

# **Topeka Metropolitan Transit Authority**

Technical Proposal: 22PROPTRNP.0026 – Consulting Services – Electric Vehicle Fleet Study for Topeka Metro

> **Submitted by:** Wood Environment & Infrastructure Solutions 100 SE 9th ST STE 400 Topeka, Kansas 66612

> > January 20, 2022 Proposal Ref: 22PROPTRNP.0026



**TECHNICAL PROPOSAL** 

Wood Proposal #: 22PROPTRNP.0026

January 20, 2022

T: 1-785-272-6830

Richard Appelhanz Topeka Metropolitan Transit Authority 201 North Kansa Avenue Topeka, KS 66603

# Re: , Request For Bid for an Electric Vehicle Fleet Study, TO-22-09

Dear Mr. Appelhanz,

Wood Environment & Infrastructure Solutions, Inc. (Wood) is excited to submit this proposal in response to Topeka Metropolitan Transit Authority ("Topeka Metro") Request For Bid ("RFB") # TO-22-09 for an Electric Vehicle Fleet Study. As you read our technical proposal, we trust that you will find that we have the availability, capacity, staff, and experience to handle this assignment.

Wood has a history of delivering professional services in assisting transit agencies with the adoption of zero-emission buses ("ZEBs"), inclusive of advising on the infrastructure, equipment, and operational requirements of fleet transition. Wood's competitive advantage is based upon the following three (3) key winning themes:

**People:** Wood's proposed project team comprises experienced staff who are industry-leaders in delivering ZEB adoption projects for the public and private sector. Our Project Manager, Norman Hendry, is an accomplished Fleet Manager with more than 25 years of senior management experience. Furthermore, Norman was instrumental in the design and specification of a new 400 bus Transit and Maintenance facility that delivered ZEB's and industry leading charging infrastructure to the City of Edmonton . We are supported by experienced and trusted firms Kimley-Horn, and Omni Strategy LLC ("Omni").

**Track Record:** Wood's Zero Emission Solutions (ZES) taskforce comprises multi-disciplinary experts from across the Wood organization and academic experts who have excelled in applying theory into practical applications. This group has a track record of delivering ZEB pilots and alternative fuels feasibility studies across the United States, Canada, and globally. This includes nine (9) Facility & Infrastructure, fourteen (14) Agency Route simulations, and nine (9) Pilot support projects.

**Technology:** Wood has industry-leading tools and technology that will be used on this engagement, including the ZES Simulator. We will also leverage our partnerships with the University of Toronto Electric Vehicle Research Centre (UTEV) and the University of Toronto Bus Operations Research Lab to best leverage the most current electric bus data to the benefit of Topeka Metro.

We have organized the submittal in a manner consistent with the RFB, and fully responsive to the requirements of your solicitation. We are very enthusiastic about this opportunity and look forward to working with you on this important Electric Vehcile Fleet Study and if you have any questions regarding Wood or this submittal, please feel free to contact the undersigned.

Respectfully submitted,

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Table of Contents

1.0	Executive	Summary	
1.0	Execut	ive Summary	4
	1.1.	Why Wood	4
		a) Anti-Discrimination Statement from the Wood Employee Business Code	of Ethics:
		4	
	1.2.	The Wood Advantage	5
	1.3.	Wood's Direct Experience	5
	1.4.	Multi-disciplinary Project Team	5
		a) Kimley-Horn	6
		b) OMNI Strategy, LLC ("OMNI")	6
2.0	Experi	ence and Qualifications	7
	2.1.	Experience and Qualifications of Proponent Company	7
		a) Woods's Specialization and Expertise	7
		b) Transit Solutions at Wood	7
		c) Transit Fleet and Facility Solutions	7
		d) Transit Advisory Solutions	8
		e) Transit Infrastructure Solutions	8
		f) Transit Service Planning and Operations Solutions	8
	2.2.	Wood's Size	9
	2.3.	Wood's History	9
3.0	Projec	t Approach and Methodology	10
	3.1.	Project Understanding	10
	3.2.	Project Approach	10
	3.3.	Project Management Framework	11
	3.4.	Activity 1: Policy Landscape Review	11
	3.5.	Activity 2: Facilities and Operational Assessment	11
		a) Site Visits	11
		b) Existing Conditions Review	12
	3.6.	Activity 3: Battery Electric Bus (BEV) Feasibility Study	12
		a) Introduction to ZES Simulator	13
		b) Topeka Metro Consultation	14
		c) Consultation with Evergy (Electrical Utility)	15
		d) BEV Feasibility Analysis	15
	3.7.	Activity 4: Financial Analysis of BEV Transition	17
		a) Introduction to ZeroEmissionSim 360 (ZES 360)	17
		b) Financial Analysis of BEV Implementation	21
		c) Funding Landscape Review	21
	3.8.	Activity 5: BEV Implementation Strategy Development	21
		a) BEV Implementation Strategy	21
		b) Risk mitigation strategies	
Тор	eka Bid Subr	nission   January 2022	Page ii





	3.9.	Deliverables	23
	3.10.	Project Schedule	24
4.0	Project	Management and Personnel	25
	4.1.	Project Management	25
		a) Quality Management System	26
		b) Cost Control System	27
		c) Ensuring Projects Proceed at or Under Budget Estimates	27
	4.2.	Personnel	28
5.0	Propon	ent Roles and Qualifications	29
	5.1.	Key Personnel and Leads	29
	5.2.	References and Past Project Summaries	29
	5.3.	John Wayne Airport, Santa Ana, California, US	31
	5.4.	Arlington Transit (ART) Bus Electrification Study, Arlington County, Virginia, US	32
	5.5.	Division 2 and Division 4 BEB Facilities Infrastructure Upgrades, AC Transit, California	33
	5.6.	Electric Bus Needs Assessment and Rollout Plan, Town of Oakville, Canada	34
	5.7.	Canada Infrastructure Bank, ZEB Program Lender's Technical Advisor	35

# Appendices

Appendix A – Resumes

Appendix B – Equal Employment Opportunity (EEO) Policy

Appendix C – Requested RFB Forms







# **1.0 Executive Summary**

Wood Environment & Infrastructure Solutions, Inc. (Wood) is pleased to submit our proposal to Topeka Metropolitan Transit Authority ("Topeka Metro") for its Request For Bid # TO-22.09 for an Electric Vehcile Fleet Study. Wood has significant experience delivering transit fleet and facility related services, with most of the proposed project team having worked directly on the recently awarded contract for **Zero-Emission Transit Planning** by Arlington Transit ("ART") in Arlington County, Virginia. Some of Wood's latest transit engagements include **Implementation of Zero-Emission Transit** at John Wayne Airport ("JWA") in Santa Ana, California, and a **Battery Electric Bus Needs Assessment and Rollout Plan** for Oakville Transit in Ontario, Canada. These services meet the requirements specified by Topeka Metro in this Request For Bid. Wood's proposed project team members have extensive experience working together to deliver various transit fleet and facility engagements, many of which are significantly related to the Required Services as identified in the Request For Bid document.

# 1.1. Why Wood

Wood's has several key advantages to deliver this work, including:

- Depth of experience delivering transit related services across the transit lifecycle, with over 150+ combined years of experience across the proposed project team members. This includes professional engineers, financial modelers, cost consultants, environmental engineers, and charging infrastructure/gaseous fuels experts.
- Depth of direct engagement team experience and subject matter experts available as resources available to execute the Required Services as defined in the Request For Bid, with extensive industry relationships, partnerships, and access to information that can be leveraged to provide exceptional services to Topeka Metro.
- Direct experience delivering the same services requested in the Request For Bid, including the items identified in the list below. For each of the required services described in this proposal, Wood has an extensive detailed approach and work plan highlighting the project team's clear understanding of the requirements and its capability to deliver the services.

# a) Anti-Discrimination Statement from the Wood Employee Business Code of Ethics:

"Ensuring equal opportunity means that all employees and job applicants are afforded fair and nondiscriminatory treatment for both employment and advancement, irrespective of race, ethnic or national origin, age, gender, religion, sexual orientation, disability or other qualities and traits irrelevant to performing the tasks required. Employment, advancement and termination or retirement must be based on aptitude, abilities, skills and qualification." Please refer to Wood's Equal Employment Opportunities Policy added as Appendix B.





# 1.2. The Wood Advantage

Wood's proposed project team is recognized by transit agencies across North America and internationally for their work supporting fleet maintenance, inspection, operations, asset management and electric bus feasibility and implementation. The proposed project team members have an extensive track record delivering the services as required by Topeka Metro's Request For Bid, including the development of electric bus pilot programs, vehicle and charging infrastructure specifications, and completing operational feasibility assessments.

# 1.3. Wood's Direct Experience

Wood's proposed project team has direct experience delivering the Required Services, including:

- Electric bus needs assessments, electric charging infrastructure costing and implementation plans, electric fleet transition and integration plans, and pilot study development and monitoring
- Cost-benefit analysis between on-street and depot charging systems, including exploration of various combinations of both types of systems.
- Preventative maintenance training program development for both full-time and contracted staff, including delivery of training programs both in-person and remotely
- Development of preventative maintenance protocols and standard operating procedures
- Development of testing protocols and evaluation criteria for electric and hydrogen fuel cell vehicle propulsion technology
- Supporting transit agency staff in the development of RFP, RFT, and RFIs related to new bus procurement, facilitating industry access, and assisting in evaluation of proponents/respondents
- Support of transit agency staff in the quality assurance inspection of new buses, including real-time defect reports and insight generation, enabling identification of trends and underlying issues
- Industry research and insight of trends and technology innovation among manufacturers and peer transit agencies, including insights regarding lifecycle impacts of technology and infrastructure design and specifications

# 1.4. Multi-disciplinary Project Team

Wood has carefully selected the proposed project team with subject matter experts across their respective domains. Wood's proposed project team includes team members with significant experience in providing a range of services across the transit sector. Our team's multi-disciplinary experience spans vehicle technology, transit service design and simulation, transit operations and maintenance, facility design and infrastructure, environmental impact modeling, business case development, electric and traditional vehicle procurement, charging infrastructure, quality assurance inspections, and more.

Wood's proposed project team is strengthened by the depth of our selected subconsultants and their respective expertise and project experiences.

Profiles of each of the selected subconsultants and their relevant experience for Topeka Metro's Request For Bid are highlighted below.



#### a) **Kimley-Horn**

Kimley-Horn is an planning, surveying, engineering, and design consulting firm which has been listed at #21 in its "Top 500 Design Firms".

Kimley-Horn is a full-service consulting firm composed of transportation planners, roadway engineers, civil engineers,

electrical engineers, landscape architects, structural engineers, environmental professionals, and construction-phase specialists. Established by transportation planning and traffic operations specialists in 1967, Kimley-Horn offers a staff of 4,890 full-time and 180 part-time employees.

Kimley-Horn brings extensive transit planning capabilities and industry-leading electric vehicle (EV) charging infrastructure experience to the team. Kimley-Horn has successfully served transit agencies across the country under general planning and design consultant contracts as well as on transformative stand-alone projects. Working in the EV industry for nearly a decade, Kimley-Horn are trailblazers who understand the implementation of locations and infrastructure related to EV charging facilities.

A national firm, Kimley-Horn offices are geographically grouped into seven regions: Atlantic, California, Florida, Midwest, Mountain, Southeast, and Texas. They are financially strong and positioned for continued financial health. Kimley-Horn has the financial ability to successfully perform the services required by Topeka Metro.

#### OMNI Strategy, LLC ("OMNI") b)

Omni Strategy LLC (OMNI) is a Kansas-registered (Unified Certification Program) Minority Business Enterprise (MBE) / Disadvantaged Business Enterprise (DBE) business professionally serving the transportation industry.OMNI's core services are systems engineering and management consulting. OMNI specializes in providing vehicle/systems

engineering, operations, and maintenance support, quality assurance/inspection, system safety certification support, training, and evaluation program development, and project management support services to the masstransit and railroad industry. OMNI's experienced team champions the client's efforts in addressing the challenges faced during the lifecycle of "assets" — vehicles, wayside systems, and shop/facility equipment.

OMNI's highly competent and comprehensive staff includes seasoned engineers/managers and members whohave previously worked on major projects for railcar builders, fleet operations and maintenance contractors, transit agency engineering/maintenance departments, vehicle subsystem suppliers, and commuter railroads. OMNI's vehicle/systems engineering capabilities comprise all modes of transit and railroad - light rail, metro (subway), commuter/passenger rail, and bus.











# 2.0 Experience and Qualifications

Wood has assembled a team of highly experienced individuals with prior experience on similar projects to those described in Topeka Metro's request document. Within this section, we present Wood's Corporate structure, ownership, and history, as well as key information for our sub-consultant firms, that make up our team. Each firm brings unique strengths and while our team members' skills overlap in some areas, our different perspectives – local, regional, national, and global – will enable our team to not only bring existing best practices but also challenge each other to evaluate the current standards.

# 2.1. **Experience and Qualifications of Proponent Company**

# a) Woods's Specialization and Expertise

Wood provides consultancy, engineering, and project management services specializing in transportation infrastructure, water & wastewater, government, and industrial/pharma sectors for both private and public



sectors in all levels of government. In 2020, Wood was listed as the Engineering News Record (ENR) No.1 International Design Firm, as well as No.5 on the ENR Top 500 Design Firms.

Wood draws on an experienced local footprint with a wide geographical reach to support our clients' needs. With technical experts across Canada and around the world, we are committed to providing solutions to improve our clients' operations, provide innovative design solutions, reduce environmental liabilities, and increase efficiencies. With our global structure, clients benefit from experts with a broad understanding of local conditions coupled with easy access to some of the world's most renowned experts in their fields.

# b) Transit Solutions at Wood

Our key engineering services in the transit sector include architectural, structural, civil, mechanical, electrical, building science, traffic and transportation engineering specializing in bus and bus rapid transit (BRT) facilities, new and existing maintenance facilities, parking structures, planning and operational studies.

# c) Transit Fleet and Facility Solutions

Wood provides fleet and facility support to transit clients, focusing on ensuring transit assets and back-office assets such as facilities, non-revenue vehicles, and maintenance processes are optimized for agencies. Services include the following:

•

- Technical vehicle specifications (conventional, specialized, non-revenue)
- Fleet lifecycle analysis
- Fleet plans
- Training & LMS support (facility & fleet)
- SOP development (facility & fleet)
- Fueling infrastructure (natural gas, electric, diesel, hydrogen)
- Shop tools & PPE guidance

- Electric & hydrogen facility gap assessment
- Alternative fuel technology evaluation (natural gas, hydrogen, hybrid, electric)
- Bus & fleet lifecycle optimization
- Maintenance policy & plans
- Facility site selection
- Space needs assessment & facility sizing
- Specialty equipment identification & specification



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#### d) **Transit Advisory Solutions**

Wood serves small and large transit systems around the world. Our areas of coverage include:

- Business case development
- Travel demand analysis
- Transit master plan
- Integrated mobility •
- Ridership modelling & forecasting •
- RFP development & support •
- Change management strategies & plans •
- Business strategy & execution support •
- Feasibility studies ٠
- Zero emission/green fleet studies •
- Electric mobility solutions •
- Asset management plans & lifecycle analysis •
- Total cost of ownership analysis •
- Budget development & review

#### **Transit Infrastructure Solutions e**)

Wood provides detailed support in the area of transit infrastructure, from consulting to engineering of new stations, railways, and BRT corridors. Globally, Wood provides the following services in Transit Infrastructure:

- Project management
- Asset management •
- Infrastructure management •
- Facility design (bus & rail) •
- Contract negotiations •
- Environmental assessments •
- Environmental engineering •
- Air quality & noise assessments
- Public consultation & facilitation
- Contract administration
- Assistance with construction procurement and evaluation of tenders submitted

#### **Transit Service Planning and Operations Solutions f**)

Wood has the following capability for service planning and operational solutions for transit clients globally:

- Standard operating procedure (SOP) • development
- Training & Learning Management System • (LMS) support
- Route optimization •
- **Operational diagnoses**
- Transit service review

- First mile / last mile analysis
- Service design standards
- Fare evasion analysis & enforcement
- Specialized / paratransit reviews
- Electric & hydrogen bus range simulation
- Electric bus charging simulation
- Schedule adherence audit & diagnosis

Topeka Bid Submission | January 2022



- Engineering services during construction
- Current state facility and track assessment
- Topographical survey
- and preparation of construction tender documents
- Structural engineering / building sciences
- Resident site inspection
- Post-construction services

# Fare strategy & policy

- Organizational design & review
- Best practice review
- Benefit cost analysis
- Public-Private Partnership (PPP) & value for • money
- Performance standards & monitoring (key • performance indicators [KPIs])
- Family of services implementation •
- Alternative revenue generation
- Transit business plan
- Data insights & visualization •
- **ITS** technology







- Preliminary design & detailed design, specifications,

#### • Mechanical engineering •

- Electrical engineering •









• Dead head optimization

# 2.2. Wood's Size

We provide consulting, projects, and operations solutions in more than 60 countries, employing around 40,000 people.

# 2.3. Wood's History

Wood was founded in 1848 and is a global leader in consulting and engineering across energy and the built environment, helping to unlock solutions to some of the world's most critical challenges. In October 2017, Wood Group combined with Amec Foster Wheeler; Amec Foster Wheeler became a wholly owned subsidiary of John Wood Group plc headquartered in Scotland, United Kingdom. Our corporate history is illustrated in the graphic below.



Wood has been providing a full range of consulting services to our transit clients for over four decades. The Zero Emission Mobility team ("ZEM") has a combined 35 years of direct involvement in zero-emission mobility. Our key engineering services in the transit sector include architectural, structural, civil, mechanical, electrical, building science, traffic and transportation engineering specializing in bus and bus rapid transit (BRT) facilities, new and existing maintenance facilities, parking structures, planning and operational studies. With nearly 5,000 employees with transit expertise across the company, Wood has been able to rapidly respond to and complete over 200+ transit projects, ranging from less than \$5K to over \$15M in fees, annually for clients across North America. During these difficult times in the COVID-19 pandemic, Wood professionals have been engaged by various agencies to support strategic re-start plans.







# 3.0 **Project Approach and Methodology**

# 3.1. **Project Understanding**

Topeka Metropolitan Transit Authority has been operating public transit since 1973 and is the fixed route and paratransit public transportation operator in the city of Topeka, Kansas. The service over the years has continues to grow from a small, privately owned bus service into a leader in local transportation which provides bus service within the Metropolitan City, plus three miles and works with other



organizations to meet mass transit needs. Topeka Metro operates a fleet of 26 fixed route buses and 9 lift-equipped paratransit vehicles that provide fixed route service and paratransit service Monday through Saturday during daytime hours covering 12 fixed routes and two daily specials.

Wood understands that Topeka Metro has received a grant to purchase three (3) Battery Electric Buses (BEV's) to be put into service in early 2023 and is considering the potential for future increases in the percentage of BEV's in the fleet. With regards to this strategy of introducing these three (3) buses into the fleet and the consideration of transitioning more of the fleet to BEV's, Topeka Metro has issued this RFB to conduct an Electric Vehicle Fleet Study.

Wood understands that Topeka Metro is seeking qualified proponents to examine current electric vehicle regulations, laws, rules, policies and practices in the Topeka Metro service area, develop and provide BEV vehicle implementation strategies with the potential for partnerships with local businesses and vendors for BEV's and the required infrastructure and charging stations, and also to conduct a financial analysis that will provide estimates across the entire lifecycle of fleets and supporting infrastructure (capital, operations, staffing, maintenance, modifications) for all aspects of the BEV implementation and a list of potential funding sources for all associated costs.

Wood understands the importance of this study and the various tasks associated with its scope of work. We confirm that our proposed team has the capacity and skills to deliver the required scope of work for Topeka Metro. The proposed team members at Wood, Kimley-Horn and Omni Strategy have helped several North American transit agencies achieve their zero-emission goals. Wood is currently delivering a similar project for Arlington County, Virginia, where we are helping the City's transit system transition to assess the available fleet and facility for eventual transition to a zero-emission fleet. We propose to bring this experience and working knowledge to assist Topeka Metro in achieving their goal of transitioning the fleet to ZEB's.

