Transportation, Toronto, ON (2012-2018) – The CRCTMC development project was divided into a site and facility design mandate under Infrastructure Ontario, and an ITS Electronic Fit-in design and operations migration planning effort led by the MTO ITS office. The Ministry relocated its two major Central Region Traffic Operations Centres into one state-of-the art facility at Arrow Rd. Ian was the Outside Communications lead for this ongoing project, in charge of developing the staged reconfiguration of the Ministry's outside plant fiber optic network to support the migration to the new centre, while keeping in mind future expansion. This assignment involved the creation of the new 10G IP Backbone which will route traffic from remote network back to the new Core Network at CRCTMC, and was critical for supporting a fully digital video management system which can support advanced video analytics.

Flora Zhang
Transit Technology Analyst

Ms. Zhang is a Transit Technology Analyst passionate about using technology to develop sustainable solutions in the public transit sector. Through her time at IBI Group, Flora has gained experience in transit management systems and fleet electrification. Flora has been responsible for conducting greenhouse gas modeling, carrying out market analyses and supporting procurement and implementation of new systems.

Representative Experience

Transit Operations Technology Modernization
(2020 – 2021) – Metrolinx, Toronto, ON –
The TOTM program is the modernization of Metrolinx transit operations technology for GO Rail and UP Express services. The program will improve the operations of GO rail's 8 train lines with a daily ridership of 215,500 and UP Express's airport rail link with a daily ridership of 10,091. Flora performed program management and business analysis services for the TOTM program. These services include:
- Providing guidance and support to project managers and project teams in their assigned work;
- Execution and management of the program plan;
- Managing delivery quality, risks, and decisions; and
- Coordinating project activities and scope with other Metrolinx wide strategic and technology projects such as: OnCorr Operational Readiness; Go Train/ Transit Control System (GTCS); Trapeze Transit Operations

Hamilton Fleet Transition Study
(2021 – Ongoing) – City of Hamilton, Hamilton, ON –
The City of Hamilton has retained IBI Group to study future propulsion technology options to lower emissions for the Hamilton Street Railway (HSR) bus fleet, as part of a larger project to design the new Hamilton Transit Maintenance and Storage Facility (MSF). The study is examining whether the fleet operating out of the new MSF should use Compressed/ Renewable Natural Gas (CNG/RNG) propulsion (HSR's current fleet-wide strategy), a mixed fleet of CNG/RNG and battery electric bus (BEB), or a fully BEB fleet. Flora developed the greenhouse gas modelling, inclusive of upstream and downstream emissions, for alternative implementation timelines and scenarios.

TTC Wheel-Trans Scheduling and Dispatching Systems
(2017 – 2020) – Toronto Transit Commission (TTC), Toronto, ON –
IBI Group was retained by the TTC to design and help TTC W-T procure new scheduling and dispatching systems to improve their operational management of specialized transit, as well as help provide more efficient methods for customers to book and manage trip, and receive trip information. TTC is integrating all modes of service to support customers the ability to use conventional services (i.e. buses, streetcar, and subway) for all or part of their trip, herein known as Family of Services. Ms. Zhang is provided assistance through developing various deliverables (e.g. project charter, QA documents, testing schedules) as IBI Group supports TTC W-T from procurement, through deployment and to roll-out of the Schedule and Dispatching systems.

Education

Bachelor of Applied Science in Civil Engineering, University of Toronto, Toronto, ON, 2015-2020

Experience

May 2018–Present
IBI Group, Toronto, ON, Transit Technology Analyst

2016, 2017
Region of Peel, Toronto, ON, Development Engineering Intern

2014
MMM Group, Mississauga, ON, Transportation Summer Student

ibigroup.com

TTC Consulting Services VISION Integrated CAD/AVL System (2014 – Present) – Toronto Transit Commission (TTC), Toronto, ON –

IBI Group provided consulting services to the Toronto Transit Commission (TTC) in support of the design, selection, procurement and implementation of a Computer Aided Dispatch/Automatic Vehicle Location (CAD/AVL) system to replace their existing Communications and Information System (CIS), which manages surface operations. The new CAD/AVL integrates other onboard subsystems including communications, automatic passenger counters, security cameras, and headsigns. The system will also include deployment of an associated yard operations management system at every TTC garage, and incorporation of the new central system into a newly centralized control centre. Ms. Zhang assisted in testing support and document review.