# 3.2. **Project Approach**

The Wood team comprises multi disciplinary experts from across the Wood organization and subconsultant teams with experience delivering over a dozen projects in e-mobility and pilot deployment. The team includes mechanical, electrical engineers, utility experts, vehicle and maintenance professionals, and transit facility specialists. These synergies combined with extensive real-world experience have enabled Wood to develop implementation, which will be used by the team to deliver this project in the most efficient way possible.





# 3.3. **Project Management Framework**

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The Project Team will develop a Project Charter and detailed work breakdown structure (WBS) for the project. This will be followed by the development of the Project Management Plan and the RACI matrix to allocate project work packages among the Project Team. A dashboard will also be delivered for the client to view project progress. All these deliverables will be presented to the client at the Kickoff Meeting at the starting of the process to review the developed framework and provide approval.

# 3.4. Activity 1: Policy Landscape Review

The Project team will begin the engagement with a project kickoff to ensure that Topeka Metro's goals, objectives, and expectations for this project in terms of base assumptions, methodology, and operational requirements are understood and established. Before kickoff, Wood will perform a thorough review of the supplementary documents provided by the Topeka Metro.

The purpose of Activity 1 is to review the existing policy landscape of Topeka Metro in the context of transitioning to battery electric buses. This will involve a thorough assessment of the existing federal, state and county laws, policies, regulations, rules and best practices related to various aspects associated with the transitioning of the fleet to battery electric buses. This Review will also identify existing regulations and practices within the Operations and Planning

Wood can also provide a landscape review highlighting what other transit agencies are planning and implementing in their drive towards zero-emissions transit

Review will also identify existing regulations and practices within the Operations and Planning departments that will require modification in light of the shift to battery electric buses.

# 3.5. Activity 2: Facilities and Operational Assessment

# a) Site Visits

In order to navigate the change to BEV operations, a review of the existing facility infrastructure and current state of operations is imperative. The Project Team will plan site visits in consultation with Topeka Metro to assess the facilities (buildings, garages, depots) and will gather data about current operations (staging, fueling, cleaning, maintenance garage arrangement and repair, station processes). The Project Team will use Wood's 100-point facility inspection checklist document to walk through the sites various areas to ensure a good understanding of the two sites.

- 1. Vehicle storage/parking (indoor/outdoor)
- 2. Wash bays
- 3. Fleet maintenance bays/servicing
- 4. Administrative/office
- 5. Utility Site Servicing
- 6. On-Site Back Up Power

- 7. Stores/stock keeping
- Staff amenities
- 9. Staff parking (outdoor)
- 10. Electrical Equipment
- **11.** Compliance to building codes and standards for electric charging







The existing facilities and operations will also be assessed for their suitability for BEV based on the incorporated assumptions, BEV route modelling outputs along with other critical externalities such as climatic conditions, factors (weather, precipitation), grade, utility infrastructure. The facilities and operations will be assessed against the following three scenarios:

- electrification of 1/4 of all the existing blocks
- electrification of 1/2 of all the existing blocks
- electrification of all the existing blocks

# b) Existing Conditions Review

The Project team will reach out to Topeka Metro to collect a round of data to develop a understanding of current state operations. The Project team will undertake a full document and data review of provided material. The Wood Team has a track record of working on zero-emission mobility projects and has methods to assist organizations in producing data requests and augment their data.

This information will serve to create an inventory of Topeka Metro current transit assets and their associate capital and operational costs. These will serve to populate the business-as-usual scenario in the financial analysis planned for Activity 4.

# 3.6. Activity 3: Battery Electric Bus (BEV) Feasibility Study

The purpose of this activity is to develop an transition plan which will guide the transition from existing GHG technology to the preferred BEV alternative. This will include determining which blocks are ready for transitioning to zero emission technologies, evaluating the required equipment and infrastructure to support the deployment, and supplementing the findings with recommendations with regard to adoption considerations (adherance to policies, standards, and training).

This activity will help assess the feasibility of BEV deployment on existing Topeka Metro blocks, peak power demand, energy consumption, and challenges/limitations for achieving 100% fleet decarbonization. This will also provide a list of blocks that are not feasible for charging with the use of the current plug-in or on-route charger technology.

Through this activity, the project team will also determine the optimal amount of charging equipment necessary to support the deployment of BEVs. Efficiencies associated with charging (both energy and power throughput) will be leveraged to optimally size the electrical infrastructure (switchboards, transformers, on-site distribution).

This section will be able to address the following aspects identified in the RFB:

- Impact of adding electric buses to the existing Topeka Metro fleet
- Impact of adding just 3 electric buses to the Topeka Metro fleet
- Best blocks for the deployment of 3 electric buses procured by Topeka Metro
- Implementation schedule of electric buses on Topeka Metro routes
- Location and quantity of electric bus charging stations needed to service an all electric fleet
- Requirement of operational changes when considering different electrification scenarios: 1/4 routes, 1/2 routes, etc.

Topeka Bid Submission | January 2022







- Recommendations on electric bus charging to optimize the power levels against costs
- Number of additional electric buses required to meet the current level of operations
- Optimization between on-route charger requirement vs additional BEV

# a) Introduction to ZES Simulator

Wood will bring our proprietary tool known as ZeroEmissionSim ("ZES") to Topeka Metro's Electric Vehicle Fleet Study. ZES is a cloud based simulation based on Wood's digital twinning tool that allows cities to evaluate alternative fleet scenarios and the route/block feasibility of adopting a new zero or a low emission power system.



ZES comprises a leading-edge simulator called ZES simulator, whose solutions are derived using realworld Zero-Emission Bus (ZEB) fleet operations and maintenance data with the help of Machine Learning (ML) and Artificial Intelligence (AI) models. The application uses a combination of theory and real-world telematics, including battery chemistries, to predict BEV characteristics. The simulator is the product of the continuous innovation and collaboration between Wood and our academic partners to create an interactive cloud platform, giving agencies the power to see, in real-time, adoption scenarios and vehicle characteristics. The simulator has four unique parameters: Network, Vehicle, Operation, and Charger. Once the original network is set up, the remaining three parameters can be modified for the three scenarios to be tested against the Business as Usual (BAU) option. An advantage of ZES simulator is the speed of simulation and the ability to run multiple concurrent scenarios for clients.

Figure 1 - ZES Simulator capabilities, Figure 2 - Route setup / Generation, and Figure 3 - Network level SOC show some of the ZES capabilities.







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n-Route Charging	6,953802	20	060056	1829.05	12.4 hrs	205.4	387.4	1022			65		1,466	
acity Charging	6_9652302	6	17,01,06	2022/02	3.3 hs	80.3	158.9	47.2	0	263	545	0	626	
neres Profile	b_9652202	6	055219	08.37.46	2.834	79.3	139.7	35.2	0	264.6	595	0	586	
	6,993392	6	03136	115446	44hs	95.3	2067	142		196.9	445		458	
hedule View	6,902902	2	0.010	98.07.03	1334	31.6	67	20.5		337.4	75A 🔤		242	
cenario Builder	6,965962	6	1551.06	20.05/03	4.0h5	94.8	181.2	15.3	0	229.5	515	0	130	
uncy hubber	b_9653332	6	192406	1557-46	4.63m	129.4	265.5	72.5	0	138.3	345	0	1,319	
	6,983992	6	HILM	1817.46	3.8 hs	12	1944	98.5		209.2	475		415	
urger buhder	6,965962	4	1431.06	1640.11	2.3 hs	\$5.7	126.6	37.8	0	276.8	625	0	536	
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Figure 3 - Network level SOC

The Project team comprises multidisciplinary experts from across the Wood organization and subconsultant teams, with experience delivering over a dozen projects in e-mobility and pilot

deployment. The team includes mechanical, electrical engineers, utility experts, vehicle and maintenance professionals, and transit facility specialists. These synergies combined with extensive realworld experience have enabled Wood to develop implementation, which will be used by the team to deliver this project in the most efficient way possible.

# b) Topeka Metro Consultation

The Project team proposes to use the ZES simulator to deliver the BEV conversion analysis. To begin with, Wood will conduct a ZES scenario workshop that will bring together the Topeka Metro project Wood's ZES simulation tool is based on digital twinning technology and utilizes and extensive database of existing transition data that also comprise of extreme weather conditions including temperatures as low as -40° F

team, and related stakeholders. This will be done to understand the operational needs of their users and vehicles, data collection requirements, and the perception of zero-emission vehicles. The Project team will develop multiple scenarios with varying BEB deployment levels configurations (1/4 runs, 1/2 runs, all runs), rank the scenarios based on client preference, and map out the adoption scenarios that can be completely developed and analyzed using the ZES simulator app. The ZES simulator app has a series of inputs focused on vehicle parameters, charging strategy, weather considerations, lifecycle challenges, and other limiting parameters. The workshop will take two hours to complete and be







monitored by the Project Manager. The workshop will begin with a summary of various considerations when adopting on-route charging, such as charging equipment, bus battery size, charge rates, power draw, and lessons learned from other adoption experiences. Future trends within the industry will also be communicated to attendees.

# c) Consultation with Evergy (Electrical Utility)

Discussions with Evergy will be conducted early in the project to introduce the project and best understand opportunities and constraints. This will support the review of historical power consumption, understanding any upgrades planned for identified areas, and any competing loads which may come on-line in the next decade. Discussions will identify future power requirement challenges the utility might have with the introduction of electric vehicles to the Topeka Metro fleet. The Project team will review power utilization and the information from discussions to establish a baseline and adoption scenarios. Moreover, a conversation regarding Topeka Metro's current and post-adoption pricing structure will serve as a source of important insights in the current state report.

Project Team will continue to meet with Evergy throughout the planning process to refine the highlevel gap analysis for future infrastructure requirements.

# d) BEV Feasibility Analysis

The Project team proposes to use the ZES simulator to deliver the BEV conversion analysis. To begin with, Wood will conduct a ZES scenario workshop that will bring together the Topeka Metro project team, the local utility Evergy and related stakeholders. The intent will be to develop multiple scenarios with varying BEV deployment levels configurations (¼ runs, ½ runs, all runs), rank the scenarios based on client preference, and map out the adoption scenarios that can be completely developed and analyzed using the ZES simulator app. The ZES simulator app has a series of inputs focused on vehicle parameters, charging strategy, weather considerations, lifecycle challenges, and other limiting parameters. The workshop will take two hours to complete and be monitored by the Project Manager. The workshop will begin with a summary of various considerations when adopting on-route charging, such as charging equipment, bus battery size, charge rates, power draw, and lessons learned from other adoption experiences. Future trends within the industry will also be communicated to attendees. The findings of the study will be consolidated in the draft final report that will be presented to Topeka Metro's project team and relevant stakeholders.

# d.i) Route Modelling

Wood will model the BEV deployment for each scenario identified in the ZES workshop. The objective of this modelling will be to establish the facility and infrastructure requirements for supporting fleet electrification and identify the opportunities where BEVs can be successfully deployed with minor or no service and reliability changes. The route modelling will be performed through Wood's ZES Simulator, which will include a block level analysis providing results such as block completion percentage, energy consumption, peak power demand, annual power demand, battery SOC impacts due to route topography, climate, passenger load, auxiliary load, and operating and maintenance costs. Wood will review ZES modelling outputs for the Topeka Metro's existing routes to identify the best-suited blocks for electrification as a priority and classify each block as either feasible or not feasible with the use of current BEV specifications.

Wood will model the ZEB deployment for each scenario developed in the ZES workshop. This objective of this modelling will be to establish the facility and infrastructure







requirements for supporting fleet electrification and identify the opportunities where ZEBs can be successfully deployed with minor or no service and reliability changes. The route modelling will be performed through Wood's ZES Simulator, which will include a block level analysis providing results such as block completion percentage, energy consumption, peak power demand, annual power demand, battery SOC impacts due to route topography, climate, passenger load, auxiliary load, and operating and maintenance costs. Wood will review ZES modelling outputs for Topeka Metro's existing routes to identify the best-suited blocks for electrification as a priority and classify each block as either feasible or not feasible with the use of current ZEB technology.

The results of the route modelling will be summarized in an electrification analysis

presentation and summarize as block completion rate, the feasibility of BEV deployment, peak power demand, energy consumptions, and challenges/limitations for achieving 100% fleet decarbonization.

## d.ii) On-route charging analysis

Using the list of blocks that failed to be electrified based on the desired bus specifications and operating conditions. Wood will refine its simulations through the incorporation of on-route charging infrastructure. This will allow Topeka Metro to understand which on-route Wood has signed Non-Disclosure Agreements (NDA) with multiple charger manufacturers and has access to detailed battery chemistry, charging curves and other specifications thus, enhancing model accuracy

charging locations enable which blocks, and how much energy/power is required to do so. To verify the feasibility of each charging location, Wood will pick the locations that can provide 100% electrification to the block it serves.

Wood can also utilize the optimization algorithms in the ZES simulator to identify the most optimal location based on the GTFS and route data. In this case, the optimal location denotes the location that can satisfy the same block electrification level by utilizing a lower number of on-route chargers. For example, instead of choosing a scenario that requires chargers at three (3) locations to achieve the required block electrification %, the ZES simulator has AI capabilities to pick a scenario that can satisfy the same block electrification % requirements fewer locations with the same or lower or higher number of chargers/dispensers. ZES simulator can also identify optimization scenarios where the total electricity draw level can be lower by maintaining the same service levels with the use of varying bus SoC thresholds. The optimization algorithms can also be used to optimize charging time for the buses to minimize the electricity cost and peak load demand.

Wood will also provide a list of blocks that are not feasible for on-route charging with the use of the current on-route charger technology.

# d.iii) Charging equipment and infrastructure requirements

Using the results of the simulations, Wood will determine the optimal amount of charging equipment necessary to support the deployment of ZEBs. This will include considerations for charging efficiency of equipment (both energy and power throughput), such that the electrical infrastructure (switchboards, transformers, on-site distribution) can be sized accordingly. This process will involve continuous collaboration with Evergy such that any





network upgrades (such as substations) will be understood, as well as required ownership models necessary when depoying large scale infrastructure.

The simulation outputs will identify the optimal charger power levels to address the requirements of low costs and fast-charging schedule. Based on the simulation outputs and the inputs from Evergy, recommendations on the charging process will be developed.

# d.iv) Optimization of fleet and charging assets

The Project Team will utilize the findings of the route modelling study and its knowledge of the existing fleet and charger technology to optimize the number of BEV required by Topeka Metro against charging infrastructure requirements by varying and identifying the right combination of battery capacity, charger configurations, charger locations and charger power level. This will be done for the three configurations:

- Electrification of 1/4 of all the existing blocks
- Electrification of 1/2 of all the existing blocks
- Electrification of all the existing blocks

# 3.7. Activity 4: Financial Analysis of BEV Transition

The purpose of this activity is to financially estimate the costs associated with transitioning from existing GHG technology to battery electric alternatives. This will include comparing battery-electric technologies for two adoption scenarios: replacement of existing assests, and growth following Topeka Metro's growth plans/strategies. This section will address the following questions listed in the RFB:

This section will be able to address the following aspects identified in the RFB:

- Cost estimates associated with all aspects of BEV implementation including infrastructure (fleet, equipment and facilities), supplies, labour and operations
- Total lifecycle costs of the BEV assets along with an assessment of larger impacts across Topeka Metro operations

# a) Introduction to ZeroEmissionSim 360 (ZES 360)

As part of our proprietary ZeroEmissionSim (ZES) application, Wood brings the best-in-class triple bottom line (capital, social, environmental) app, ZES 360, to develop robust scenarios for the implementation and cost estimation of the green fleet. ZES 360 allows users to set up forecasts for 5,10,15, 25, and 50-year outlooks with the capability of testing up to three scenarios simultaneously against the business-as-usual scenario. Moreover, each scenario is computed against a Net Present Value (NPV). This tool is structured with total lifecycle considerations for



clients and will take the capital, operating cost for zero or low emission adoption from the perspective of facility, infrastructure, vehicles, fueling infrastructure, chargers, on-site generation and storage, and organizational training and tooling. Outputs include total NPV for each scenario, payback periods, GHG per scenario, GHG per dollar spent, Fleet Adoption, and Phasing. The ZES 360 application can also perform a sensitivity analysis.



Page 17

Wood can also provide detailed analysis of battery recycling and explore its implications in terms of operations and costs for Topeka Metro



ZES features over 400 data points structured in five key areas (facility, fleet, people, environment, and infrastructure) to assist a user to build out multiple scenarios and test sensitivities of pricing of battery cost changes, electricity rates, and maintenance changes over time. The following tables is a sample of capital and operating expenditures (CAPEX and OPEX), as well as GHG emissions, which are captured in the ZES 360 analysis:

## People

- Personal Protective Equipment (PPE), (OPEX \$)
- Tools and Training, (OPEX \$)
- Health of Drivers, (OPEX \$)

## Environment

- GHG Emissions & Air Contaminants (Tailpipe) (OPEX GHG)
- GHG Emissions & Air Contaminants (Upstream) (OPEX GHG)
- Noise Pollution (OPEX Dba)
- \$ Noise Reduction (OPEX \$)
- \$ GHG Tonne Pricing (OPEX \$)

## Facility

- Facility Modifications (CAPEX \$)
- Equipment & Shop Tools (CAPEX \$)
- Facility Chargers (CAPEX \$)
- Facility Chargers Maintenance (OPEX \$)
- Facility Charger Overhaul (CAPEX \$)

## Infrastructure

- On-Route Chargers (CAPEX \$)
- Utility Service Upgrades (CAPEX \$)
- On-Route Charger Maintenance (OPEX \$)
- On-Route Charger Overhaul (CAPEX \$)
- On-Site Storage & Generation (CAPEX \$)
- On-Site Storage & Generation (OPEX \$)

### Fleet (Conventional, Specialized, NRV)

- Fleet Purchase Cost (CAPEX \$)
- Fleet Maintenance Cost (labour, parts) (OPEX \$)
- Fleet Overhaul (labour, parts, components) (CAPEX \$)
- Battery Overhaul (labour, parts) (CAPEX \$)
- Fleet Consumables (fluids, shop supplies) (OPEX \$)
- Fuel & Energy Cost (kwh \$, Diesel Liter \$) (OPEX \$)

The ZES 360 tool can model the phased implementation of zero or low carbon emission vehicles and infrastructures. The tool can consider several aspects throughout the fleet's transition such as implemented policies, regulatory requirements, and parallel operation of conventional and zero or

Topeka Bid Submission | January 2022





low carbon emission vehicles. Figure 4 - Comparison of forecasted capital and operating, Figure 5 - Capital budgeting investment plan, Figure 6 - Phased transition plan for the deployment of a low carbon fleet, Figure 7 - Tailpipe emission forecast and Figure 8 - Estimated total fuel vs electricity cost comparison all show sample outputs from of ZES 360.



# Figure 4 - Comparison of forecasted capital and operating expenses disclose bus procurements alternative propulsion vehicles alt. propulsion midlife overhaul program a Infrastructure upgrades Total and the second seco



Figure 5 - Capital budgeting investment







Figure 6 - Phased transition plan for the deployment of a low carbon fleet



Figure 7 - Tailpipe emission forecast



Figure 8 - Estimated total fuel vs electricity cost comparison





# b) Financial Analysis of BEV Implementation

The Project Team will leverage its extensive experience across triple bottom line considerations (capital, social, environmental) to develop a robust implementation plan for the procurement, phasing, and transition of operations of the proposed BEV program. This will include a financial transition plan forecasting annual capital and operating expenditures (vehicle procurements, operating and maintenance expenses) of BEV adoption and facility development as well as estimated timelines for the duration of project execution and into the operations period.

The timing of diesel and battery electric bus procurements will follow the fleet growth plan established as part of the implementation plan, and will serve to inform capital costs, maintenance costs, and unit retirements for each year of the plan.

- Wood will use ZES 360 to forecast the following characteristics of the project:
- The capital investment required in the continued procurement of buses.
- Operating expenses, including fuel, electricity costs, maintenance, and midlife overhauls.
- Greenhouse gas emissions and other environmental impacts of electrification.

The model will quantify and value the reduction in GHG emissions from the transition from fossil fuel consumption by business-as-usual vehicles to the lower amount of GHG produced to generate the power to recharge the electrified fleet. Annual operating cost saving will be highlighted, such as reduced maintenance for BEV compared with traditional propulsions systems and the elimination of most fuel costs.

The capital investments required for facility modifications, such as an expansion to the bus storage are, will be added using cost per square meter approximations. Costs associated with specialized tooling for new gantry platforms, cranes, and static free spaces will be informed by Wood's industry partners.

The analysis will result in a comparison of battery-electric buses with the existing technology. These will be presented for each procurement plan, first using one-to-one replacements of the existing fleet and second, following the anticipated growth plan provided by Topeka Metro.

# c) Funding Landscape Review

The Project Team will leverage its extensive knowledge and network to assess the funding landscape in US and Kansas, and will provide the outcomes in the draft final report. The Project Team will also inform Topeka Metro of other options such as financing or leasing of BEV assets and battery leasing opportunities.

# 3.8. Activity 5: BEV Implementation Strategy Development

# a) BEV Implementation Strategy

The Project Team will use the outputs of Activities 1-4 in developing the overall BEV Implementation Strategy for Topeka Metro. This final strategy development document will comprise of high-level guidelines for installation and maintenance of the chargers along with a phased plan for replacing existing bus fleet at Topeka Metro with BEV. The Project Team will also provide a detailed list of potential vendors for BEV, charging infrastructure and other supporting equipment. This section will also provide high-level designs and layouts for parking, refueling and bus storage to streamline operations of BEV and diesel buses in a mixed-fleet environment.





The Project Team will leverage their experience of planning and managing electric bus and chargers pilot projects to provide suggestions and feedback regarding the deployment of the initial 3 BEVs and supporting charging infrastructure. The Project Team will be able to provide benchmarks and parameters for evaluating the system's performance and identify potential challenges and opportunities with respect to future procurements.

# b) Risk mitigation strategies

The findings from Activities 1-4 will be expanded to

identify any potential challenges that may expose Topeka Metro and local agency stakeholders to risks. Strategies to mitigate risks will be presented for each challenge identified.

Value Add

Wood has experience in pilot planning and implementation. Guidance on initial 3 BEV deployment: Wood will provide planning guidance and identify Key Performance Indicators (KPIs)





# 3.9. **Deliverables**

Please find the proposed deliverable schedule summarized in the table below assuming a start date of February 2022:

Activity	Deliverables	Date
Project Management Framework	<ul> <li>Project Management Documentation</li> <li>Meeting Schedule</li> <li>Project Deliverable Schedule</li> </ul>	Ongoing
<b>1.</b> Policy Landscape Review	<ul> <li>Memo on the existing legal, policy and regulatory framework</li> </ul>	• March 15 <sup>th</sup> , 2022
<b>2.</b> Facilities and Operational Assessment	• Site Visits (based on Wood's and Topeka Metro's local health advisories)	• March 15 <sup>th</sup> , 2022
<b>3.</b> BEV Feasibility Study	<ul> <li>Memo on the BEV Feasibility Study covering:         <ul> <li>Route Modelling</li> <li>On-route charging</li> <li>Charging equipment and infrastructure requirements</li> <li>Optimization of fleet and charging assets</li> </ul> </li> </ul>	• May 15 <sup>th</sup> , 2022
<b>4.</b> Financial Analysis of BEV Transition	<ul> <li>Memo on the Financial Assessment of BEV Transition covering:         <ul> <li>Financial Analysis of BEV Implementation</li> <li>Funding Landscape Assessment</li> </ul> </li> </ul>	• July 7 <sup>th</sup> , 2022
<b>5.</b> BEV Implementation Strategy Development	<ul> <li>Memo on the BEV Implementation Strategy</li> <li>Risk Mitigation Strategies</li> </ul>	• August 15 <sup>th</sup> , 2022

Topeka Bid Submission | January 2022





# 3.10. **Project Schedule**

Topeka Metro																										
Project Schedule																										
Month		February			м	arch			A	pril			м	lay			Ju	ine			J	uly			Aug	ust
Week	Week 1 We	eek 2 Week	3 Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3
Project Management Framework				1	1			1		1	1	1	1			1	1	1		1		1				
i Project Management Documentation																										
ii Kick-off & project update meetings		М	М		М		М		М		М		М		М		М		М		М		М		М	
iii Quality assurance and quality control																										
iv Final presentation																									D	R
Activity 1 - Policy Landscape Review											_			_								-				
1 Assessment of Policy, Regulations and Legal frameworks					D	R																				
Activity 2 - Facilities and Operational Assessment																						-				
2 Site Visit			W																							
3 Existing Conditions Review																										
Activity 3 - Battery Electric Bus (BEV) Feasibility Study																										
4 Topeka Metro Consultation				w																						
5 Utilities Consultation				w																						
6 Route Modelling																										
7 On-route Charging Analysis																										
8 Charging Equipment and Infrastructure Analysis																										
9 Optimization of fleet and charging assets																										
10 BEV Feasibility Memo													D	R												
Activity 4 - Financial Analysis of BEV Transition		·																								
11 Financial analysis of BEV Implementation																				D	R				i T	
12 Funding landscape review																										
Activity 5 - BEV Implementation Strategy Development																										
12 Risk Mitigation Strategies																										
13 BEV Implementation Strategy																									D	R

L	.egend
	Wood Task
М	Meeting
w	Workshop
D	Deliverable
R	Client Review









# 4.0 **Project Management and Personnel**

# 4.1. Project Management

The Project Team will be governed by a project management system (PMS) that is designed to achieve our goal to "deliver quality services on schedule and within budget". Norman Hendry, Wood's Project Manager will manage an integrated PMS with the delivery of services that demonstrates a thorough understanding of the project objectives, assigns the right tasks to the right expertise, and implements a detailed work plan, communication plan, financial management plan, health, safety, and environment plan. Wood's Project Manager will be supported by the Project Coordinator, Saravanan Kumar. Saravanan will support the Project Manager in the day-to-day management, project delivery, lead meetings, and engagements in the absence of our Project Manager. Wood confirms that Norman will be available to Steering Committee for project management meetings as required. Additional details of Norman's role and responsibilities to be performed during the execution of this project are included in the table below.

Task	Role/Responsibilities
Project Management	<ul> <li>Chair all Project Team, subconsultant, agency, and stakeholder meetings</li> <li>Identify design and project quality, constructability, cost effectiveness and safety issues</li> <li>Direct, advise and monitor senior consultant staff</li> <li>Verify appropriate communications between project team members occurs, including regular project team meetings</li> <li>Verify that appropriate data sharing occurs</li> <li>Allocate resources to provide timely completion of the assignment by qualified staff</li> </ul>
Coordination of Subconsultants and Specialty In- house Staff	<ul> <li>Responsible for subconsultant and specialty staff initiation and regular subconsultant and specialty staff liaison</li> </ul>
Schedule and Cost Control	Monitor project progress and complete project reporting
Client Liaison	<ul> <li>Responsible for daily or regular client liaison</li> <li>Copied on all retainer project related correspondence</li> </ul>
Consultation with External Agencies and Stakeholders	• Liaise with various agencies to obtain any necessary information to inform the retainer project, if required
Quality Control	<ul> <li>Verify quality assurance and quality control (QA/QC) procedures are in place and being implemented</li> <li>Responsible for ensuring all project deliverables in both draft and final format have been reviewed and approved by senior QA/QC reviewers</li> <li>Verify that identified QC corrective measures are implemented</li> </ul>

Topeka Bid Submission | January 2022

Page 25

wood.



A project task charter will be developed upon project initiation to facilitate communications, set expectations among the team members, and drive the consistency of all deliverables. This charter will incorporate a project team contact list and RACI (responsibility assignment matrix) to ensure that the various project team members will be informed, consulted, accountable, and responsible for various tasks. Wood will use Microsoft Teams and Office 365 bundles that have advanced file sharing and team collaboration capabilities. Microsoft SharePoint will be used to efficiently share large files both internally and with the Steering Committee.

To ensure successful delivery of this project and associated tasks, we propose the following meeting schedule to inform clients of the status of project deliverables and provide opportunity for discussion, questions and any course correction.

**Bi-weekly Meetings:** Bi-weekly meetings (using Microsoft Teams) will occur between the Project Manager, Project Coordinator, and any pertinent disciplines to review the action items list, resolve issues, and provide updates. These meetings will occur internally to assist quality control, review performance, resolve resource issues, and coordinate with other internal/external stakeholders, as required. Wood will keep the Steering Committee updated on any matter discussed during the bi-weekly meetings that require their attention.

The supplementary objective of bi-weekly meetings is to share information and keep all stakeholders up to date throughout this study. For all meetings and presentations, materials (agenda, reports, and deliverables) will be circulated at least one (1) week in advance to provide adequate time for review and comments.

# a) Quality Management System

We are committed to satisfying our clients' requirements while continually improving our standard of service. We have a comprehensive Quality Management Plan (QMP) that is aligned with the ISO 9001 Standard. Our program is structured to assure project delivery consistency across our business and is built on project management, sound engineering/ technical work, and supply chain/procurement policies and procedures. This project will be completed in accordance with our QMP.

Our Technical Review Procedure requires an informed independent evaluation by one of our designated seniorprofessionals of all opinions, conclusions, and recommendations that are the outcome of any of our projects. This procedure applies to all staff, whether in licensed practice areas or other science/technology-related fields.Technical Review is an integral part of the process we use to execute projects. The review is conducted throughout the life of the project to help promote a surprise-free technical environment. Harpal Kapoor, Vice President of Advanced Bus Technology Programs at Omni Strategy, LLC, a DBE based out of Maryland, and Carly Macias, Transit Project Manager at Kimley-Horn, will be providing Quality Assurance on all Wood's deliverables to Topeka Metro and local agency project managers. He will also be available for providing any on-site assistance that may be required during the length of this project.

Norman Hendry, as our Project Manager, will help ensure consistency across the project, as will our dedicated team.







# b) Cost Control System

A key aspect of effective project management is having appropriate systems in place to monitor and control progress in terms of cost and time. This has a triple benefit of describing performance, identifying negative trends and forecasting the end state.

Having a cost/budget control system in place enables Project Managers to analyze a project's cost trajectory, and can provide a wide variety of information, according to the specific needs of Topeka Metro. Through this system our Project Manager, Norman Hendry can provide Estimates-to-Complete, and Estimates-at-Completion related to our services. Generally, the approach is as follows:

- Work hours are estimated to complete each deliverable or task
- The total cumulative work hours determine the baseline budget
- Progress against each deliverable or task is measured based upon predetermined completion milestones (e.g., the physical percentage complete at a certain time during the project)
- Earned value is then calculated to show the work hours that were planned to be spent to achieve the
- measured progress at a specific point in time
- Comparing actual work hours expended against the earned value gives an accurate indication of both, schedule, and budget performance

# c) Ensuring Projects Proceed at or Under Budget Estimates

Norman has the authority to assign sufficient staff and resources to projects to meet commitments, or to minimize delays in critical path activities in the event of a major change in scope or other project delays. Continual monitoring of work progress and comparison to the base line schedule is undertaken to flag any possible delays and allow allocation of resources, as required, to maintain designated completion dates. Norman will convene regular internal coordination meetings to proactively identify, prioritize and implement the necessary measures to address issues effecting demands on internal resources and maintain the overall project schedule.

The Project Team intends to implement Wood's BST program (an innovative business management software) to provide Topeka Metro with accurate and up-to-date financial information. In addition to providing information on costs-to-date, the Project Team will also provide forecasts for ongoing tasks to determine costs required/anticipated to complete a particular project. Forecasting is a proactive tool, helpful in identifying potential deviations from the anticipated final costs for a project. In this way, should changes occur during the project life cycle any cost impacts can immediately be identified and discussed with Topeka Metro.

Whenever possible, the Project Team will work within pre-approved budget amounts. In the instance that additional scope is required, out of scope work will be identified and raised with Topeka Metro and local agency project managers before proceeding.

Additional fees will only be invoiced upon receipt of written permission from Topeka Metro.





# 4.2. **Personnel**

Wood carefully considered our pool of resources to select individuals who are most qualified to to deliver the Electric Vehicle Fleet Study to Topeka Metro. Wood has assembled individuals with the skills and experience needed to deliver the analysis and plan, as shown in our organization chart below. Our team is committed to delivering this project as stated in the RFQ.

Refer to Appendix A for the resumes for key personnel with formal education, professional licences and certifications, and work history.



LEGEND:

Subcontractor







#### 5.0 **Proponent Roles and Qualifications**

#### 5.1. **Key Personnel and Leads**

Our key personnel will provide the direction and guidance needed to produce first class deliverables that meet all of Topeka Metro's requirmements. They have been selected, not only for their technical expertise, but for their management and decision-making abilities.

# **Key Team Members**



#### Clean50 Naeem Faroogi Account Executive

Delivered over 77 fleet-related projects for public and private sector organizations. Delivered over 20 vehicle bus and CNG feasibility projects,

including 9 BEB pilots. Delivered over 10 municipal-focused fleet projects, assisting clients in understanding the operational requirements and feasibility of alternative fuels for a wide variety of vehicle classes



#### Norman Hendry Project Manager

- 25+ years of international experience in fleet management, fleet transition planning and implementation, personnel and training, asset design and specification.
- Designed and managed the development of facilities for zero-emission buses storage and maintenance Developed and managed the establishment of integrated charging facilities for electric buses

#### Saravanan Kumar **Project Coordinator**

- Delivered a wide range of consulting projects for public sector clients including transit agencies and municipalities.
  Areas of expertise include vehicle lifecycle analysis, alternative
  - propulsion technologies, reliability engineering, business case studies and project management, fleet sustainability, feasibility and implementation, and he also holds a Six sigma Green Belt





#### Igor Bozic **Power Specialist**

- 19+ years of experience as an electrical engineer, project manager and electrical team lead
- Experienced in the design of high, medium and low voltage power distribution systems, lighting, grounding, utility scale solar and wind farm systems, and auxiliary systems

#### Jenna McDavid Utilities Lead

- 20+years of experience in the energy and utilities industries and supports to transportation electrification engagements
- Areas of expertise include technical and market research, client program strategy, design delivery and evaluation

#### Harpal Kapoor QA/QC

- 35+years of experience in the various fields . of transit industry.
- Experienced in implementing alternative fuel programs, including clean diesel, CNG, hybrid diesel electric, battery electric, and hydrogen fuel cell technologies

#### 5.2. **References and Past Project Summaries**

We invite Topeka Metro to contact any of our references.

Wood ne References rev sp we vi str ca	<b>own of Oakville,</b> anCarlo Mirolla, <i>Project Manager</i> el: +1 (905) 845-6601, ext.3510 <b>anCarlo.mirolla@oakville.ca</b> 'ood was retained by the Town of Oakville to complete an electric bus eeds assessment and rollout plan. This engagement included a holistic view of Oakville Transit's facilities and operations, market scan of available pecialized electric vehicles and electric vehicle charging infrastructure, as ell as a peer review of comparable municipalities and transit portfolios and ill culminate in the implementation of a recommended fleet procurement rategy, including the required associated infrastructure, fleet, and other ipital expenditures.
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	City of Saint John Samir Yammine, Manager of Asset and Energy Management Tel: +1 (506) 333-2309 samir.yammine@saintjohn.ca Wood was retained by the City of Saint John, New Brunswick to complete an electrification plan for the City's corporate and transit fleets, beginning with a current state assessment of the current profile of fleet assets held by the City and its associated environmental baseline along with a review of industry best practices. Wood will engage the City and its stakeholders to develop a green fleet scenario identifying the optimal fleet assets and associated infrastructure to electrify in a phased approach. Forecasts of future fleet growth and right-sizing optimization of the City's corporate fleet are included as well transit fleet electrification studies and analysis using Wood's proprietary ZES toolkit.
	Canada Infrastructure Bank, Brian Reilly, <i>Director, Investments</i> Tel: +1 (416) 802-7091 breilly@cib-bic.ca Wood was retained to assist the Canada Infrastructure Bank with the operationalization of its Zero-Emission Bus (ZEB) Loan Program, serving as Lender's Technical Advisor. Wood is currently engaged working with CIB and prospective loan recipients to establish operating cost savings for the implementation of electric school and transit buses in Canada. This included development of methodologies to measure operating and maintenance cost savings of electric buses compared to conventional diesel buses.
	Washington Metropolitan Area Transit Authority (WMATA) Jasvinder Singh, <i>Senior Program Manager</i> Tel: +1 (301) 618-1018 jsingh@wmata.com
OMNI Reference	OMNI Strategy LLC (OMNI) assisted WMATA with testing, evaluation, and validation of the prototype 220 kWh BEB with a limited range. The project involved developing KPIs to compare the performance results against a conventional bus. OMNI selected a test route based on battery range, garage charging, number of stops, and passenger load. They coordinated with the bus manufacturer to gather operational data from the "CONNECT" system. The daily and weekly reporting format that OMNI developed for the project was adopted as a standard after testing on this bus.

To showcase the extent of work this team has provided to the local and regional government, we have selected a few of our past projects and outlined them on the following pages.







# 5.3. John Wayne Airport, Santa Ana, California, US



# Wood's Scope of Work and Responsibilities

Wood was contracted by John Wayne Airport (JWA) Environmental to provide planning, project management support and technical



review for deploying three (3) EV Charging Stations to support the electrical needs for three (3) electric buses scheduled to be delivered to JWA in late 2021.

As part of this study, Wood will provide project management framework for the site planning, design, and installation. The designated location is expected to be expanded to house an additional three chargers apart from the three that are currently planned along with 10 electric buses (with 2 buses in reserve).

Some other tasks assigned to Wood include conducting market and landscape scan for electric buses and chargers along with the estimation of site requirements. Wood has also been tasked with the review of the electric bus build along with the acceptance procedures.

Wood will conduct an assessment of the site electrical requirements with South California Edison (SCE) and also provide support on the vendor selection process by providing assistance on RFP development, bid review and vendor selection.

# Client

John Wayne Airport, US **Project Location** Santa Ana, California, US **Project Value** \$100,000 USD **Start Date | Finish Date** 

January 2020 | Ongoing

**Project Owner** 

Wood – Prime

Key Staff InvolvedMelinda McCoy Project Manager

## **Project Relevance**

- Green Fleet Infrastructure
- Facility and Fleet
   Electrification Transition
   Planning
- Technical Specification
   Development
- Stakeholder Consultation
- Implementation Plan



## File# 22PROPTRNP.0026



# 5.4. Arlington Transit (ART) Bus Electrification Study, Arlington County, Virginia, US



# Wood's Scope of Work and Responsibilities



Wood was contracted as a subconsultant to Omni Strategies and Kimley-Horn to provide consultancy services to Arlington County for ART Bus Electrification Study.

As part of this study, Wood will conduct a market review of the commercially available buses and charging solutions.

This project will also involve facility and fleet assessment for battery electric, hydrogen fuel cell and renewable natural gas along with detailed GHG Impact assessment. Wood will also be conducting a study on the impacts of performance, infrastructure requirements, lifecycle costs and operational resiliency. Additionally, Wood will undertake a study to understand the financial requirements associated with battery procurement and leasing, fueling costs for zero-emission vehicles and lifecycle costs. Finally, Wood will be assisting Arlington County in developing an Implementation Plan to assess the lifecycle of the existing fleet assets and identify suitable zero-emission replacements to ensure continuity of operations.