Smart Driver Systems Deployment (2017 – 2018) – Metrolinx, Toronto, ON –

The Smart Driver project's vision is to deploy technologies to identify issues and monitor activities to decrease operating costs, as well as to improve overall safety. These two key functional areas are monitoring of bus driver performance and overall vehicle health. The latter by upgrading an existing Vehicle Health Monitoring (VHM) system, and the former by deploying a new Driver Behaviour Monitoring (DBM) System. Ms. Zhang assisted in the development of logical solution architecture documents and test case development.

BATA Transit Technology Review, Evaluation and Acquisition Plan (2020 – 2021) – Bay Area Transportation Authority (BATA), Traverse City, MI, USA –

BATA retained IBI Group to conduct a thorough review of the agency's current technologies and develop a comprehensive transit technology roadmap for its future operations. Ms. Zhang conducted an industry scan to identify new technologies that will address system gaps and agency needs. Ms. Zhang also developed an incremental transit technology plan that maximizes system potential and estimated the price of implementation.

Microtransit Pilot (2019 – 2020) – Metrolinx, Toronto, ON –

IBI Group supported Metrolinx in building the financial and economic elements of the business case for a micro-transit pilot at five GO stations. IBI Group assessed the ridership and revenue potential and determine the number of existing customers who may be enticed to switch from driving and parking at the station to using micro-transit. Ms.Zhang developed cost estimates for different business models and evaluation criteria to measure the success of the pilots.

Brianna Jasset
Transit Technology Analyst

Brianna is a Transit Technology Analyst that has professional experience with collecting and analyzing data on new transit technologies associated with demand response and micro-mobility services. In addition, Brianna has experience with transit technology strategy and requirements related to transit management systems, fare collection, and fleet electrification. Prior to IBI, Brianna co-led a six-month transportation demand management (TDM) project that encouraged University of Vermont employees to commute sustainably to work. In addition, Brianna developed, launched, and directed the weekly webinar series*, "Transportation Fridays,"* that has hosted and interviewed transportation professionals and public figures such as Chair of the Vermont House Transportation Committee Curtis McCormack and former Vermont Lieutenant Governor David Zuckerman.

Representative Experience

Sound Transit I-405 Stride BRT Phase 3 Bus System Requirements, Seattle, WA (2021-ongoing): IBI is a subconsultant on the Stride BRT Phase 2 conceptual design team responsible for the Needs Assessment and Concept of Operations (ConOps) definition for bus Intelligent Transportation Systems (ITS) components that will support *Stride* BRT service when it launches. The *Stride* program includes new BRT service along the I-405 corridor from Renton to Bellevue (the I-405 S corridor) and from Bellevue to Lynnwood (the I-405 N corridor), as well as the SR 522 corridor from Woodinville to Bothell. A new bus operations and maintenance facility (Bus Base North) in Bothell will also be built using a Design-Build approach. IBI, along with the rest of the Phase 2 team, was retained for Phase 3 of the project. Brianna supports the development of the battery electric bus charging, core ITS, and farebox requirements.

HIRTA Complete Trip – ITS4US Health Connector, Dallas County, IA (2021-Ongoing): IBI has been selected by HIRTA, one of the five awardees for Phase 1 of USDOT's Complete Trip Program, to serve a leading role in the development of an end-to-end customer experience for HIRTA riders seeking non-emergency medical transportation. The end-to-end experience will provide customers access to trip scheduling, trip management, and transportation services (including wayfinding) through one unified application. Brianna is responsible for addressing comments from USDOT, preparing 508-conformant documents, and supports other USDOT required project tasks.

NCATT – Technical Assistance, IA (2021-Ongoing): IBI has been selected by the CTAA as Strike Team consultant to work with N-CATT, ECICOG, and six counties operating demand response transportation within ECICOG's region to provide demand-response technology assistance and guidance to improve cross county coordination and day-to-day operations. Brianna is responsible for assisting in the development an operating environment report and supports required data collection project tasks.

Education

Bachelor of Arts in Environmental Studies,
University of Vermont, Burlington, VT, 2021

Experience

2021–Present
IBI Group, Boston, MA, Transit Technology Analyst

2020–2021
Sustainable Transportation Vermont, Burlington, VT, Internship Coordinator

2019–2020
Sustainable Transportation Vermont, Burlington, VT, Student Intern

NEORide Integrated Mobility Platform, OH (2021-ongoing): IBI Group has been selected by NEORide to develop an RFP for an integrated mobility platform that will manage both demand response and paratransit services. Brianna supports the development of paratransit system requirements and other required tasks.

NEORide Mobility Call Center (2020-On-going): IBI Group has been tasked with conducting a comprehensive review of existing technology and procedures for the paratransit services of five transit agencies in Ohio including SARTA (Stark County, OH), WRTA (Youngstown, OH), and Trumbull County Transit (Trumbull, OH) that are a part of NEORide. NEORide is an organization that supports statewide public transportation in Ohio, Michigan, and Kentucky and supports the coordination between them. The goal of the project is to identify the feasibility of creating a One-Call Center. This effort also includes identification of an implementation strategy for the group of agencies. Brianna provides on-going general support and provides assistance with other related tasks.

Lextran Accelerating Innovative Mobility (AIM) FTA Initiative, Lexington, KY (2020-ongoing) – The goal of the project is to use advanced technologies to improve the mobility options available to university students and staff to ensure their safe and reliable trips across the campus using a mix of scheduled and on-demand public transit services and related modes. Further, given the uncertainty related to demand (ridership) and supply (vehicle/driver needs) due to post-COVID-19 mobility needs, this project aims to provide Lexatran with the ability to 1) efficiently plan ahead for anticipated demand, 2) match supply and demand in real time to meet that vision and 3) have the flexibility to initiate new MaaS services to meet unanticipated needs and/or demands post-COVID. IBI Group led the writing of the grant that awarded Lextran over $400,000 in FTA funding. Brianna provides on-going general support, assists in document review, and other required tasks.

Southeastern Regional Transportation Authority (SRTA) Transit Technology Consulting, New Bedford, MA (2018-ongoing) – IBI Group has been supporting SRTA with the procurement and deployment for various technology systems, including CAD/AVL, real-time passenger information, maintenance management, radio integration, and fuel management systems. IBI Group supported procurement, contract negotiations, and is currently providing design review and deployment services. As part of this project, IBI Group has also supported an evaluation of SRTA's existing paratransit technology software and supported an upgrade of onboard paratransit technology and integration with the newly implemented onboard equipment. Brianna assists with testing and implementation support for paratransit vehicles and customer information systems.

Other Relevant Experience

Sustainable Transportation Vermont (STVT), Burlington, VT (2021 – 2021) Prior to IBI Group, Brianna served as Sustainable Transportation Vermont's Internship Coordinator. In this role, Brianna helped to grow STVT's larger student internship program by 72% in one year. In an administrative role, Brianna worked on the restructuring of STVT's internship program to now combine formal educational opportunities with fieldwork experience. Brianna achieved this through implementing weekly lectures taught by former city planner Faith Ingulsrud and breaking down the intern pool into individually supervised subgroups each with specialized projects and tasks.

Sustainable Transportation Vermont (STVT), Burlington, VT (2019 – 2020) As an intern at Sustainable Transportation Vermont, Brianna co-led a six-month transportation demand management (TDM) project that encouraged University of Vermont employees to commute sustainably to work. In addition, Brianna developed, launched, and directed the weekly webinar series, "Transportation Fridays," that has hosted and interviewed transportation professionals and public figures such as Chair of the Vermont House Transportation Committee Curtis McCormack and former Vermont Lieutenant Governor David Zuckerman.