# Client

Arlington County, Virginia, US

**Project Location** Arlington, Virginia, US

**Project Value** \$280,000 USD (Wood: \$36,000)

Start Date | Finish Date

January 2022 | Ongoing

**Project Owner** 

Wood – Subconsultant

# **Key Staff Involved**

- Naeem Farooqi, Project Manager
- Rick Baltzer, Fleet Maintenance Specialist
- Jamal Nureddin, Project Coordinator & Financial Lead
- Igor Bozic, Power Lead
- Abhishek Raj Project Coordinator

# **Project Relevance**

- Green Fleet Infrastructure
- Facility and Fleet
   Electrification Transition
   Planning
- Technical Specification
   Development
- Market Scan for available charging solutions
- Emission Reduction Targets
- Implementation Plan





# 5.5. Division 2 and Division 4 BEB Facilities Infrastructure Upgrades, AC Transit, California



# Kimley Horn's Scope of Work and Responsibilities

AC Transit is enacting its Zero-Emissions Bus Rollout Plan that provides a comprehensive path for the agency to transition to a 100-percent-electric fleet. As part of this plan, the District must upgrade and expand its BEB charging infrastructure to additionalfacilities to service its growing BEB fleet. Kimley-Horn is providing the District with facilities planning and design services at the Emeryville (D2) and East Oakland (D4) Divisions. For the smaller D2, Kimley-Horn is supporting the District with designing 16 to 20 at-grade BEB plug-in chargers, and for the larger D4 helping the District upgrade existing plug-in pedestal chargers with 50 overhead plug-in chargers installed with a new overhead canopy structure. Both Divisions and associated designs will include electrical infrastructure upgrades, assisting the District with EV manufacturer procurements, assessment and design of a reliable battery energy backup system for added resiliency, and staging/phasing plans

# **Key Challenges and Solutions Implemented**

Kimley-Horn assisted AC Transit with not only EV design but technology assessment and OEM procurement and bid process as well, concurrent to developing design and construction bid documents. Kimley-Horn was able to expedite the design schedule to meet the requirements of the District. The BEBs are already on order and due to be delivered by end of the year sooner than expected; the EV design and infrastructure are required to accommodate the new BEBs.

The EV infrastructure for the BEBs is to be installed in existing operational facilities. Special attention to both impacts on operations as well as designing for the ability for future expansion was required. Other key issues Kimley-Horn assessed and covered were the battery electric resiliency to provide AC Transit the capability of charging at off-peak hours for utility rates and using batteries to charge the buses at night during peak utility rates.

# File# 22PROPTRNP.0026

# Client

AC Transit, California

# **Project Location**

Oakland & Emeryville, California, US

# Start Date | Finish Date

February 2021 | October 2022

## **Project Owner**

Kimley Horn – Prime

# **Project Relevance**

- Electric Fleet
   Facility
   Planning &
   Design
- Electrical Infrastructure Upgrades
- EV Infrastructure Phasing Plan

www.woodplc.com



# File# 22PROPTRNP.0026



# 5.6. Electric Bus Needs Assessment and Rollout Plan, Town of Oakville, Canada



# Wood's Scope of Work and Responsibilities

Wood was contracted to conduct a comprehensive electric bus needs assessment for the Town of Oakville in Ontario, Canada. This included the creation of roadmap to guide the Town to reach its sustainability goals and replace the current diesel-powered public transit buses with zero-emission vehicles. Our team of public infrastructure experts and our innovative, cloud-based simulation tools determined the optimal transit network and decarbonization solutions, from bus routes and battery charging station locations to the actual types and sizes of buses in the fleet. The study included the following objectives:

- Current state assessment, gap analysis, and infrastructure assessment
- Review of operational goals and scenario development
- Route modelling and impact assessment
- Comparative vehicle and charging system analysis
- Infrastructure gap analysis and requirements identification

# **Key Challenges and Solutions Implemented**

- Wood completed a Fleet Phasing Plan to highlight a strategy to fully electrify specialized and conventional buses by 2035. A financial model of 25 years pro-forma of the electrification is the final major deliverable for this project
- Wood reviewed the existing facility electrical infrastructure limitations against the estimated expected load from electrical charging infrastructure and charging schedule to develop an infrastructure gap implementation and costing plan
- Wood is developing a Facility and Infrastructure Transition Report which comprises a single line diagram, area distribution map, conceptual charger layouts, energy demand modelling, and backup generation plan for Oakville Transit's Bus Garage

# Client

Town of Oakville

**Project Location** 

Oakville, Ontario, Canada

**Project Value** 

\$150,000 CAD

# Start Date | Finish Date

November 2020 | April 2021

**Project Owner** 

Wood – Prime

# **Key Staff Involved**

- Naeem Farooqi, Project Manager
- Rick Baltzer, Vehicle & Maintenance Expert
- Jamal Nureddin, Financial and Risk Lead
- Igor Bozic, Power Infrastructure Lead
- Matthieu Goudreau, Support Team

## **Project Relevance**

- Electric Fleet Costing and Implementation Plan
- Electric Vehicle Facility Charging Infrastructure
- Utility / Power Needs Assessment
- On-site Storage and Energy Generation
- Same Team in Key Roles



File# 22PROPTRNP.0026



# 5.7. Canada Infrastructure Bank, ZEB Program Lender's Technical Advisor



# Wood's Scope of Work and Responsibilities

Currently, Wood is delivering Phase 1 of CIB's ZEB program as the Lender's Technical Advisor. CIB has launched a program to accelerate the adoption of ZEBs in Canada in support of the Federal Government's priority to facilitate the purchase of 5,000 ZEBs over the next five years. Under the ZEB program, CIB will make direct loans to transit and school bus owners/operators to cover the higher upfront capital costs of ZEBs and charging infrastructure compared to conventional greenhouse gas (GHG) emitting vehicles. Currently, CIB intends to make this financing solution available to members of the Association of School Transportation Services of British Columbia and to BC Transit to facilitate the purchase of ZEBs. CIB expects the loans to be repaid through the operational cost savings that will be generated instead of using conventional GHG vehicles throughout the lifecycle.

CIB has engaged Wood as its Technical Advisor to support the implementation of this financing project.

- Phase 1: Provide technical advisory for operationalizing the ZEB financing program, including establishing appropriate controls on reported costs and developing normalized cost measures to accurately identify operations and maintenance cost savings
- Phase 2: Support due diligence by reviewing ZEB implementation plans and determining operating cost savings that can be achieved by the deployment of ZEBs over conventional GHG vehicles. Provide recommendations that can reduce the risks involved in ZEB deployment, including associated infrastructure
- Phase 3: Provide quarterly monitoring and reporting services for qualifying project costs, the status of implementation of associated infrastructure, ZEB deployment, and performance indicators

# Client

Canada Infrastructure Bank

# **Project Location**

Various Provinces, Canada

# **Project Value**

Phase 1: \$50,100 CAD

Phase 2: \$110,102 CAD

# Start Date | Finish Date

February 2021 | Ongoing

# **Project Owner**

Wood – Prime

# Key Staff Involved

- Naeem Farooqi, Technical Lead and Deputy Project Manager
- Rick Baltzer, Transit Vehicle Specialist
- Saravanan Kumar, Project Coordinator
- Jamal Nureddin, Financial Analyst
- Igor Bozic, Power Lead

## **Project Relevance**

- Green Fleet
   Infrastructure Needs
   <u>Assessment</u>
- Utility / Power Needs Assessment
- Innovative Tools Deployment


**Appendix A – Resume** 



## Naeem Farooqi, BBA, MSc. Pl Global Technical Director- Zero Emission Mobility





Summary

Years of Experience 15 (1 with Wood)

**Office of Employment** 

Vaughan, ON

## Languages

- English
- Urdu
- Punjabi
- Hindi

## **Areas of Expertise**

- Business Case Development
- Value For Money (VFM)
- Fleet & Facilities Management
- Asset Management
- Specialized Transit
- Operations & Maintenance Planning
- Strategic Planning
- Vehicle Propulsion Lifecycle & Policy
- Supply Chain & Goods
  Movement
- Vehicle Lifecycle Analysis
- Maintenance Reliability
  Modelling
- Decarbonization
- Fleet Emissions & Sustainability Alternative Fuel Feasibility and Deployment

## **Professional Summary**

Mr. Farooqi is an expert in business case development and asset management. His expertise spans across organizational performance benchmarks, accessibility design and compliance, supply chain and goods movement, fleet procurement, fleet decarbonization and emission optimization, technology feasibility analysis, project development and strategy execution within various transit functions. Naeem is known for solving complex transit challenges with innovative solution. He has helped establish transit fare policies, and organizational designs to support bus rapid transit and conventional transit service. Naeem has worked on zero-emission transit projects across the globe including Canada, USA, Peru, Bulgaria, Saudi Arabia and Ivory Coast. Naeem is completing a PhD in vehicle lifecycle and maintenance reliability modelling in the Department of Mechanical and Industrial Engineering at the University of Toronto. His research is at the forefront of examining reliability, lifecycle costing, and the various propulsion impact for different return to base transit fleets and rolling stock.

## **Qualifications**

## **Education**

Doctor of Philosophy (PhD) (Flex-Time), Mechanical & Industrial Engineering, University of Toronto, Exp 2022

Master of Science in Planning (Specialization in Public-Private Partnerships and Municipal Finance), University of Toronto, 2010 Honours Bachelor of Business Administration (Marketing and Finance Specialization), Schulich School of Business, York University, 2008 General Certificate in Urban Studies, York University, 2008

## Training

Master Certificate in Supply Chain & Logistics Management, Schulich School of Business York University, 2012

Certificate in Transportation Planning, Canadian Urban Transit Association, 2008

## **Publications / Presentations**

- Authored a three-part series on the optimization of the transit parts supply chain published in *Metro Magazine*:
  - "Inventory Management: How Stock-Out Risks Drive Inefficient Transit Parts Program," March 2012.
  - "Life Under a New Supply Chain," July 2012.
  - "Moving Beyond Inventory: Building a Transit Supply Chain Network," May 2012

## Naeem Farooqi, BBA, MSc. Pl Global Technical Director- Zero Emission Mobility



- The Canadian Urban Transit Association Fall 2011 ("Transit Inventory Supply Chain").
- The New York Public Transit Association Fall 2011 ("Transit Supply Chain and Joint Sourcing").
- BusCon, Fall 2016 ("Asset Management and Technology")
- Schulich Connect, Summer 2017 ("Unlocking the Value of Infrastructure").
- OPTA, Spring 2018 ("Useful life of Urban Transit buses")
- C40, Spring 2019 Clean Bus Finance Academy ("Total Cost of Ownership for Electric Buses")
- Canadian Network of Asset Managers (CNAM), 2019 1st Place Award: Student Research Symposium
- Numerous media appearances educating and promoting the Shelter Bus project including CBC, GlobalTV and the Canada, a charitable initiative that retrofits end of life coaches into mobile shelter for homeless groups in Toronto.

### **Awards**

- 2019 Clean50 "Emerging Leader" in Sustainability for professional and academic leadership in zeroemission transport
- 2018 Mass Transit "Top 40 under 40" in Transit for global professional and career accomplishments
- 2012 President's Award/ Supply Chain Logistics as supply chain person of the year award for leadership and innovation in developing a joint procurement for public transit bus parts using Vendor Managed Inventory.
- 2012 Supply Chain Excellence Award/ PMAC (team recipient) for supply chain excellence for joint procurement of buses and parts in Ontario.
- 2010 Joseph Armand Bombardier Scholarship/ SSHRC awarded for analysis into infrastructure publicprivate partnership development and its impact on decision makers

## Experience

## Director of Sustainable Transport & Asset Management Solutions, Wood Metrolinx- GHG Reduction Roadmap & Strategy

Project Manager for GHG reduction strategy. Wood was retained by Metrolinx to complete an evaluation of Greenhouse Gas (GhG) emissions reductions through analysis of up to five scenarios of various GHG reductions scenarios. This included full electrification, partial electrification, as well as adoption of renewable energy and co-generation at GO stations, facilities and rail corridors, and adoption of battery electric rolling stock across the GO network. Wood will also complete a benchmarking exercise comparing each scenario's forecast emissions reductions against comparable transit portfolios and their stated emission reductions targets.

#### **Translink – Quality Assurance Bus Inspection**

Project Manager for 60FT articulated and double decker bus inspection from New Flyer and Alexander Dennis plants in Vaughan, Winnipeg Canada and Crookston, Napanee USA. Overseeing field staff of 4 inspectors reporting weekly quality assurance and real-time inspection monitoring using NexusIC. 50 buses to be inspected in 2021 and additional 100 buses over 2022-2023 (ongoing).

## **YRT - Fleet Retainer**

Project Manager for contracted for a three-year fleet consulting support services of \$600K, retainer to complete a wide range of consulting services for York Region Transit, including facility and fleet electrification transition planning and electric vehicle technical specification development. Wood also



## **Global Technical Director- Zero Emission Mobility**

completed an electric vehicle jurisdictional scan to assess the available specialized transit charging infrastructure available on the market (ongoing).

### BC Transit- Specialized Transit E-bus garage

Project Manager supporting engineering firm with power demand and charging equipment selection for BC Transit garage (ongoing).

## St. Catherine Transit Commission- Electrification Strategy

Project manager delivering a utility and charger manufacturer feed study to help implement electrification of transit fleet. Wood completed Battery Electric Bus (BEB) modelling to simulate BEB performance accurately in a variety of scenarios. These scenarios were used to test operations across climate seasons, a variety of bus models, with and without on-street charging, identify locations for developing on-route charging, and allow SCTC to best understand the limits and opportunities of operating BEBs on their network, tailored to their operating context.

## Saint John, New Brunswick- Green Fleet Strategy

Project Manager as part on behalf of Wood. Was retained by the City of Saint John, New Brunswick to complete an electrification plan for the City's corporate and transit fleets, beginning with a current state assessment of the current profile of fleet assets held by the City and its associated environmental baseline along with a review of industry best practices. Wood will engage the City and its stakeholders to develop a green fleet scenario identifying the optimal fleet assets and associated infrastructure to electrify in a phased approach. Forecasts of future fleet growth and right-sizing optimization of the City's corporate fleet are included as well transit fleet electrification studies and analysis using Wood's proprietary ZES toolkit. (ongoing)

## City of Charlottetown, Prince Edward Island- Electrification Study

Project Manager for PEI's electrification study and implementation strategy. Wood is currently supporting the implementation of electrified transit for the City of Charlottetown in Prince Edward Island, Canada. The project involves evaluating the City's developing bus, facility, and charging equipment specifications to be tendered to public market. The specifications were informed by route modelling such that Charlottetown could procure vehicles and equipment that met its needs. Included multiple workshops with project stakeholders regarding site prioritization and selection, functional programming, and funding application support.

## Halifax Transit – BEB Modelling

Project Manager for 60 BEB pilot range simulation for Ragged Lake Transit Centre (RLTC) of 40ft buses. Providing client with multiple simulations and scenarios evaluating different operational impacts. (ongoing)

## Canadian Infrastructure Bank – Zero Emission Technical Advisor

Project Manager supporting CIB to examine roll-out of electric school buses and transit buses in Canada. Developing baseline savings models, and reviewing technical transition plans by fleets requesting loans. (ongoing)

## TTC – Supply Chain Support & Strategy

Project Manager supporting TTC MM&P department pertaining to bus parts sourcing, alternative parts brand identification, aftermarket warranty and core management. (ongoing)

## Town of Oakville- Electric Bus Feasibility & Roll Out Plan

Project Manager for the feasibility study reviewing the current state of Oakville Transit fleet and facilities for electrification. Route simulation, vehicle specification, electrical infrastructure analysis, energy modelling and business case for adoption. Reviewing operational challenges and maintenance for electric fleet adoption on NRV, conventional and specialized transit. Roll-out plan includes a rapid pilot and adoption timeline for specialized and conventional buses. (ongoing)

## **Metrolinx- Quality Assurance Inspection**

April 2021 Page 3 of 12



## **Global Technical Director- Zero Emission Mobility**

As project manager overseeing the inspection services of 46 double decker Alexander Dennis. Established Pre-delivery inspection protocol, road test and water test strategy to improve new bus build quality and reliability. (ongoing)

## Academia & Industry Teaching

Mr. Farooqi has worked with various academic universities and industry associations to promote educating the next generation of leaders. Industry teaching is focused on technical topics of energy transition in transport, and asset management for public sector.

## **Electric Bus Pilot Program Training Material**

## Finance Academy, C40 (March 2021)

Developed a comprehensive training module material for self-learning and guidebook for 96 cities to implement electric bus pilots with standardize data collection and operational procedures.

## Electric Bus Training Workshop, On-line Learning

## Global Sustainable Electricity Partnership, GSEP (September 2020)

Leading a one-week training (October 2020) course in Lima, Peru (virtually) to educate private transit operators on electric mobility adoption covering fleet, infrastructure, lifecycle cost, operational changes.

## Natural Gas & Hydrogen Transit Transition Course, CUTA On-line Learning Canadian Urban Transit Association, CUTA (August 2020 to Present)

Developed and delivering a 5-week course on introducing transit industry to gaseous fuels. Covering topics of vehicles, operations and maintenance, fueling & infrastructure, and business case development. Course endorsed by Compress Natural Gas Vehicle Alliance and Hydrogen 2 GO Canada.

## Transit Asset Management Course, CUTA On-line Learning

## Canadian Urban Transit Association, CUTA (September 2018 to Present)

Delivering a 10-week course endorsed by Federation of Canadian Municipalities on transit asset management. The objective of the course if to improve transit employee's knowledge of asset management and develop asset management material for their organization. Final project entails creating a Transit Asset Management plan.

## Sessional Instructor (PROP 6780), Case Studies in Infrastructure

## Schulich School of Business, York University (September 2017 to Present)

Developed and co-taught new graduate business course, Case Studies in Infrastructure, to students specializing in Infrastructure and real estate. Created case studies about innovative infrastructure projects, stakeholder opportunity and risk matrix (STORM) framework, and modules on asset management. Key topics included public-private partnerships, value for money, project lifecycle, project risks, stakeholder analysis, lifecycle costing, and asset management.

## Principal Consultant: Sustainability & Asset Management, WSP Canada Inc, Planning and Advisory (August 2014 to August 2020)

Mr. Farooqi led transit, transportation and asset management business and strategy development for various public and private clients across Canada and the world, including:

## **Business Case, PPP, Asset Management**

# TTC 1810 Markham Road Facility and Non- Revenue Vehicles (NRV) Business Case, Toronto (2020)

As Project Manager oversaw the development of a business case to second source the maintenance of TTC's non-revenue vehicle and City of Toronto fleet and facility.



## **Global Technical Director- Zero Emission Mobility**

### Town of Oakville Fleet Utilization and Optimization Study, Oakville (2019 – 2020)

As Project Manager and Fleet Specialist oversaw and supported Oakville fleet services study on utilization, optimization, green fleet and peer benchmarking, performance and business case development.

### City of Brampton Light Duty Fleet Review, Brampton (2019)

As Project Manager in support for EY's study on a light duty fleet assessment study for the City of Brampton fleet services by identifying key operational, asset and service efficiency recommendations, and conducting peer agency benchmarking and stakeholder engagement workshops.

### TTC McNicoll Bus Garage Business Case & RFP Development, Toronto (2019 - 2020)

As Project Manager and bus industry expert conducted a comprehensive business case analysis to assess the risk and value-for-money (VfM) of outsourcing all facility maintenance and operating staff functions of the TTC's new McNicoll facility. Developed ensuing RFP to outsource functions.

### City of Halton Fleet Management Strategy, Burlington (2019)

As Project manager conducted fleet management review, identified key operational, asset and service efficiency recommendations, and conducted peer agency benchmarking and stakeholder engagement workshops

### City of Hamilton Transit Tire Lease vs Buy Study, Hamilton (2019)

As Project Manager delivered a 'Lease vs Buy' strategy for the City's fleet of 267 transit buses. This included an industry best practices analysis along with a financial analysis comparing lifecycle of leasing vs buying tires.

# Ontario Northland Railway Asset Management State of Good Repair, North Bay (2018-2019)

As Project manager identified state of good repair backlog for agency along with prioritization framework for future asset acquisition.

#### Ontario Northland Railway Asset Management, North Bay (2016-2017)

As Co-Project Manager conducted asset audits of vehicle fleet and rail rolling stock and determined state of good repair deficit. Developed coach and locomotive lifecycle models, and KPIs for asset performance.

## Department of National Defense, DCC Base Capital Plan, Ottawa (2016-2017)

As Co-Project Manager led cost benefit analysis of national defense portfolio strategy, asset management plan for select base reduction, and financial impact analysis on the state of good repair and synergies from consolidation decision.

#### TransLink Asset Management On-Call, Vancouver (2017–2018)

As Project Manager worked with TransLink to address various asset management needs across transit bus fleet, trolley pole infrastructure, hoists and maintenance facility asset classes in addition to examining operational information to help mitigate state of good repair backlog.

#### **UNOPS - Darfur Water Model (2017)**

As Asset Management Lead developed water lifecycle asset management plan for distribution of various water service levels in two urban centers. Also created a sustainable and equitable costing structure.