Dorothy Liu
Transit Technology Analyst

Dorothy is a Transit Technology Analyst with a keen interest in transit planning and operations and how they could be optimized. She is also passionate about expanding public transportation's role in climate change mitigation, both through fleet electrification and through assisting transit agencies in designing and acquiring better technologies to improve services, thus competing with private transportation on a large scale. Since joining IBI Group, Dorothy has worked on a variety of traditional and multi-modal transit projects, furthering her knowledge and experiences not only in electrification technologies, but also in how to successfully manage and implement changes that technologies bring upon organizations.

Representative Experience

Toronto Parking Authority (TPA) EV Charging Strategy and Deployment Consultant Services; Toronto, Ontario (2021-Ongoing) –TPA's Green P eMobility Project will see the installation of 429 EV chargers in 25 parking garages by the end of 2024, and the following delivery of EV charging equipment across the remaining balance of TPA's surface parking facilities. Dorothy is the project coordinator of this project and works in close liaison with both the client and the internal IBI team. She oversees the project schedule, budget and scope to ensure that they align with client expectations and the project contract.

Metrolinx OnCorr Operational Readiness Change Management; Toronto, Ontario (2021-Ongoing) – Metrolinx is in the process of expanding their rail services to better serve the growing Greater Toronto and Hamilton Area by outsourcing parts of rail operations to a consortium of private enterprises. Dorothy is working closely with senior management at Metrolinx' Network Operations Centre (NOC) to identify change management needs, NOC deliverables, and resource needs to ensure the successful transition to the future state. This work involves extensive coordination with Metrolinx business owners, thorough understanding of program schedules and requirements, and development of ways of working with the consortium. Additionally, she is assisting the Metrolinx electrification effort by developing a workback schedule to determine Metrolinx' operational needs during the electrification transition, as well as an Electrification Strategy Presentation to establish the need for Metrolinx to become an informed owner during this process.

Chattanooga Area Regional Transportation Authority (CARTA) Electrification Feasibility Study and Business Case (2021-Ongoing) – CARTA retained IBI Group to investigate the feasibility of full fleet electrification and develop a business case to support this transition. IBI Group is currently in the process of completing the feasibility study. Dorothy conducted cost estimates for BEB capital and O&M costs, as well as costs for in-depot charging infrastructure. She will be continuedly providing technical support for the rest of the study.

Chattanooga Area Regional Transportation Authority (CARTA) MaaS Procurement and Implementation Support (2021-Ongoing) – IBI Group is providing consulting services to CARTA to retain a

Education

Bachelor of Applied Science in Civil Engineering, University of Toronto, 2021

Experience

May 2019–Present
IBI Group, Toronto, ON

Awards

University of Toronto Centennial Senior Project Award, 2021

2017 – 2021 Dean's Honours List

First Place - IBI Group Campus Connext Award, 2019

Young Leader Delegate – CUTA (Canadian Urban Transit Association) Young Leader Summit, 2019

Second Place – NECA (National Electrical Contractors Association) Green Energy Challenge, 2019

First Place - ILead (Institute for Leadership Education in Engineering) Social Innovation Project Competition, 2016

Dean's Merit Scholarship, 2016

Languages

Fluent in English and Mandarin

technology vendor to automate their current microtransit operations, and eventually support the agency's MaaS vision. Dorothy evaluated vendor technical proposals and demo with her team. Her feedback helped CARTA select a vendor that best meets their needs. CARTA is currently in the process of finalizing the contract with the preferred vendor. Dorothy will be providing implementation support such as testing and project management once the project kicks off.

Toronto Transit Commission (TTC) Operator Sign-Up and Daily Work Assignment Management Analysis; Toronto, Ontario (2021-2021) – TTC is modernizing its workforce management method and retained IBI Group to conduct an analysis on its operator sign-up and daily work assignment processes to document current state, identify gaps, and put forward recommendations. Dorothy estimated capital and operating costs, developed detailed project implementation timelines, and estimated TTC internal resource need by FTEs per quarter for three alternatives. Findings from her work were used towards evaluating the alternatives and recommending the best approach for TTC going forward.