## Sarnia Transit- Fleet & Asset Management, Sarnia (2016)

Project Manager for identifying vehicle lifecycle and state of good repair deficit, inspecting 100% of fleet and reviewing maintenance practice to determine optimum vehicle retirement age. Examined alternative propulsion fleets of hybrid, CNG and electric buses to provide short-term and long-term direction of overall fleet propulsion.





## TTC- Fleet & Asset Management, Toronto (2015-2017)

Deputy Project Manager for developing new lifecycle model to identify optimum age of retirement for TTC using operational, capital and labour costs. Conducted fleet condition assessment on 96 units. Reviewed hybrid bus technology and lessons learned for TTC operations and cost of operating over lifecycle.

### TTC Enterprise Asset Management, Toronto (2015-2016)

Local Project Manager in charge of managing project schedule, project budget and client deliverables. Assisting the TTC with creating strategic asset management policy for subway operations and identifying funding gaps.

### Transit Windsor-Bus Lifecycle Study, Windsor (2015)

Project Manager for delivering a 20 year business plan for City of Windsor on operating transit bus fleet, assessing condition of fleet and developing an optimal lifecycle and replacement plan for fleet. Reviewing in house staff skills and identify training opportunities for maintenance staff.

### Confidential Private Sector Client, Vehicle Manufacturer (2015-2017)

Project Manager on delivering a cost per km of operating a purpose-built specialized vehicle versus conversions and cut-away. Examine full life cycle cost of vehicle and provide client with a market strategy for growth to transit, taxi and personal vehicles.

### **Operations & Management Metrolinx Fleet Retainer, Toronto (2020)**

As Project Manager supporting Metrolinx on various maintenance and operation support during COVID19. Projects include maintenance specification, training, reliability improvements, and service line improvements.

## TTC Supply Chain Improvement, Toronto (2019 – 2020)

As Project Manager determined methods to improve cost efficiencies in TTC's supply chain and implementing recommendations of the Auditor General study from 2018. Focus on aftermarket warranty, OEM parts, core tracking and aftermarket parts.

## McGill University Campus Shuttle, Montreal (2017)

As Operations and Cost Lead developed multiple scenario analysis for 10-year forecast of operating McGill campus shuttle. Identified vehicle size, operating parameters and amenities for student transport. Developed hourly cost model and optimized fleet selection.

## **OPTA Handheld Device Market Analysis, Toronto (2017)**

Project manager helpied Ontario Public agencies prepare for the exemption of bill 118 for handheld radios for public transit agencies and preparing a case for an extension of exemption for Ministry of Transportation.

# Royal Canadian Navy, Water & Land based Base Personnel Transport Feasibility Study, Vancouver (2016-2017)

As technical lead, Naeem developed operational cost scenarios of transportation per hour of 14 to 200 individuals during morning and evening peak. Identifying capital and operating cost for 10-year horizon. Furthermore, identifying land and marine based vehicle, which can meet navy regulations for troop transport.

#### **Oakville Transit - Standard Operating Procedures, Oakville (2017)**

As technical advisor on reviewing and developing standard operating procedures for maintenance staff activity for transit facility operations.

#### York Region Transit, Facility Standard Operating Procedures, Vaughan (2014)

April 2021 Page 6 of 12



## **Global Technical Director- Zero Emission Mobility**

Developed and reviewed over 100+ SOPS for York Regions operations contractors to ensure compliance to region transit agreement. Focus on maintenance activity for transit vehicles and facility operations.

## York Region Transit, Training Program Development, Vaughan (2014-2015)

As Technical lead, leading project to identify and modules for training. Developing RFP and providing support for firm hired to deliver final project.

### Grand River Transit (GRT), Preparation of a Fare Enforcement Plan, Kitchener (2015)

Participated in a field study to ascertain the current rate of fare evasion. Reviewed industry best practices along with GRT's fare policy to identify strategies and opportunities for improving fare enforcement.

#### Zero- Emission Vehicles, Fleet & Facilities

#### MiWay Electrification Study, Mississauga (2020)

Project Manager in determining an electric bus adoption strategy and how to phase the garages to accommodate electric buses.

#### TTC eBus Manufacturers' Canadian Content Audit, Toronto (2020)

Project Manager in auditing the Canadian Content of 60 eBuses from 3 manufacturers as part of the eBus program.

### **County of Kings Green Fleet, NS (2020)**

Project Manager for helping County of Kings located in Nova Scotia explore a green fleet strategy of vehicles in use for public works and county operations.

#### EBRD Amman, Jordan E-Bus Feasibility (2020)

Technical Vehicle Lead in developing ebus mobility specifications for chargers and electric buses for BRT operation in Jordan.

#### Transport Canberra (Australia) Zero Emission Feasibility Study (2020)

As Deputy Project Manager and Global Technical Expert assisting with technology analysis, gap assessment of operations and due diligence of transition using triple bottom line tool and BOLT simulation metrics.

#### World Bank Colombia EV Study (2020)

As Technical lead on vehicle standards and battery technology assisting to explore adoption challenges and building a roadmap for various vehicles, chargers and sectors.

#### Abbotsford Garbage Trucks Lifecycle Modelling (2020)

Project Manager for the lifecycle modelling of Abbotsford's garbage trucks fleet to determine the lifecycle costs and greenhouse gas (GHG) emissions for different scenarios of alternative propulsion technology

#### Brisbane, Australia Transit Bus Testing (2020)

SME in delivering a vehicle testing regime for double-articulated transit buses. First double articulate vehicle being brought to Australia for BRT.

#### Auckland Battery Electric Bus Feasibility Study (2020)

Project Manager delivering a transit electric bus modelling and feasibility project for private contractors in Auckland New Zealand.

#### TriMet Battery Electric Bus Feasibility Study (2020)

Project Manager in delivering a transit bus fleet modelling to identify routes/blocks that can be served with battery electric buses. Scope includes feasibility of depot vs on-route charging along with charging infrastructure requirements

#### **YRT Fleet Retainer**

April 2021 Page 7 of 12



## **Global Technical Director- Zero Emission Mobility**

- YRT Facility Electrification Infrastructure Feasibility Study and Implementation Plan (2019 2020): Project Manager for the feasibility study reviewing the current state of the garages and planning the required changes to equip YRT's facilities to support fleet electrification. This includes modelling energy consumption for different scenarios.
- York Region Transit, 60 Foot Technical Bus Specification and Procurement (2017–2018): Project Manager assisting York Region with the acquisition of new 60 foot diesel and hybrid vehicles for YRT VIVA BRT service.
- York Region Transit, Facility Optimization (2017–2018): Project Manager assisting region to identify optimal location for new transit garage based on fleet operations and routes. Goal is to identify minimize dead head using new garage.
- **YRT Bus In-line Inspection(2016-2020):** Project Manager Quality assurance for 90 Nova low-floor 40 foot + 60 foot buses for the YRT. In-charge of managing project costs, inspector daily inspection logs, weekly reports and final testing on all vehicles for the YRT built at Nova and New Flyer plant
- **YRT- Exterior Collision Warning System (2015-2016):** As Technical Lead, oversaw market scan for client on technology and possible solutions to pedestrian collisions during bus turning left or right for YRT. Further, he examined various vendors, cost per unit, impact to operations and on-going operating dollars needed to maintain the system for client.

## AC Transit ZEB Program (2019)

Project Manager delivering a transit electric bus modelling and feasibility project for hydrogen and BEB vehicles.

#### Humber College Shuttle Bus Electrification RFP development (2019)

SME for developing the Request For Proposal (RFP) and reviewing technical proposal responses for Humber College's parking shuttle electrification.

## Calgary Refuse Fuels Study, AB, Canada (2019-ongoing)

Technical lead on developing scenarios to evaluate options with Calgary's 268 refuse trucks for electric, natural gas and hybrid drivetrain and compaction design. Developing feasibility study including triple bottom line approach.

#### San Bernardino E-Bus modelling (2019)

Project Manager delivering electric bus modelling project to determine the feasibility of transit bus fleet electrification.

## Halifax Alternative Fuels Study, NS, Canada (2019)

Project Manager delivering second phase analysis of Halifax alternative fuels study for transit operations examining fleet, operating and maintenance cost and facility modifications across CNG, BEB, Hydrogen, and Hybrids. Triple bottom line feasibility study undertaken.

## TTC eBus Manufacturers Plant Audit (2019 - 2020)

Project manager inspecting four OEM eBus production across 8 manufacturing sites for quality assurance for upcoming TTC eBus build.

## Los Angeles, California, USA (2019)

Modelling lead in charge of developing a deployment plan for 2,000+ buses in LA. Moreover, supporting change management and technology phasing to ensure LA Metro's goal of 100% electric adoption.

## Montreal Airport, Canada, (2019)

Technical lead assisting in deployment of vehicle shuttles during construction of airport and developing a zero-emission electric vehicle performance criteria to reduce GHG for airport operations.

April 2021 Page 8 of 12



## **Global Technical Director- Zero Emission Mobility**

## Durham Region CNG Fleet Study, ON, Canada (December 2018 – 2019)

Project Manager developing potential demand scenarios for region owned and operated vehicles from class 0 to class 8 including transit. Mapping out potential CNG GHG reductions and total cost of ownership savings.

## Lethbridge Alternative Fuel Study, AB, Canada (2018-2019)

Project Manager developed an alternative fuel study for the cities public works and transit operations of over 500 vehicles and 3 fuelling infrastructure sites. Examining infrastructure, fleet, and operating impact of various technologies (CNG, hydrogen, electric, diesel)

## E-Bus Feasibility, Boston, MA, USA

Deputy Project Manager developing pilot bus strategy for MBTA along with roadmap for full adoption of 1,600 buses to electric. Leading the electric bus simulation for bus routes and electric route adoption. Developing bus specification for operation and change management plan for operations to electric.

### Bus Operations & Specifications, Makkah, Saudi Arabia (2018 – 2019)

Technical SME for bus fleet and facility design for Makkah Transit new operation of 2,000 buses and rail service. International expert overseeing bus, facility, asset management for owner as part of PMO team. In-charge of plant quality control and audit of manufacturing facilities.

### E-Bus Feasibility, Sofia, Bulgaria

Fleet and Procurement expert on the file assisting EBRD to develop a technical specification for 30 electric fast charging vehicles for deployment in Sofia. Leading electric bus simulation analysis on vehicle range and route identification.

### Alternative Propulsion Feasibility Study, Winnipeg, MB, Canada

Part of BRT project examining alternative propulsion impact of introducing CNG and/ or Electric bus fleet to new service line, including maintenance, and facility changes.

## BRT Feasibility Study, Abidjan Ivory Coast Africa (2017):

Fleet lead examining the vehicle specification, propulsion (CNG, Diesel, Electric) for BRT corridors for vehicle length, facility needs and passenger amenities. Reviewing bus maintenance and operations for gap analysis and institutional training.

## Abbotsford, Green Fleet Strategy (2017)

Project Manager examining 300+ assets for the municipality of Abbotsford to develop medium and longterm goal of reducing emissions in fleet operations. Identifying electric and CNG vehicles capable of meeting city needs.

#### Lima, Peru Electric Bus Feasibility (2017–2019)

Project Manager helping to examine triple bottom line approach to feasibility of electric buses from suburbs of Peru to downtown. Examining fleet, infrastructure, operations, and lifecycle considerations.

## Halifax Transit Electric Bus Feasibility (2017)

Project Manager helping to develop a triple bottom line approach adoption of technology of electric buses for Halifax Transit covering facility, operations, fleet and lifecycle considerations. Examining infrastructure need for on route and end point charging.

## Calgary Transit Electric Bus Feasibility (2017)

Providing support to local team to examine electric bus vehicle market and potential feasible electric routes for Calgary Transit.

## Confidential Private Sector Client, Electric Bus mid-life specification (2016-2017)



## **Global Technical Director- Zero Emission Mobility**

As Client Strategic Advisor examined the feasibility with CUTRIC funding for a pilot of 40ft diesel bus to be re-powered to electric. Provided guidance on maintenance and lifecycle challenges. Moreover, examined charging infrastructure needs for pilot study and battery requirements. Examined return to base charging (overnight) and en-route charging using inductive and overhead charging.

## Epic Cars Light Duty (Class 6 & below) Electric Repower Market Analysis (2016-2017)

As client strategic advisor examined the market opportunity of electrifying pick-up and small SUVs to electric in application for return to base fleets. Examined operating environment, user group challenges and potential battery pack requirements for various applications from delivery trucks to on-site construction manager support vehicle.

## **Ontario Northland Coach Operations Business Plan (2017)**

Project Manager examining entire coach operations scheduling, vehicle specifications, maintenance practices to improve cost recovery ratio. Reviewing and providing feedback for hourly service cost. Developing business case feasibility for converting fleet to near zero emission CNG for inter-city transport in Northern Ontario.

### London Transit BRT (Zero Emission) (2016)

Provided support to Project manager in developing the business case for BRT vs. LRT in London Ontario. Conducted a scan of electric 40FT & 60FT vehicles and operating constraints for BRT service.

### Fort Saskatchewan Vehicle Specification and Quality Assurance (2016)

Part of overall project team to bring conventional transit to the area of Fort Saskatchewan. As lead of fleet identified vehicle needed for operations through market scan, developed technical specifications and evaluated vendor vehicles. Developed tender contract for operating and maintenance of bus fleet. In charge of quality assurance during build period of bus.

## TTC Vehicle Engineering Non-Revenue Vehicles (2016)

Project Manager in charge of staff, seconded to the TTC to write vehicle specifications for a wide range of support vehicles and ensure quality assurance on vehicle specifications developed.

## TTC Wheel Trans Service Review (2016-2017)

Fleet Lead responsible for development condition assessment structure, review of future vehicle requirements, fleet size and operational strategy for maintenance.

## TTC Bus Idling Study and Policy (2016)

Technical Analyst reviewing the operational and vehicle performance of TTC buses for NOX, particulate and other air quality particulars. Helping team develop standard guidelines and policy for idling of fleet. Provided market scan of emerging propulsion technologies such as electric, CNG and hybrid for consideration for TTC fleet.

## TTC Bus In-line Inspection (2016-2018)

Project Manager Quality assurance for 213 Nova low-floor 40 foot buses for the TTC. In-charge of managing project costs, inspector daily inspection logs, weekly reports and final testing on all vehicles for the TTC built at Nova plant. Contract extended for inspection of another 97 buses in 2017-2018.

# Confidential Private Sector Client, Cost Benefit Analysis and Market Scan, GTHA (2014-2015)

Project Manager on delivering a life cycle cost benefit for major subcomponent on transit vehicle. Reviewed bus radiator data provided by a private sector firm operating in the transit maintenance industry for applicability in an Excel-based cost-benefit model. Analyzed industry survey results to determine benchmark maintenance practices. Created a cost-benefit model to evaluate, from a transit



## **Global Technical Director- Zero Emission Mobility**

agency (client) perspective, the advantages of installing new parts as opposed to refurbishing and reinstalling existing parts. Presented findings in a final report.

# Director of Business Development and Supply Chain Solutions, Neopart LLC, (November 2012- June 2014)

Led the introduction and execution of lean supply chain practices using a Vendor Managed Inventory model for OEM and after-market parts. Responsibilities included establishing and strengthening customer and supplier accounts across Canada and championing cross-referenced sourcing strategies for 9,000 SKUs.

# Program Analyst, Metrolinx, A crown corporation of Province of Ontario (May 2008 – October 2012)

Comprehensive facilitation and leadership in the development and implementation of supply chain and public procurement projects including:

# Transit Inventory Management (Recipient of the 2012 PMAC Supply Chain Excellence Award)

Advocate and project lead of a joint consignment Vendor Managed Inventory model (valued at \$120 million over 5 years) that will result in \$2.5 million annual savings for transit operators across the Greater Toronto and Hamilton Area (GTHA). Examined the supply chains, carbon footprints and purchasing practices of various Ontario transit systems in order to maximize value for money for Ontario taxpayers and minimize carbon footprints through consolidation and Integrated Planning Forecasting and Replenishment (IPFR). Instrumental in project development, negotiations and implementation with transit operators to refine the scope of the Request for Proposals (RFP) and Project Agreements. Engaged in regular interactions with stakeholders to manage concerns and issues regarding on-going contract issues. Responsible for the deployment across 8 transit properties and over 40,000 Stock Keeping Units (SKU) as acting contract administrator. Developed regional benchmarking standards for materials management for transit with an external consulting firm examining over 100,000 individual data points. Personally awarded the 2012 SCL President's Award for vision and leadership.

#### **Consolidated Transit Procurement**

Supported RFP creation for specialized and general joint bus procurements for numerous transit properties across Southern Ontario. Developed evaluator workbooks and chaired a consensus committee for cut-away bus (8-metre) RFPs. Project lead on market research and developed Expressions of Interest (EOI) for future joint procurements.

#### Metrolinx 8M Cutaway & 12M Conventional Fleet Procurement (2008-2011)

Supported RFP creation for specialized and general joint bus procurements for numerous transit properties across Southern Ontario. Developed evaluator workbooks and chaired a consensus committee for cut-away bus (8-m) RFPs. Developed sustainability evaluation criteria for bus vehicle.

#### Metrolinx Materials Management Dashboard (2010-2011)

Developed regional benchmarking standards for materials management for transit with an external consulting firm examining over 100,000 individual data points. Covering key KPI's of on-time performance, fill rate, invoice accuracy and carbon footprint.

## Metrolinx Carbon Footprint Metric (2009-2012)

Project lead in creation of a tracking mechanism to analyze and collect last point of shipment GHG and carbon footprint impact for transit part's supply chain. Identified average part travels over 400Km's to facility and generate 12,000 unique delivery trips to facilities

#### Province-Wide Joint Fuel Purchasing and Price-Hedging Program

April 2021 Page 11 of 12



## **Global Technical Director- Zero Emission Mobility**

Developed an internal proposal to examine the joint purchase of diesel fuel for transit vehicles. Researched Fuel-purchasing practices across North America. Developed a business case and a participant survey to advance a province-wide transit diesel fuel purchasing and price-hedging program that will account for 3 percent, or 270 million litres, of Ontario's diesel consumption. The Program is anticipated to launch in 2013 and will achieve fuel savings of 1-2 percent on purchased price, or \$5.4 million, annually.

### Pay-By-Cell Fare Payment

Developed the financial model and the business case for a mobile fare payment system on all GO Transit vehicles.

### Metrolinx Long-Term Project Strategy

Designed the Innovation Department's project finance model and tracking system. Member of the Transit Procurement Initiative Five Year Strategic Planning and Development Team. Created brand identity, stakeholder engagement plans and promotional materials for the Transit Procurement Initiative Program at Metrolinx.

### **Investment Strategy Public Engagement Tool Project Lead**

Project lead on the creation and delivery of an online innovative public engagement tool (Bigmove.ca) to implement the Province of Ontario's long-term transit funding plan with the target of reaching 100,000 users. Procured and developed the interface ahead of schedule and under budget. Reported to an executive panel for review.

## **Professional History**

- Wood, Director Sustainable Transportation & Asset Management Solutions (2020 Present)
- Academia & Industry Teaching (2017 present)
- WSP Canada Inc, Principal Consultant: Sustainability & Asset Management (2014 2020)
- Neopart LLC, Director of Business Development and Supply Chain Solutions (2012 2014)
- Metrolinx, A crown corporation of Province of Ontario, Program Analyst (2008 2012)

## Norman Hendry, I.Eng Zero-Emission Lead, Canada





Years of Experience

## **Office of Employment**

Edmonton, Alberta

#### Languages

- English
- German

## **Areas of Expertise**

- Fleet Management
- Vehicle Lifecycle Analysis
- Asset Design and Specification
- Fleet and Facility Alternative Fuel Feasibility Trials and Deployment
- Procurement and Contract Negotiation
- Personnel Training and Development
- Employee / Labour Relations

## **Sectors**

- Transit
- Oil and Gas
- Waste Management
- Transportation
- Military

## **Professional Summary**

Mr. Hendry is an accomplished Fleet Manager with a record of success that includes over twenty-five (25) years of senior management experience within the British military, and the public and private sectors. Norman's extensive leadership and management experience has led to a record of accomplishment in implementing strategic change and operational delivery which has produced productive and long-lasting results in delivering a sustained level of service in a cost-effective manner at an acceptable level of risk. Norman has developed and implemented fleet management strategies and has been involved in the design, specification, standardization of equipment, and procurement management.