Barrie Transit Comprehensive Transit Technology Review (2020-2020) – The City of Barrie retained IBI Group to investigate alternatives to improve its fare payment methods and specialized transit software, as well as to explore new and emerging technologies that will enhance the transit network and rider experience. Dorothy assisted in gathering stakeholder needs, alternative evaluation, and cost estimates for all three tasks of the project. For each alternative, she constructed a detailed technology implementation plan that took into account Barrie's internal resource capability, project dependency, required training, and capital and operating costs by quarters. Findings from her research were used towards developing a transit technology roadmap for Barrie Transit for the next twenty years.

Hamilton Street Railway (HSR) CAD/AVL Upgrade (2019-2020) – HSR retained IBI Group to conduct a CAD/AVL market scan in preparation for their CAD/AVL system upgrade. Dorothy conducted vendor evaluation to assess how well each vendor's technology addressed HSR's high- and medium-priority needs. She was also involved in the product and training cost estimations for each of the system upgrade options.

Peter Lai
Transit Technology Analyst Intern

Peter is a Transit Technology Analyst Intern who is passionate about the intersection of technology and transportation and has experience in data analysis, operations, modelling, and software development in transportation contexts. Using his interdisciplinary background in both Electrical & Computer Engineering and transportation, Peter has contributed to transit fleet electrification projects for agencies including Hamilton Street Railway, Brantford Transit, Chattanooga Area Regional Transportation Authority (CARTA), and Sound Transit in Seattle. To support the technical analysis, he has been developing software tools to perform automated route energy use modelling, charging simulations, scheduling optimization for power efficiency, and data visualization. Furthermore, Peter has experience with other transit technologies including CAD/AVL as well as real-time passenger information and digital platforms through project involvement with Brantford Transit and OC Transpo in Ottawa.

Representative Experience

Hamilton Fleet Transition Study, Hamilton, ON (2020 – Ongoing) – The City of Hamilton has retained IBI Group to study future propulsion technology options to lower emissions for the Hamilton Street Railway (HSR) bus fleet, as part of a larger project to design the new Hamilton Transit Maintenance and Storage Facility (MSF). The study is examining whether the fleet operating out of the new MSF should use Compressed/Renewable Natural Gas (CNG/RNG) propulsion (HSR's current fleet-wide strategy), a mixed fleet of CNG/RNG and battery electric bus (BEB), or a fully BEB fleet. As part of the first phase, Peter developed software tools to automate the energy modelling to evaluate the compatibility of BEB operation for individual service blocks and to optimize the charging schedule to maximize power efficiency.

Brantford Electric Bus Needs Assessment and Feasibility Study, Brantford, ON (2021 – Ongoing) - The City of Brantford has retained IBI Group to conduct a feasibility study to assess and recommend an approach to transition the city's conventional and specialized transit fleet to fully electric buses. The project is carried out through several tasks including facility assessment, electrical service assessment, route modelling, comparative analysis and alternative scenario development, and creation of a recommended implementation plan. Peter is facilitating the route modelling task to analyze the energy requirements of Brantford Transit service and to optimize facility charging activity to inform infrastructure procurement and any necessary electrical service upgrades.

CARTA Electrification Feasibility and Business Case, Chattanooga, TN (2021 – Ongoing) - IBI Group is working collaboratively with CARTA stakeholders to anticipate operational needs related to the next increment of fleet electrification, including evaluating the required access to electricity, charger space requirements, and complex service delivery models related to the replacement of long-range diesel buses with battery electric buses. The first phase of the project involves the development of a business case, including an analysis of the total cost of ownership, high-

Education

Bachelor of Applied Science in Engineering Science (Major in Electrical & Computer Engineering), University of Toronto, Toronto, ON, 2018-Present

Experience

2021–Present
IBI Group, Toronto, ON, Transit Technology Analyst Intern

2020
University of Toronto Transportation Research Institute, Travel Modelling Group (TMG), Toronto, ON, Summer Undergraduate Research Student

2019
Ministry of Transportation of Ontario (MTO), Toronto, ON, Traffic Engineering Intern

Awards and Publications

Rob & Sky Bicevskis Scholarship (2021)

NSERC Undergraduate Student Research Award (USRA) grant (2020) for summer research project in transit operating costs modelling and associated software development

The Peter Sands Award in Engineering Science (2020)

Dean's Honour List (2018-2021)

Finalist, STEM Fellowship Big Data Challenge (2018)

level facility infrastructure requirements, and greenhouse gas emissions. The second phase will see the development of an investment strategy detailing an implementation and procurement plan. As part of this work, Peter is involved in the analysis of route management and service delivery options for electric vehicle operation and modelling charging power demand. This will provide the foundation for investigating fleet replacement options, utility needs, and infrastructure procurement planning.

Sound Transit Stride Bus Rapid Transit, Seattle, WA (2019 – Ongoing) – IBI Group is a subconsultant on the Stride BRT Project Phase 3, responsible for developing design requirements for ITS packages, vehicles, battery electric bus (BEB) charge management system (CMS), and enterprise system interfaces, among others. Peter supported the system concept design and development of requirements and specifications for the BEB CMS, which provides control and optimization of key battery-electric bus fleet management functions, including fleet charging schedule management, real-time bus charge state/range monitoring to support dispatch, charging station management and monitoring, and performance reporting.

Additional Experience

OC Transpo Digital Platform Strategies, Ottawa, ON (2021 – Ongoing) - IBI Group is working with OC Transpo to help the agency determine a way forward with their various digital platforms. IBI Group will recommend strategies to inform how the City should proceed in the following focus areas: mobile app and website, including Real-time Passenger Information (RTPI) and trip planning, customer alerts and alerts entry system, and generating Real-time Information for O-Train Line 1. Our approach includes gathering information and existing conditions for all relevant digital platforms, understanding needs, issues, and the customer experience, conducting an industry review, identifying technology options, and recommending the best strategies to move forward with. Peter has been supporting the peer agency interviews, development of technology options, the design of a customer survey, and report writing for these key tasks.

Brantford Transit Fare and CAD/AVL Systems Replacement, Brantford, ON (2021 – Ongoing) - Brantford retained IBI Group to facilitate the replacement of the agency's current Fare and AVL systems for its Brantford Transit and Brantford Lift services. The project scope includes a thorough review of the agency's needs and pain-points for these systems, development of system architecture and specifications to address those needs, development of an implementation plan, and procurement and implementation support. To date, Peter has engaged in client stakeholder workshops and developed the draft system requirements and specifications.

Metrolinx GO Rail Expansion On Corridor Project, Toronto, ON (2020 – Ongoing) – Central to Metrolinx's GO Rail Expansion program, the On Corridor contract ("OnCorr") will result in the appointment of a private sector partner ("Project Co") with responsibility for the majority of on-corridor construction works and rail operations over the next 30 years. Metrolinx has retained IBI Group to manage the Operations Division's input into OnCorr and provide specialist technical support. The program is divided into multiple workstreams. The Performance stream includes defining, procuring, deploying, and implementing the performance management processes, people, and technology required to manage Project Co performance in the future. Peter created several business process maps using BPMN notation to build a visual representation of contract schedules, processes, and requirements for various Performance regimes.

Appendix B

Required Forms

PRICE QUOTE

Price to Complete Electric Vehicle Fleet Study $ $89,710

Additional Charges: $ $1,550

Four 1-person-day site visits
including flights, lodging, and food

Total: $ $91,260

List all applicable charges on the price quote. Any charge other than those listed on the price quote will not be paid.

Work will be invoiced monthly for the mutually agreed percentage completion on the work.

Topeka Metro is tax exempt. Do not include sales tax in your proposed price

DISADVANTAGED BUSINESS ENTERPRISES (DBE) CERTIFICATION

This contract is subject to the requirements of Title 49, Code of Federal Regulations, Part 26, *Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs*. The national goal for participation of Disadvantaged Business Enterprises (DBE) is 10%. Metro's overall 2019-2021 goal for DBE participation is 2.00%; the race neutral goal is 1.12%, and the race conscious goal is 0.88%. There is no contract goal for this procurement.

The contractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of this DOT-assisted contract. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as Metro deems appropriate. Each subcontract the contractor signs with a subcontractor must include the assurance in this paragraph (see 49 CFR 26.13(b)).