Norman was on the steering committee, and the design and specifications committee for the Kathleen Andrews Transit Garage, a 400-bus storage and maintenance facility, to deliver a new capability in the City of Edmonton supporting the introduction of battery-electric buses. He also collaborated on the Alberta Zero Emission Hydrogen Transit (AZEHT) initiative where two hydrogen fuel cell electric buses (FCEB) and supporting fueling infrastructure is to be used in road trials shared by the municipalities of Edmonton and Strathcona County, with the active participation of Calgary, and Banff/Bow Valley.

Norman has presented at many conferences, symposiums, webinars, executive meetings, and training sessions to share his experiences and learnings throughout his career and most recently on the City of Edmonton's bus electrification journey to zero emissions.

## Qualifications

## **Education**

**Diploma in Engineering Management** University of Greenwich, UK

#### **City & Guilds of London Institute**

Licentiateship in Mechanical Engineering Motor Vehicle Craft Studies

- Part Two Certificate -Light Vehicle
- Part Three Wheeled vehicle Technology

Business & Technician Education Council BTEC- Higher National Certificate in Engineering

## Norman Hendry, I.Eng Zero-Emission Lead, Canada



Clear Impact Consulting Group

Leadership Effectiveness in Engineering

Interprovincial Standards Red Seal Program Heavy Equipment Technician

Government of Canada Gender-based Analysis Plus (GBA+)

## **Training & Learning**

- Cultural Commitments
- Contributing to Our Respectful & Inclusive Workplace
- Introduction to Anti-Racism
- Building our Respective Workplace
- Indigenous Awareness
- Inspiring Understanding -Reconciliation Today & Tomorrow
- Emotional and Social Intelligence

Mental Health Commission of Canada

The Working Mind-Train the Trainer

- Enabling Conversations 3 Modules
- Setting Direction and Supporting Growth
- Guiding through Coaching, Feedback and Recognition
- Resetting for a Clear Performance Plan
- ENVISO Management Awareness
- Contract Management
- Defining Specifications and Preparing Scope of Work

## Experience

## Director of Transit Fleet Maintenance, City of Edmonton, 2015-Sep 2021

- Strategic leadership, direction and oversight of the Fleet Maintenance management team that directed and managed 400+ employees that performed the inspections, legislated maintenance, planned and unplanned maintenance, and recycling of a fleet of approximately 1000 public transit buses.
- Created and allocated an annual operating budget of approximately \$80M for the four (4) service garages and two (2) heavy repair shops
- Reviewed and monitored the maintenance program while striving for continuous improvements and identifying future maintenance requirements which effectively increased productivity levels, fleet availability and reliability which resulted in reduced expenditures
- Member of the Steering Committee, and the Design Committee for the Thomas Ferrier Garage renovation planning option design for battery-electric bus
- Collaborated on the design and specifications of the Kathleen Andrews Transit Garage, a 400-bus storage and maintenance facility, to deliver a new capability in the City of Edmonton supporting the introduction of battery-electric buses
- Developed, implemented and led strategic plans that aligned with the Modern Municipal Organization strategy while enhancing internal, external and cross functional working relationships.

## Norman Hendry, I.Eng Zero-Emission Lead, Canada



 Key team member of the City's battery-electric bus program; including bus design, specification and procurement, industry leading charging system and standards (SAE J3105), employee training, and safety/emergency response capability

## Fleet Manager- Weatherford Canada Partnership, 2008-2015

- Negotiated and managed contracts for vehicle purchases, leases, fuel, tires, and external fleet maintenance for a fleet of 2000+ light-duty, medium-duty, and heavy-duty vehicles.
- Design and specification of the special to role light-duty, medium-duty and heavy-duty vehicles used within the different Product Lines
- Strategic leadership and direction of the Fleet Safety, Fleet Procurement, and Fleet Maintenance groups.
- Developed and Implemented fleet management strategies, and standardization of equipment specifications.
- Collaborated with Product Line Regional Business Unit Directors in the development and management of the fleet operating budget through Life Cycle Cost Analysis of equipment acquisition, maintenance, and disposal.
- Representative on the Client Advisory Boards of GMC, Ford, and Chrysler.

## Market Area Fleet Manager-Western Canada, Waste Management, 2003-2008

- Established maintenance and labour expenditure targets for the 5 Hauling Districts, 2 Landfills, and a Materials Recycling Facility within the Market Area.
- Analyzed maintenance and labour expenditure for the Market Area on a weekly basis for comparison to the monthly budgeted amount and sent variance justifications to the Group office.
- Evaluated asset distribution and spare ratio analysis within the Market Area to ensure that the Hauling Districts had the correct number of assets (fleet and containers) to ensure customer satisfaction and maximize Return On Capital Expenditure (ROCE).

## **Professional History**

- Wood (November 2021 Present)
- City of Edmonton (2015 2021)
- Weatherford Canada Partnership (2008-2015)
- Waste Management (2003-2008)



## **Summary**

### **Years of Experience**

35 (<1 with Wood)

## **Office of Employment**

Burlington, Ontario

## Highlights

- 35+ years of experience in transit maintenance, vehicle specification
- Inspected over 6+ electric buses, and 600 diesel buses for various transit agencies
- Tremendous experience in job function and process mapping for maintenance activities

## **Areas of Expertise**

- Fleet & Facilities Management
- Asset Management
- Fleet Procurement
- Fleet Standard Operating Procedures
- Transit & Fleet Maintenance
- Maintenance Training
- In-Line Vehicle Inspection

## **Professional Summary**

Rick Baltzer is a Senior Fleet Consultant with Wood's Sustainable Transport & Asset Management Solutions practice. Rick specializes in asset management, fleet procurement, fleet SOPs, maintenance training and in-line vehicle inspection. Rick brings a proven track record of over 35 years of fleet management service. He is a licensed diesel mechanic who has risen through the ranks over his career.

Prior to joining Wood, Rick worked at Burlington Transit and City of Burlington Fleet Services in the development and growth of its joint transit procurement and maintenance initiatives. He has extensive senior level experience with major transit companies and services, as well as business development optimization across the North American transit industry. Rick's insights and experience are widely respected in the areas of transit and fleet maintenance.

Recently, Rick has supported several fleet reviews focusing on NRVs including the Halton Region Fleet Management Review and Town of Oakville Fleet Utilization & Optimization Review. Rick worked with TTC on ebus manufacturer audit, vehicle specification and Canadian content audits.

## Qualifications

## **Education**

Business Administration Diploma, Human Resources, Sheridan College, 1987

Ministry of Colleges and Universities, Class "A" Mechanics License, Automotive Apprentice Program, Honours Standing, Mohawk College, 1980

## **Registrations / Certifications / Licenses**

310T Truck and Coach Mechanic310S (Automotive) Technician License



## **Experience**

## Wood, Transit Fleet Specialist (2020 – Present)

### **Senior Technologist**

### Transit Windsor Bus Lifecycle Study, Transit Windsor

Delivery of a 20-year business plan for City of Windsor on operating transit bus fleet, assessing condition of fleet and developing an optimal lifecycle and replacement plan for fleet. Reviewing in house staff skills and identify training opportunities for maintenance staff. Role was to inspect the vehicles for this project.

## **Senior Technologist**

### Fleet & Asset Management, Toronto Transit Commission (TTC)

Development of new lifecycle model to identify optimum age of retirement for TTC using operational, capital and labour costs. Conducted fleet condition assessment on 96 units. Reviewed hybrid bus technology and lessons learned for TTC operations and cost of operating over lifecycle. Role was to inspect the vehicles for this project.

## **Senior Technologist**

### **Bus In-Line Inspection, Toronto Transit Commission (TTC)**

Quality assurance for 213 Nova low-floor 40 foot buses for the TTC. Project included managing project costs, inspector daily inspection logs, weekly reports and final testing on all vehicles for the TTC built at Nova plant. Contract extended for inspection of another 97 buses in 2017-2018. Role was to inspect the vehicles for this project.

## **Senior Technologist**

#### **Bus In-Line Inspection, York Region Transit**

Quality assurance for 17 Nova low-floor 40 foot buses for the YRT. Project included managing project costs, inspector daily inspection logs, weekly reports and final testing on all vehicles for the YRT built at Nova plant. Inspecting another 40 buses in 2016-2017 bus build year. Role was to inspect the vehicles for this project.

## **Senior Technologist**

## Fleet & Asset Management, Sarnia Transit

Sarnia Transits vehicle lifecycle and state of good repair deficit. Project included inspecting 100% of fleet and reviewing maintenance practice to determine optimum vehicle retirement age. Examined alternative propulsion fleets of hybrid, CNG and electric buses to provide short-term and long-term direction of overall fleet propulsion. Role was to inspect the vehicles for this project.

## **Senior Technologist**

## Fort Saskatchewan Vehicle Specification and Quality Assurance, Fort Saskatchewan Transit

As part overall project team to bring conventional transit to the area of Fort Saskatchewan. Project included identifying vehicle needed for operations through market scan, developed technical specifications and evaluated vendor vehicles, and quality assurance during build period of bus. Role was to inspect the vehicles for this project.



## WSP, Transit Fleet Specialist (2015 – 2020)

## **Contract Services to the Town of Oakville**

### Town of Oakville

Inspection and monitoring of Transit Coach Refurbishments

## **Digital Electric Contract Services**

#### **Transport Canada/Grand River Transit**

Installation and training of a vehicle/driver lookout device in conjunction with Transport Canada and Grand River Transit.

## Neopart, Warehouse Leadhand (2013 – 2020)

- To assist in the operation of the warehouse and provide support to the office staff.
- Train staff on the "Inventory Management" software.
- Assist in the Health and Safety, WHMIS and First Aid.
- Provide product information for tenders, quotes, and request for proposals/information documents.
- Product research and sourcing.
- Trouble shooting part's issues, cross referencing.
- Product delivery and pick-up.
- Warehouse receiving and delivering of products.
- Process RMA's (Product Returns) for credit.
- Process third party documents for product delivery.

## Neopart, Warehouse and Facility Manager (2011 – 2013)

Liaison with the Vice President and Director of Neopart Canada in setting up and managing the "Parts Distribution Warehouse" for Neopart LLC who was awarded the TIM's (Transit Inventory Management Project) contract through Metrolinx to provide parts and services to Transit Properties in Ontario and throughout Canada.

- Hire warehouse staff and drivers.
- Set-up warehouse and office, arrange for racking and shelving, lift devices, trucks, packaging materials, office furniture and equipment.
- Finalized building acceptance from leasing agent.
- Learn "Inventory Management" software and train staff.
- Control and managed the Warehouse and Facility budget short term/long term.
- Register and obtain CVOR. (Commercial Vehicle Operators Registration)
- Prepare annual budget for Operating and Capital.
- Set-up Health and Safety, WHMIS and First Aid.
- Develop and prepare tenders, quotes, request for proposals, and request for information documents.



- Initiate, prepare and issues purchasing documents in conjunction with the
- Purchasing Department policies.
- Develop and prepare reports, information and recommendation documents.
- Maintain and update fixed asset inventory.
- Manage and control all contract services related to warehouse, fleet and the building maintenance.
- Develop, prepare and initiate Standard Operating Procedures (SOPs).
- Review and update as required legislated policies, operating procedures, contractual agreements.
- Initiate and/or oversee fleet, equipment and building maintenance and repairs.
- Provide updates and recommendations to the Director, of legislative and technical changes affecting the staff, fleet, equipment and building.

Secondary Activities:

- Participant on the Neopart Management Team.
- Oversee Health and Safety as the certified workplace member of OHSA.
- Participant on the Metrolinx Technical Committee for parts and service review for the TIMS project.
- Product research and sourcing.
- Trouble shooting part's issues, cross referencing, onsite visits to Transit Properties and vendors.
- Emergency and after hours support.
- Warehouse receiving and delivering of products

## **Transit Maintenance Project Coordinator, City of Burlington (2010 – 2011)**

Control and management of the maintenance annual Operating budget of approximately \$4.5 million.

- Control and management of the maintenance Capital budget short term/long term.
- Annual budget preparations for the maintenance area Operating and Capital.
- Develop and prepare tenders, quotes, request for proposals, and request for information documents.
- Initiate, prepare and issues purchasing documents in conjunction with the Purchasing Department policies.
- Develop and prepare reports, information and recommendation documents for senior management and council.
- Maintain and update fixed asset inventory.
- Manage and control all contract services related to fleet and the building maintenance.
- Arrange and schedule repairs and servicing of our external clients.
- Develop, prepare and initiate Standard Operating Procedures (SOPs) for the maintenance area.
- Review and update as required legislated policies, operating procedures, contractual agreements.
- Initiate and/or oversee fleet, equipment and building maintenance and repairs.



- Provide updates and recommendations to the Operations Manager and the Director of Transit and Traffic, of legislative and technical changes affecting the staff, fleet, equipment and building.
- Provide training to new Maintenance Supervisor.

Secondary Activities:

- Participant on the Transit Management Team.
- Certified member of the Transit Health and Safety Committee in association with OHSA.
- Participant on the Regional Trunk Radio System Replacement Team. (\$18 million project budget)
- Participant on the Metrolinx Joint Vehicle Procurement Project.
- Participant on the Metrolinx Transit Inventory Management Project (TIMS)
- Participant on the City of Burlington Environmental Assessment Team.
- Participant on the City of Burlington CVOR (Commercial Vehicle Operators Registration) Team.
- Participant on the City of Burlington Fleet Management System Project.
- Participant on the City of Burlington/Metrolinx Fare Collection Project. (Presto)

### **Transit Maintenance Supervisor, City of Burlington (1986 – 2010)**

- Maintenance Supervision of the conventional, paratransit and support fleet of vehicles.
- Maintenance Supervision of the Operation/Maintenance facility.
- Control and management of the annual Operating budget. Approximately \$4.5 million for 2009.
- Control and management of the annual Capital budget short term/long term. Approximately \$4.6 million for 2009.
- Prepare and participate in the annual budget process for the maintenance area Operating and Capital.
- Develop and prepare tenders, quotes, request for proposals, and request for information documents.
- Initiate, prepare and issues purchasing documents in concert with the Purchasing Department.
- Perform new vehicle inspections at supplier sites.
- Arrange for the acceptance and registration of new vehicles into the fleet.
- Arrange for the decommissioning of retired vehicles from the fleet.
- Develop and prepare reports, information and recommendation documents for senior management and council.
- Oversee and participate in the daily operations of the Transit maintenance stock room.
- Oversee and participate in the annual inventory, purchasing policies and audits of the materials, supplies and services.
- Maintain and update annually the fixed asset inventory of fleet and facility.
- Manage and control all contract services related to fleet and the building maintenance.
- Oversee contract service personnel; bus cleaners, tire service, HVAC, etc.



- Arrange and schedule repairs and servicing of our external clients.
- Prepare and issue billing documents for our external clients.
- Develop, prepare and initiate Standard Operating Procedures (SOPs) for the maintenance area.
- Review and update as required legislated policies, operating procedures, contractual agreements.
- Initiate and oversee fleet, equipment and building maintenance and repairs.
- Complete and update all annual, semi-annual certifications, licensing and MTO subsidy forms.
- Schedule and oversee all aspects of vehicle maintenance: i.e. MTO brake and safety inspections, emission testing, drivetrain repairs, structural repairs, destination signs, fare collection equipment, two-way radio system, bike racks, etc.
- Prepare for annual MTO Fleet inspections/audit.
- Investigate vehicle and facility accident/incidents. Process necessary documentation for resolution.
- Initiate, prepare, issues and finalize insurance claims. Correspond with insurance agents and brokers.
- Oversee and supervise a staff of 13 union and non-union employees. Seven mechanics, four mechanic helpers, one maintenance clerk and one parts coordinator.
- Develop staff job descriptions and duties.
- In concert with Human Resource prepare and issue job request documents, perform interviews and hire staff.
- Develop and manage staff working schedules, vacation schedules and training programs.
- Provide updates and recommendations to the Operations Manager and the Director of Transit on legislative and technical changes affecting staff, fleet, equipment and building.
- Review and update hardware/software for fleet management, inventory, fuel, building HVAC system, building fire suppression system, vehicle maintenance – Thermo King, Allison, Cummins, Detroit Diesel, Webasto, Vapor Door systems, Ricon lifts, Electrical multiplexing, Snap-on scanner, Pro-link scanner.
- Manage and maintain MOE waste removal for Operation/Maintenance facility.

#### Secondary Activities

- Participant on the Transit Management Team.
- Certified member of the Transit Health and Safety Committee in association with OHSA.
- Participant on the Regional Trunk Radio System Group.
- Participant on the Metrolinx Joint Vehicle Procurement Project.
- Participant on the Metrolinx Transit Inventory Management Project (TIMS)
- Participant on the City of Burlington Environmental Assessment Team.
- Participant on the City of Burlington CVOR (Commercial Vehicle Operators Registration) Team.
- Participant on the City of Burlington Fleet Management System Project.



• Participant on the City of Burlington/Metrolinx Fare Collection Project. (Presto)

## **Apprentice Diesel Mechanic/Diesel Mechanic, City of Burlington (1977 – 1986)**

- Performed mechanical maintenance duties transit fleet/facility.
- Lead hand responsibilities on the P.M. shift.
- Served as acting supervisor of maintenance in the absence of the Mechanical Supervisor.
- Represented maintenance on Health and Safety committee.
- Performed stockroom activities, ordering and stocking parts, charging out parts to work orders, assisting in annual inventory count.

## Labourer/Mechanic's Assistant, City of Burlington (1975 – 1977)

- Performed mechanical functions and assistance to the maintenance groups through the Public Works, Recreation and Transit departments.
- Worked in the Public Works as a labourer and lead hand on the asphalt road gang and leaf pickup.
- Part of the winter control crews plowing, salting and snow removal.

## **Professional History**

- Wood, Transit Fleet Specialist (2020 Present)
- WSP, Transit Fleet Specialist (2015 2020)
- Neopart Canada, Warehouse Leadhand (2013 2015)
- Neopart Canada, Warehouse and Facility Manager (2011 2013)
- City of Burlington/Burlington Transit, Maintenance Project Coordinator (2010 2011)
- City of Burlington/Burlington Transit, Ontario Transit Maintenance Supervisor (1986 2010)
- City of Burlington, Apprentice Diesel Mechanic/Diesel Mechanic (1977 1986)
- City of Burlington, Ontario Labourer/Mechanic's Assistance (1975 1977)

#### Jenna McDavid

Jenna has more than 20 years of experience in the energy and utilities industries and supports transportation electrification engagements focused on technical and market research as well as customer program strategy, design, delivery, and evaluation. A recognized leader in the energy industry, Jenna serves as Vice President of the Board of Directors for the Association of Women in Water, Energy & Environment (AWWEE) and Treasurer of the Board of Directors for the International Energy Program Evaluation Conference (IEPEC). Past clients for transportation electrification engagements include the Independent System Operator of New England (ISO-NE), National Grid, Sacramento Municipal Utility District, Tennessee Valley Authority, and others. She has moderated EV sessions and presented research on EV program optimization and grid-enabling technologies to support EVs. In addition, Jenna served two consecutive terms as Commissioner on Energy Use & Climate Change for the City of Somerville, MA from 2002 through 2006 and as Expert Advisor to the California Public Utilities Commission in support of strategic planning initiatives from 2008 through 2017.

#### **Professional Credentials**

- Master of Arts, Environmental Science & Policy, Clark University
- Bachelor of Arts, Environmental Science & Policy, Clark University

#### **Professional Associations**

- Vice President, Board of Directors, Association of Women in Water, Energy, and Environment
- Treasurer, Board of Directors, International Energy Program Evaluation Conference
- Women of Electric Vehicles

#### **Relevant Experience**

Jenna worked on the following projects prior to joining Kimley-Horn:

Tennessee Valley Authority (TVA), Fleet EV Adoption Forecast and Load Forecast for 2021-2032, Statewide, TN — Principal-in- Charge. This project included a detailed characterization of vehicle classifications and characteristics across all fleet vehicle types (light-, medium-, and heavy-duty vehicles) and fuel types, a summary of total fleet vehicles currently in operation within TVA's jurisdiction, a forecast of EV adoption from 2021 through 2032, and weather-tunable models forecasting EV charging load from each of the four key fleet vehicle segments of interest (including variations by month, season, day type, and hour) with disaggregation by state and load zone (to the extent the data permit). Jenna developed the project's scope of work, oversaw its delivery, and was ultimately responsible for successful execution of the project.