The contractor is required to pay its subcontractors performing work related to this contract for satisfactory performance of that work no later than 30 days after the contractor's receipt of payment for that work from Metro.

The contractor may not hold retainage from its subcontractors.

The contractor must promptly notify Metro, whenever a DBE subcontractor performing work related to this contract is terminated or fails to complete its work, and must make good faith efforts to engage another DBE subcontractor to perform at least the same amount of work. The contractor may not terminate any DBE subcontractor and perform that work through its own forces or those of an affiliate without prior written consent of Metro.

Signature: 

Name and Title: Santosh Mishra, Associate Director

Company Name: IBI Group Architects, Engineers and Landscape Architects

Date: 01/20/2022

FLY AMERICA CERTIFICATION

The Contractor agrees to comply with 49 U.S.C. 40118 (the "Fly America" Act) in accordance with the General Services Administration's regulations at 41 CFR Part 301-10, which provide that recipients and sub-recipients of Federal funds and their contractors are required to use U.S. Flag air carriers for U.S Government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. The Contractor shall submit, if a foreign air carrier was used, an appropriate certification or memorandum adequately explaining why service by a U.S. flag air carrier was not available or why it was necessary to use a foreign air carrier and shall, in any event, provide a certificate of compliance with the Fly America requirements. The Contractor agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

Signature: _____

Name and Title: Santosh Mishra, Associate Director

Company Name: IBI Group Architects, Engineers and Landscape Architects

Date: 01/20/2022

LOBBYING CERTIFICATION

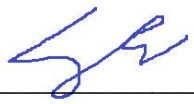
The undersigned contractor certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions. See 49 CFR 20.100.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 USC. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure. [Note: Pursuant to 31 USC 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure or failure. See 49 CFR 20.400.]

The undersigned contractor certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 USC 3801, et seq, apply to this certification and disclosure, if any.

Signature: 

Name and Title: santosh.mishra@ibigroup.com

Company Name: IBI Group Architects, Engineers and Landscape Architects

Date: 01/20/2022

NON-COLLUSION CERTIFICATION

This is my sworn statement to certify that this proposal was not made in the interest of or on behalf of any undisclosed entity. This proposal is not collusive.

This proposer has not been a party to any agreement or collusion in restraint of freedom of competition by agreement to bid a fixed price, to refrain from bidding, or otherwise. This proposer has not, directly or indirectly, by agreement, communication or conference with anyone, attempted to induce action prejudicial to the interest of Topeka Metropolitan Transit Authority, or of any proposer, or anyone else interested in the proposed contract.

Signature: 

Name and Title: Santosh Mishra, Associate Director

Company Name: IBI Group Architects, Engineers and Landscape Architects

Date: 01/20/2022

SUSPENSION / DEBARMENT CERTIFICATION

In regard to 2 CFR Parts 180 and 1200

In accordance with 2 CFR Parts 180 and 1200, the contractor is required to verify that none of its principals or affiliates:

1) is included on the federal government's suspended and debarred list;
2) is proposed for debarment, declared ineligible, voluntarily excluded or disqualified;
3) within three years preceding this proposal, has been convicted of or had a civil judgment rendered against them for (a) commission of fraud or criminal offense pertaining to performing a public transaction, (b) violation of any federal or state antitrust statute, or (c) embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property;
4) is indicted or charged by a governmental entity for any of the charges in 3) above; and
5) has had any public transaction terminated for cause or default within three years preceding this proposal.

The contractor is required to include this requirement in any subcontracts related to this contract.

By signing and submitting its proposal, the proposer certifies that the certification in this clause is a material representation of fact relied upon by Metro. If it is later determined that the proposer knowingly rendered an erroneous certification, in addition to remedies available to Metro, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment. The proposer agrees to verify that none of its principals or affiliates is included on the federal government's suspended and debarred list at any time throughout the period of this contract. The proposer further agrees to include a provision requiring the same compliance in its subcontracts related to this contract.

Signature: _____

Name and Title: Santosh Mishra, Associate Director

Company Name: IBI Group Architects, Engineers and Landscape Architects

Date: 01/20/2022