Independent System Operator of New England (ISO-NE), Fleet EV Adoption Forecast and Load Forecast for 2021-2032, CT, ME, MA, NH, RI, and VT — Principal-in-Charge. This project included a detailed characterization of vehicle classifications and characteristics across all fleet vehicle types and fuel types; a summary of total fleet vehicles currently in operation, a forecast of EV adoption from 2021 through 2032 for four key fleet vehicle segments of interest (light-duty fleet vehicles, medium-duty delivery trucks, transit buses, and school buses), each of which includes several subtypes, by state and load zone, and weather-tunable models forecasting EV charging load from each of the four key fleet vehicle segments of interest with disaggregation by state and load zone (to the extent the data permitted). Jenna developed the project's scope of work and oversaw its delivery. She was ultimately responsible for successful execution of the project.

NV Energy, Residential Customer EV Adoption Forecasting and Customer Program Optimization Study, Multiple Locations, NV — Principal-in-Charge. To support NV Energy in developing incentive programs to support residential customer adoption of EVs, supporting equity in program delivery, and understanding the impacts of adoption on the electric grid, the project included an online survey of 800 of NV Energy's residential electric customers that focused on the needs of lower-income customers and residents of multi-unit dwellings. The research identified the optimal combination of program services to maximize residential adoption of EVs among these customer groups. A detailed geospatial forecast of light-duty EV adoption in NV Energy's service territory at the Census Block Group level for 2021 through 2030 also was performed. Results from these efforts supported NV Energy in its application to regulators to support new customer programs serving low-income customers and residents of multi-unit dwellings. Results also will support distribution grid infrastructure planning. Jenna developed the project's scope of work and oversaw delivery. She was ultimately responsible for successful execution of the project.

**NV Energy, Fleet Program Design Support, Multiple Locations, NV — Principal-in-Charge.** The project included an online survey of 100 of NV Energy's commercial fleet customers that focused on identifying barriers to EV adoption and the most valuable forms of support the utility could provide to support their electrification journeys. NV Energy will use the results from this work to support expansion and tailoring of their existing fleet electrification incentive program. Jenna developed the project's scope of work, oversaw its delivery, and bore ultimate responsibility for the project's successful execution.

**NV Energy, EV Program Implementation Assistance, Multiple Locations, NV — Technical Advisor.** This project includes the Fleet Electrification Program, which focuses on accelerating EV adoption in Nevada fleets (including municipal fleets); The Multi-Family Charging Program and the Workplace Charging Program, both of which focus on increasing residents' or employees' access to (and use of) electricity as a transportation fuel; and the Custom Grant Program, which is designed to help commercial customers with an EV infrastructure project that does not qualify for other NV Energy incentives. In July 2021, two new programs were added: Governmental Charging Program, which provides incentives to government agencies interested in installing EV charging infrastructure; and Lower-Income Multi-Family Program, which provides incentives multi-family property owners and managers for properties that qualify as low income per state and federal definitions. Jenna provided technical expertise and guidance regarding EVs and EV charging infrastructure.





#### **EDUCATION**

Bachelor of Science, Mechanical Engineering, NIT, Kurukshetra, India, 1978

#### REGISTRATIONS

Engineer-in-Training, VA, 1988

LANGUAGES English/Hindi/Punjabi/Urdu

#### PROFESSIONAL

**MEMBERSHIPS** Society of Automotive Engineers (SAE)

Board member, American Public Transportation Association (APTA) and Florida Public Transportation Association (FPTA)

Vice chair, APTA Bus Technical Maintenance Committee

APTA, Clean Propulsion & Support Technology Committee

APTA, Procurement and Standards Development Committee

APTA, Connected and autonomous vehicles Committee

**INDUSTRY TENURE** 35 Years

## Harpal Kapoor

Vice President, Advanced Bus Technology Programs

Harpal has more than 35 years of experience in the various fields of transit industry. He is an analytical, data-driven leader with extensive experience providing highquality leadership in all phases of the transit system development and operation. He has developed successful long- and short-term strategic plans for bus and rail planning, operations, maintenance, capital programs and engineering. He managed annual operating and capital budgets of up to \$1B and oversaw a unionized workforce of 3,200+ employees. He operated, maintained and expanded transit system with 96 bus routes, 21 rail stations, 20 mover stations with annual ridership of 100 million.

Harpal has experience implementing alternative fuel programs, including clean diesel, CNG, hybrid diesel-electric, battery electric and hydrogen fuel cell technologies. He provided program management in the construction of heavy rail corridors and extension of bus rapid transit (BRT). He procured, installed and operated automatic fare collection systems to ensure seamless integration with the four modes of transportation. He procured and upgraded CAD/AVL/AVM technology for buses. He utilized Lean Six Sigma methodologies to drive efficiency, productivity, and cost-effectiveness. He developed plans that significantly improved repair and maintenance operations. He collaborated with cross-functional teams of stakeholders, including senior elected officials, to drive policy and legislative decision making. He created high-quality customer and safety focused organizational teams. He completed highly complex capital projects within strict budgets and deadlines.

Harpal is an energetic leader known for driving improvements in quality, increasing customer service, and maintaining efficient project operations. Key qualifiers include:

- Program Management
- Project Management
- Asset Management
- Alternative Fuel Programs
- Technology Implementation
- Lean Six Sigma
- Route Planning
- Strategic Planning
- Gap Analysis
- Customer Service
- Capital Budgets
- O&M Budgets
- Finance
- Procurement
- Change Management
- Union Labor
- Safety & Security
- Bus/ Rail Maintenance
- Process Improvements
- Operations



#### RELEVANT EXPERIENCE

**OMNI STRATEGY, LLC EXPERIENCE (October 2020- Present)** 

Maryland Transit Administration (MTA), Technical Support for Maintenance and Transition Plan for Zero emission Vehicles, Baltimore, MD. Senior Program Manager. Assist MTA bus engineering and maintenance in resolving fleet and reliability issues. Provide support for procurement of pilot buses for testing of batteryelectric technology and related infrastructure.

HDR EXPERIENCE (May 2019 to October 2020)

San Mateo County Transit District (SAMTRANS), Feasibility study, batteryelectric bus program, Francisco, CA. Vehicle/Planning/ O&M Lead. Harpal was responsible for data collection for transit agency's existing bus routes and cost of maintenance/ operations. He worked with the HDR's modeling team in the analysis of entire existing bus routes for transitioning to zero emission buses. Identified the routes which can achieve the daily range with single depot charging, and the others with limited range and need on-route charging with optimum location of on-route fast charging stations. The team developed various scenarios for charging profile to optimize peak and demand charges to reduce electricity costs. Provided high level cost estimates for operations, maintenance, training and capital costs for facility and infrastructure upgrades. Provide alternative cost analysis for hydrogen fuel cell technology implementation.

Maryland Transit Administration (MTA), Assist Bus Maintenance and Engineering in Developing the Roadmap for Transitioning to Zero emission Vehicles, Baltimore, MD. Senior Program Manager. Harpal worked on the first phase of developing a roadmap for transitioning to zero emission buses for MTA. The task includes assisting with grant applications, route selection and testing & evaluation of zero emission pilot buses. This pilot program will be expanded in phases to implement the transition of entire fleet to zero emissions.

Monterey- Salinas District (MST), Roll out plan under ICT Guidelines for Zero Emission Vehicles (battery-electric and hydrogen fuel cell), CA. Vehicle Technology /Planning/ O&M Lead. Harpal initiated and worked on the roll out plan for the MST fleet for route modeling, infrastructure requirements, Capital and O&M cost comparison for battery electric and hydrogen fuel cell technology.

CH2MHILL/ JACOBS EXPERIENCE (June 2011 to May 2019)

Washington Metropolitan Transit Authority (WMATA), Testing and evaluation of battery-electric bus, Washington DC. Senior Program Manager. Harpal was responsible for leading the testing and evaluation of a prototype battery electric bus on daily revenue service on WMATA's duty cycle. The work included analysis of daily performance, and resolution of technical problems with the bus manufacturer; training of bus drivers; developing key performance indicators; weekly reporting and monthly progress meetings with all the stakeholders on the performance and the lessons learned.



Washington Metropolitan Transit Authority (WMATA), Green House Gas (GHG) emission reduction plan and alternative fuel analysis, Washington DC. Senior **Program Manager.** Harpal was responsible for development of GHG tracking tool for more than 1500 bus fleet. The alternative fuel analysis study helped achieve the GHG reduction goal with a 5- year fleet replacement plan utilizing CNG and hybriddiesel electric buses and CNG/ diesel engine retrofits during mid-life overhaul. Developed a 20- year fleet plan to continuously reduce emissions with a goal for zero emissions.

Washington Metropolitan Transit Authority (WMATA), Multi-year Bus Procurement, Washington DC. Senior Program Manager. Harpal was responsible for developing technical specifications, procurement guidelines, on-site QA inspections, resolution of production defects, testing and acceptance of more than 1000 buses for WMATA. Led the multi-year procurement with three different types of propulsion technologies, clean diesel, CNG and hybrid-diesel electric. Developed the technical requirements for zero emission battery-electric bus for WMATA's duty cycle for prototype testing and evaluation on various routes.

Washington Metropolitan Transit Authority (WMATA), Vehicle Technical Support, Washington DC. Senior Program Manager. Harpal was responsible for reliability improvements for the mix of various propulsion buses for the entire life-cycle utilizing reliability centered and condition based maintenance approach; develop PM and mid-life overhaul programs; failure and data analysis for root cause; oil analysis; special maintenance campaigns and retrofits; asset management plan for the state of good repairs; and process and efficiency studies.

Massachusetts Bay Transit Authority (MBTA), Master Plan of facilities for future integration of electric buses, Boston, MA. Subject Matter Expert, Vehicles. Harpal was responsible for working with the facilities team in developing a master plan for facilities improvements and new construction. The facilities plan was developed to transition from CNG and hybrid-electric to100% battery electric. The study included cost impacts, service planning and selection of future vehicle technology for shop charging.

York Regional Transit (YRT) and Toronto Transit Commission (TTC), Alternative fuel studies, Toronto, ON. Technical Lead, Vehicles. Harpal was responsible for the alternative fuel study for the Canadian transit agencies. Developed the roadmap for immediate GHG reductions by introducing transition technology like hybridelectric (extended range) and then switching to battery- electric in order to meet zero emissions goal in 2035.

MIAMI-DADE TRANSIT EXPERIENCE (February 1985 to November 1999 & February 2006 to June 2011)

**Miami-Dade Transit, Miami, Florida. Various Engineering and Maintenance positions leading to General Manager**. Harpal was responsible for operations, maintenance, and capital improvements of the 14<sup>th</sup> largest transit agency in country. He oversaw the development of bus and rail technical specifications and support to engineering and planning projects. He was responsible for introducing diesel hybrid electric and CNG technology in the fleet plan to reduce GHG emissions. He led transit agency to test and evaluate the electrification of accessories in the diesel, CNG and hybrid buses with a dedicated generator for the operation of air-



conditioning, cooling fans, doors, air compressors and steering. The test provided 7 to 10% improvements in fuel mileage and improved the reliability of the bus.

WMATA EXPERIENCE (November 1999 to February 2006)

## Washington Metropolitan Transit Authority (WMATA), Technical Support, Washington DC. Manager of Engineering

Harpal was responsible for reliability improvements for the 1400 bus fleet for the entire life cycle utilizing reliability centered and condition- based maintenance approach; develop PM and mid-life overhaul programs; failure and data analysis for root cause. Develop plans for special maintenance campaigns and retrofits; develop fleet plan, technical specifications for procurement of buses, and testing diesel hybrid-electric and CNG technology.

#### PUBLICATIONS AND PRESENTATIONS

- Experts Talk: Converting to an Electric Bus Fleet with Harpal Kapoor, Civil + Structural Engineer Magazine, May 2020
- Miami-Dade Transit Expects Electrification to Increase Fuel Efficiency, Fleet Maintenance Magazine, June 2011
- Miami-Dade Transit Fleet Enhancements Help Curb Costs, Emissions, Metro Magazine, May 2011
- Creating a Safety- First Culture, Annual APTA Meeting, San Antonio, Texas, October 2010
- MDT System Showcase, Operations, Maintenance and Capital Expansion, Florida Public Transportation Association (FPTA) Annual Meeting, Miami, Florida, October 2010
- Driving Improvements at Miami-Dade Transit, Greater Miami Chamber of Commerce, Transportation and Infrastructure Committee, Miami, Florida, February 2009
- A Transit Methodology using Six-Sigma for Heavy Rail Vehicle Maintenance, final report prepared for USDOT, FTA Office of Research, Demonstration, and Innovation prepared by New England Associates, August 31, 2009
- MDT Profile, Supply Chain Digital Magazine, July 8, 2009
- Case Study Miami Easy Card System, Cubic Transportation Magazine, October 2009
- Technology in the New Rail Cars and Airport Link, Metro-Rail Americas, 2008
- Transit Authority Updates Maintenance Facility, GovPro Magazine, March 2006
- Experts spot ways to improve diesel emissions retrofit programs, best technology verifications, Diesel Forum/ SAE, June 2003
- Alternative Fuels and Advanced Vehicle Data Center, Authored by West Virginia University, August 2002
- Air-conditioning, No Air, No fare, APTA Annual Meeting, Miami, Florida, 1997
- Various presentations at APTA conferences on development of standards, brake procedures, Air-conditioning, and Diesel-Electric Hybrid bus specifications (1997 thru 2011)
- Various technical and internal papers presented for Larsen & Toubro on new applications for reclamation of critical parts utilizing various specialized welding processes (1981 thru 1984)



## **Summary**

Years of Experience 7+

## **Office of Employment**

Burlington, Ontario

## **Areas of Expertise**

- Zero-Emission Vehicle Implementation
- Zero-Emission Vehicle Modelling
- Zero-Emission Vehicle Operating and Maintenance Cost Forecasting
- Zero-Emission Vehicle Electrical Infrastructure Requirements
- Financial Model Development
- Project Finance
- Transportation Analysis
- Asset Management
- Economic Analysis

## **Sectors**

- Transportation
- Infrastructure
- Real Estate
- Sustainability

## **Professional Summary**

Jamal has over seven (7) years of experience providing advisory services to public and private sector clients across Canada. He is experienced in modelling the adoption and implementation of Zero-Emission Vehicles. With Wood, Jamal has managed 5+ zero-emission projects, including simulation of electric vehicle implementation and development of operating and capital budget forecasts. Jamal is experienced in a range of consulting services, including financial modeling, business case development, and project management.

Jamal also has previous consulting experience in building sustainability and landscape architecture, working on projects across Canada spanning healthcare, educational, institutional, and commercial real estate sectors. Jamal's project experience includes project management and development of project documentation, including preliminary and detailed design drawings, quantity takeoffs, cost estimates, and stakeholder engagement presentation materials such as 3D renderings and site plans.

## Qualifications

## **Education**

Master of Business Administration (with Distinction) Schulich School of Business, York University, 2019

**Bachelor of Landscape Architecture (Honours)** University of Guelph, 2014

## **Accreditation / Certification**

- Certified Associate in Project Management (CAPM): Project Management Institute
- LEED AP Building Design + Construction: Green Business Certification Inc.
- Member, Canadian Society of Landscape Architects
- Member, Manitoba Association of Landscape Architects
- Passed CFA Level 1: Chartered Financial Analyst Institute

## Software / Skills

- Microsoft Excel / VBA
- AutoCAD, SketchUp, 2D and 3D Modeling



## Experience

## Senior Consultant, Sustainable Transportation & Asset Management, Wood

### City of Charlottetown – Transit Electrification Study (2021-Ongoing)

Deputy Project Manager for supporting the implementation of electrified transit in Charlottetown. The project involved developing bus, facility, and charging equipment specifications to be tendered to public market. The specifications were informed by route modelling such that Charlottetown could procure vehicles and equipment that met its needs. Included multiple workshops with project stakeholders regarding site prioritization and selection, functional programming, and funding application support.

## BC Transit – Specialized Battery Electric Bus Modelling (2021)

Deputy Project Manager for specialized battery electric bus (BEB) modelling study enable BC Transit to understand the infrastructure requirements necessary to support the adoption of 110 BEB at their Victoria Handy DART facility. The project involved defining vehicle and charging equipment configurations available for the future adoption and reliably determining per kilometer energy consumption.

### Siemens Canada / St. Catharines Transit Commission - Electric Vehicle Study (2021)

Wood was retained by Siemens Canada to assist St. Catharines Transit Commission in assessing the feasibility of electrifying its transit portfolio. Jamal served as Deputy Project Manager for this battery electric bus (BEB) modelling study enable St. Catharines Transit Commission (SCTC) to plan and implement the transformation from diesel to a BEB fleet. Including modelling to simulate BEB performance accurately in a variety of scenarios. These scenarios were used to:

- Test operations across climate seasons, a variety of bus models, with and without on-street charging.
- Identify locations for developing on-route charging such that 98% of existing blocks could be successfully electrified with as few as two on-route locations.
- Allow SCTC to best understand the limits and opportunities of operating BEBs on their network, tailored to their operating context.

These simulations allowed SCTC to visualize in dashboard format which aspects of its current service are optimal to electrify and which routes require additional service adjustments to implement BEB technology. A key ZES output is the total electrical infrastructure and equipment implications of fleet electrification – including total energy consumption, peak power loads, daily cost savings, and daily emissions reductions.

## Canada Infrastructure Bank (CIB) – ZEB Program - Lender's Technical Advisor (2021-Ongoing)

Deputy Project Manager supporting the CIB to establish operating cost savings for the implementation of electric school and transit buses in Canada. Developed normalized approaches and methodologies to measure operating and maintenance cost savings of electric buses compared to conventional diesel buses. The project scope includes identifying the cost savings for each fleet operator (i.e., school districts and transit agencies) that will be used to structure loan repayments.

## York Region Transit – Fleet Consulting Services (2021-Ongoing)

Wood was contracted for a three-year retainer to complete a wide range of consulting services for York Region Transit, including facility and fleet electrification transition planning and electric vehicle technical specification development. Wood also completed an electric vehicle jurisdictional scan to assess the available specialized transit charging infrastructure available on the market. Jamal is providing advisory services to York Region Transit across delivery of multiple retainer projects.



## Town of Oakville - Electric Bus Feasibility & Roll Out Plan Project (2020-2021)

Wood was retained by the Town of Oakville to complete an electric bus needs assessment and rollout plan. This engagement included a holistic review of Oakville Transit's facilities and operations, market scan of available specialized electric vehicles and electric vehicle charging infrastructure, as well as a peer review of comparable municipalities and transit portfolios, and will culminate in the implementation of a recommended fleet procurement strategy, including the required associated infrastructure, fleet and other capital expenditures.

## Halifax Transit - Electric Bus Feasibility & Roll Out Plan Project (2021)

Deputy Project Manager for battery electric pilot range simulation for Ragged Lake Transit Centre (RLTC) of sixty (60) 40-ft buses. Wood provided Halifax Transit with multiple simulations and scenarios evaluating different operational impacts to understand electrification feasibility, including total daily power demand and peak power demand throughout the scenario simulations.

## Nalcor Energy – Facility Development Cost Benefit Analysis (2020-2021)

Jamal developed and oversaw financial analysis in modelling capital and operating costs and benefits for 13 scenarios facility aimed at housing Nalcor Energy staff and operations. Reviewed benefits associated with lower travel times and accident rates for off and on-site facility options. This work included providing a comparative analysis between alternatives as well as summarizing additional unquantified costs and benefits to be considered in the decision making stages of the project.

## Senior Analyst, Infrastructure Advisory & Transactions, EY Corporate Finance

## Edmonton Regional Transit Service Commission, Business Case & Operating Financial Pro Forma Model, Edmonton, Alberta

EY was engaged to develop a business case exploring the costs, benefits and impact of a Regional Transit Service Commission for Edmonton and the twelve surrounding municipalities to deliver an improved transit experience for residents of the Edmonton Metropolitan Region. Jamal developed the financial model for the business case, forecasting the existing operations performance and tax impact for each municipality as well as the expected tax impact resulting from the Regional Transit Services Commission.

## Transport Canada, VIA Rail High Frequency Rail Market Sounding, Ontario

EY was engaged by Transport Canada as part of the due diligence for a major passenger rail transportation project. Market sounding sessions were designed to solicit critical insights from private sector market participants into the proposed High Frequency Rail project. Jamal assisted throughout the market sounding process and in the development of the final report highlighting findings of the market sounding project. Jamal coordinated market participants from international and domestic companies across a range of relevant industries applicable to the project, including operators, contractors, traditional lenders and investors.

## Senior Analyst, Development Finance, Replay Destinations

## Luxury Real Estate Development, Hotel & Residences, Antigua and Barbuda, West Indies

Jamal worked as part of an international Real Estate development firm (Replay Destinations) on the twinisland state of Antigua and Barbuda in the West Indies. Jamal developed a dynamic operating pro forma to automate the importation and updating of the live project reporting model, including projected and actual sales, infrastructure and construction costs, and regular project expenses, and coordinated with internal accounting teams to develop new integrated purchase order workflow tied to the pro forma. Jamal coordinated with local and international vendors, contractors, and lenders, maintaining accurate



cash flow forecasting to track project performance and contribute to capital draw requests and capital needs forecasts. Jamal also conducted construction quantity take-offs and costing estimates using CAD and PDF format drawings and coordinated with contractors and consultants throughout design and initial construction and site infrastructure development phases.

## Landscape Architect, Sustainability Specialist, WSP Canada Inc. (MMM Group Ltd.)

# Humber River Hospital, LEED Documentation and Sustainability Certification, Toronto, Ontario

Jamal completed comprehensive LEED documentation and associated sustainability certification submission preparation and compliance assurance throughout design and construction phase of the project, including quantity take-off measurements of architectural drawings to ensure sustainability targets and design specifications were in compliance with LEED requirements.

## Joseph Brant Memorial Hospital and McMaster University, Halton McMaster Family Health Centre / Joseph Brant Memorial Administration Building, Burlington, Ontario

Completed review and analysis of project drawings and construction reporting to ensure project compliance with sustainability requirements. This joint initiative between Joseph Brant Memorial Hospital and McMaster University incorporates research, clinical and administrative spaces. Totaling approximately 56,000 sq. ft. and targeting LEED Silver, key sustainable strategies included a 50% water usage reduction and total energy usage reduction of 32% less than MNECB benchmarks.

## Hanlan Feedermain Multi-Use Trail Feasibility Study & Design

Completed comprehensive site visits, developed inventory and analysis to inform feasibility study of multiple trail alignments in coordination with design and installation of the Hanlan Feedermain in Mississauga, ON. Worked with Region of Peel and City representatives to develop boulevard multi-use trail alignment along portions of Tomken Road, Cawthra Road, and Eastgate Parkway. Assisted in preparation of feasibility study report and AutoCAD production of preliminary and detailed trail designs and signage plans along all three road sections.

## Selkirk Regional Health Centre

Completed site visits, project documentation review and analysis as well as monthly reporting to ensure project maintained compliance with sustainability targets throughout design and construction. Included specification and verification of high efficiency fixtures, and associated sustainability measures.

## Lac du Bonnet Fire Attack Station

Completed review of project design and construction documentation to ensure project achieved Power Smart designation under the Manitoba Green Building Program. The 16,000 sq. ft. remote fire response base included equipment warehouse, offices, radio and operations room as well as tarmac / runway for response team vehicles. The project included heat recovery measures, high insulation wall design and occupancy sensors to improve energy efficiency, in addition to enhanced commissioning to ensure the building maintains optimal performance throughout operation.

## Shepard Municipal Reserve Site, Athletic Tournament Park

Coordinated site drawings, site visit documentation and analysis, and facilitated client and stakeholder engagement meetings in the development of Tournament Athletic Facility on a 40 acre site in the Hamlet of Shepard, Calgary, AB. Prepared engagement presentations and facilitated collection and analysis of



relevant community association groups and associated stakeholders to shape the Conceptual Plan for the future Tournament Athletic Facility.

## Icefields Parkway Highway, Niblock and David Thompson Entry Gate Design

Completed site assessment, conceptual and detailed drawings in coordination with various disciplines for the total redesign of two entry points onto Icefields Parkway within Banff National Park. Assisted in coordination of 6 consulting disciplines ranging in architectural, civil, transportation planning, environmental and geotechnical testing.

## **Galt Gardens Master Plan Redesign**

Jamal prepared stakeholder engagement materials and facilitated collection of stakeholder feedback, including analysis to inform the conceptual redesign of the historic urban park in Lethbridge, AB. Completed detailed site analysis, public engagement, urban design as well as budget costing and construction estimates.

## Additional Institutional Project Experience -Sustainable and Energy Efficiency LEED Consulting

- Region of Waterloo Courthouse Renovation, Waterloo, ON
- St. Thomas Elgin General Hospital Redevelopment, London, ON
- Sage Creek School, Winnipeg, MB
- Seven Oaks Renal Dialysis Centre, Winnipeg, MB
- Park Manor Care Home, Winnipeg, MB
- Morden Long-Term Care Facility, Morden, MB
- Winnipeg Convention Centre Expansion, Winnipeg, MB
- East End Community Centre, Winnipeg, MB

## **Professional History**

- Wood (2020 Present)
- Replay Destinations (Freetown Development Ltd.) (2019 2020)
- EY Orenda Corporate Finance (2019)
- WSP Canada Inc. (2013 2017)
  - Landscape Architect & Sustainability Specialist (2015 2017)
  - Sustainability Specialist (Green Building Consultant) (2014 2015)
  - Landscape Designer (2013 2014)

## Matthieu Goudreau, MScE Sustainable Transportation Consultant



## **Summary**

## **Years of Experience**

4 (1 with Wood)

## **Office of Employment**

Remote, New Brunswick

## Languages

- English
- French

## **Areas of Expertise**

- Zero-Emission Vehicle Implementation
- Zero-Emission Vehicle Modelling
- Zero-Emission Vehicle Operating and Maintenance Cost Forecasting
- Zero-Emission Vehicle Electrical Infrastructure Requirements
- Non-Traditional Transit
  Solutions
- Transportation Analysis
- Asset Management
- Economic Analysis

## **Professional Summary**

Matthieu is a consultant experienced in modelling the adoption and implementation of Zero-Emission Vehicles. With Wood, Matthieu has supported six (6) zero-emission projects as a analyst and project coordinator. His background in transportation gives him the technical skills to efficiently evaluate the adoption of battery-electric vehicles, including operational and infrastructure needs.

Matthieu completed his master's degree in Transportation Engineering at the University of New Brunswick before moving into a consulting career in 2019. The focus of his research was on understanding emergent non-traditional rural transit, Volunteer Driver Programs, for incorporation into transportation planning. Matthieu has experience working for the Federal Government where he was involved as the primary analyst reviewing interprovincial trucking movements to inform policy development. Matthieu's experience focused on analytics for supporting evidenced based decision making, having worked on projects involving road, rail, maritime, and air transportation modes.

## Qualifications

## **Education**

Master of Science, Transportation Engineering, University of New Brunswick, NB, 2019

Bachelor of Science, Transportation Engineering, University of New Brunswick, NB, 2016

## **Publications / Presentations**

- Developing Transportation Engineering and Planning Metrics for Rural Volunteer Driver Programs. Washington D.C., USA, January 2019.
- A Community-Based Approach to Addressing Transportation Needs for Rural Older Adults in Canada: Progress in Research. Taipei, Taiwan, Nov 2018.
- The Development and Application of a Maturity Model to Understand Volunteer Driver Program Practices. Gatineau QC, Canada, June 2018.
- How many New Brunswickers rely on Organized Volunteer Driver Programs? Preliminary tools and approaches to help us find the answer. Winnipeg MB, Canada. May 2017.

## Matthieu Goudreau, MScE Sustainable Transportation Consultant



## Awards

- Transport Canada Scholarship in Economics, Efficiency and Competitiveness in Transportation, 2017
- Transportation Association of Canada Civil Division Scholarship, 2017
- Thomas H. Prescott Scholarship in Transportation, 2017

## **Experience**

## **Consultant, Sustainable Transportation & Asset Management, Wood**

## Charlottetown – Electric Transit Study (2021-Ongoing)

Project Coordinator for supporting the implementation of electrified transit in Charlottetown. The project involved developing bus, facility, and charging equipment specifications. The specifications were informed by route modelling such that Charlottetown could procure vehicles and equipment that met its needs.

## BC Transit – Specialized Battery Electric Bus Modelling (2021-Ongoing)

Project Coordinator for specialized battery electric bus (BEB) modelling study enable BC Transit to understand the infrastructure requirements necessary to support the adoption of 110 BEB at their Victoria Handy DART facility. The project involved defining vehicle and charging equipment configurations available for the future adoption and reliably determining per kilometer energy consumption.

## St. Catharines Transit Commission - Electric Vehicle Study (2021)

Project Coordinator for battery electric bus (BEB) modelling study enable St. Catharines Transit Commission (SCTC) to plan and implement the transformation from diesel to a BEB fleet. Matthieu led the modelling simulate BEB performance accurately in a variety of scenarios. These scenarios were used to:

- Test operations across climate seasons, a variety of bus models, with and without on-street charging.
- Identify locations for developing on-route charging such that 98% of existing blocks could be successfully electrified with as few as two on-route locations.
- Allow SCTC to best understand the limits and opportunities of operating BEBs on their network, tailored to their operating context.
- Answer SCTC's key questions regarding their goals for electrification.

These simulations allowed SCTC to visualize in dashboard format which aspects if its current service were most ideal to electrify first, and which routes require additional service adjustments to optimize BEB technology. A key ZES output is the total electrical infrastructure and equipment implications of fleet electrification – including total energy consumption, peak power loads, daily cost savings, and daily emissions reductions.

## Canadian Infrastructure Bank (CIB) - Lender's Zero Emission Technical Advisor (2021)

Project Coordinator and Analyst supporting the CIB to establish operating cost savings for the implementation of electric school and transit buses in Canada. Developed normalized approaches and methodologies to measure operating and maintenance cost savings of electric buses compared to conventional diesel buses. The project scope includes identifying the cost savings for each fleet operator (i.e., school districts and transit agencies) that will be used to structure loan repayments. The work included multiple transit authorities across three provinces and numerous stakeholder meetings in French and in English.
# Matthieu Goudreau, MScE Sustainable Transportation Consultant



# Halifax Transit - Electric Bus Feasibility & Roll Out Plan Project (2021)

Project Coordinator for battery electric pilot range simulation for Ragged Lake Transit Centre (RLTC) of 60 40ft buses. Providing client with multiple simulations and scenarios evaluating different operational impacts to understand electrification feasibility.

# Nalcor Energy - Cost Benefit Analysis for Facility Alternatives (2020-2021)

Financial analyst role in modelling capital and operating costs and benefits for 13 scenarios facility aimed at housing Nalcor Energy staff and operations. Reviewed benefits associated with lower travel times and accident rates for off and on-site facility options. This work included providing a comparative analysis between alternatives as well as summarizing additional unquantified costs and benefits to be considered in the decision making stages of the project.

# Town of Oakville - Electric Bus Feasibility & Roll Out Plan Project (2020-2021)

Research Analyst for the feasibility study reviewing the current state of Oakville Transit fleet and facilities for electrification. Route simulation, vehicle specification, electrical infrastructure analysis, energy modelling and business case for adoption. Reviewing operational challenges and maintenance for electric fleet adoption of conventional and specialized transit. The roll-out plan included a rapid pilot and adoption timeline for specialized and conventional buses.

# **Consultant, Advisory Services, WSP**

# Asset Management Plan, Neebing, ON, Canada (2019 - 2020)

Technical support in reviewing existing asset inventory and evaluating the City's state of local infrastructure data. Specific tasks included data entry, gap analysis and valuation of assets. Provided asset data gaps, asset replacement values, expected service lives, and recommended improvements. Client: Municipality of Neebing.

# Gas Utility Asset Management Plan, Kitchener, ON, Canada (2019)

Technical support in reviewing asset inventory and evaluating the Utility's state of local infrastructure. Specific tasks included data entry, gap analysis and valuation of assets. Provided asset data gaps, asset replacement values, expected service lives, and recommended improvements. Client: City of Kitchener.

# Island Rail Corridor Ridership Forecast, BC, Canada (2019)

Worked as team lead in research and forecast model creation to predict ridership for a new commuter rail development between Courtenay and Victoria. Specific tasks included researching data sources, developing prediction methodology, creating forecasting model, and reporting on findings. Provided data sources, report of rail ridership for 8 project scenarios/phases, summary of analysis limitations. Client: British Columbia Ministry of Transportation and Infrastructure

# **Transportation and Economic Analyst, Transport Canada**

# Harmonization of Interprovincial Trucking, ON, Canada (2018)

The ministry of transportation had a need to reevaluate steps and policies aimed at reducing barriers to goods movements between provinces. To support this objective the Economic Analysis group tasked Matthieu with creating a brief outlining the history of policies and restrictions affecting interprovincial trade, summarizing available data sets and limitations, as well as performing a detailed analysis of changes over time. The key factors of the analysis were truck configuration, weight utilization, space utilization, travel flows, and commodity group. The outcome was quantitative evidence created and communicated to policy makers to aid in policy development and decision making.

# Matthieu Goudreau, MScE Sustainable Transportation Consultant



# Atlantic Air Freight Capacity Assessment, Atlantic Canada (2018)

In response to US tariffs being applied to Canadian goods, the Economic Analysis group conducted exploratory research to promote international goods movements with Eastern Atlantic countries, primarily in Europe. To facilitate this trade Matthieu was tasked with creating an inventory and capacity assessment of Atlantic air cargo infrastructure. The outcome was a better understanding of current air cargo climate in Atlantic Canada and a quantitative assessment of the four constraining factors for Atlantic Canada's primary cargo airports. Near term changes in capacity were also forecasted.

# **Professional History**

- Consultant, Sustainable Transportation & Infrastructure, Wood (2021 Present)
- Consultant, Advisory Services, WSP, Toronto, ON (2019 2020)
- Transportation and Economic Analyst, Economic Analysis, Transport Canada, Ottawa, ON (2018)
- Research Assistant, Transportation Research Group, University of New Brunswick, Fredericton, NB (2016 – 2019)
- Engineering Technologist, Water Department, City of Saint John, Saint John, NB (2013 2015)



# **Summary**

Years of Experience

**Office of Employment** 

Oakville, ON

# Languages

- English
- Serbian

# **Professional Summary**

Igor has over 19 years of experience as an electrical engineer, project manager and electrical department lead. His main responsibilities have included the design of high, medium and low voltage power distribution systems, lighting, grounding, utility scale solar & wind farm system and auxiliary systems (F/A, Security, Data and communication). He has been a project lead and has experience with a number of different clients in the industrial, commercial, government, energy and renewables sectors.

# Qualifications

# **Education**

B.Sc., Electrical Engineering, Ryerson University, Toronto, ON, Canada

# **Registrations / Certifications / Licenses**

- Professional Engineers Ontario, ON
- LEED<sup>®</sup> Accredited Professional (NC and MR)
- Canada Green Building Council

# Software / Skills

- NABCEP PV Design Specialist certification (pending)
- Advanced PV design and Electrical Code, Solar Academy
- ISO 9001 Internal Auditor, BSI
- Power Systems, EPIC
- Grounding Systems, EPIC
- Fuseology, Mersen



# **Experience**

# Loyalist Solar Farm, BluEarth, Guelph, ON, Canada

Owner's Engineer. Review and provide comments on electrical design packages (1000 V DC solar system, 34.5kV MV distribution and 230kV HV substation). Conduct construction site monitoring and provide site inspection reports

# 10MW Solar Farms, Hydro Quebec, Montreal, QC, Canada

Electrical Lead. Preliminary electrical engineering of 10MW solar farm consisting of fixed rack and single axis rack arrangement. Design of solar farm 25kV substation.

### 100 MW Solar Farms, Samsung Renewable Energy, Toronto, ON, Canada

Electrical lead. Preliminary electrical engineering of 100MW solar farm and RFP documentation preparation

# Rainy River First Nations Solar Projects (Dave Rampel, Morley, Vanzwolf), Cedarvale Energy, Dawson & Pinewood, ON, Canada

Electrical lead. The project consists of Dave Rampel 10MW Solar Farm, Morely 10MW Solar Farm, and Vanzwolf 5MW Solar Farm – three grid-connected, ground-mounted solar photovoltaic generating facilities. Part of the scope or work includes electrical engineering design for 20 E-house assembly units, underground collector systems, and transformer stations.

# 10MW Brockville Solar Farm, IPR-GDF Suez, ON, Canada

Electrical lead. Electrical engineering and design for 10 MW solar farm in Ontario.

### 10MW Beckwith Solar Farm, IPR-GDF Suez, ON, Canada

Electrical lead. Electrical engineering and design for 10 MW solar farm in Ontario.

### 30MW Smith Falls Solar Farms, Recurrent Energy, ON, Canada.

Electrical Engineer. Electrical advisor for design of 30 MW solar farms in Ontario.

### 150 MW Solar Farms, Recurrent Energy, ON, Canada

Electrical Lead. Proposal preparation for 19 solar farms in Ontario ranging from 3MW to 10MW.

### Walnut Ridge Wind Power Project, J.F. Edwards, Bureau County, Illinois, USA

Electrical Lead. Design, protection and control engineering for 230kV/34.5kV Substation for the 212 MW wind farm, including procurement and vendor document review.

### Belle River Wind Farm, Samsung/Pattern, Town of Lakeshore, ON, Canada

Electrical lead. Design, engineering, procurement and construction of the 100 MW wind farm with 6.7 km of 230 kV underground transmission line, 34.5kV underground collector lines and 34.5 kV / 230 kV substation and 230kV switching station for the connection to the Hydro One 230kV transmission line.

# McLean's Mountain Underground Cable Project, Northland Power, Manitoulin Island, ON, Canada

Electrical lead and project manager. Design, engineering of 115kV underwater transmission line between substation and switching station.

### Crystalline Succinic Acid Plant, BioAmber Inc., Sarnia, ON, Canada

Lead approver. Checked approved, and stamped drawings and documents during detail design of a crystalline succinic acid facility from sugar feedstock.



# Grand Bend Wind Farm, Northland Power, Town of Grand Bend, ON, Canada

Electrical lead. Design, engineering, procurement and construction of the 100 MW wind farm with 32 km of 230 kV underground transmission line, 34.5kV of underground collector lines and 34.5kV/230kV substation and 230kV switching station for the connection to the Hydro One 230kV transmission line.

## Krembil Discovery Centre, KDC, Toronto, ON, Canada

Electrical lead. Electrical engineering and design of lighting, lighting control, power, fire alarm and security systems for this conference room addition.

### Airlocks Addition & Renovations, Apotex, Toronto, ON, Canada

Electrical lead. Electrical engineering and design of lighting, power, fire alarm and security systems.

#### Escarpment Cancer Research Institute, Hamilton Health Science, Hamilton, ON, Canada

Electrical Engineer. Preliminary electrical design and cost estimate for proposed facility upgrades.

### NRC FEL 3 Study, Vale Canada Limited, Copper Cliff, ON, Canada

Electrical Engineer. Preliminary electrical engineering and design of new bag house fans, screw conveyors and other mechanical equipment.

### 8.32 kV – 600 V Substation Addition, Procter & Gamble, Brockville, ON, Canada

Electrical Engineer. Electrical engineering of power and grounding for new MV unit substation.

#### Encapsulator Addition, Apotex, Toronto, ON, Canada

Electrical engineering and design of lighting and power systems for new encapsulator unit rooms.

#### Kearl Oil Sands Project, Imperial Oil-ExxonMobil, AB, Canada

Electrical Engineer. Electrical system studies (load flow, equipment evaluation, short circuit, coordination, relay file settings and arc flash) of medium and low distribution systems using SKM power system software and GE EnerVista software for support and management of Multilin products.

### Exshaw Cement Plant, Lafarge, Exshaw, AB, Canada

Electrical engineering and design of all electrical systems, short circuit power studies for the cement plant in Alberta.

### Joppa Expansion Project, Lafarge, IL, USA

Electrical engineering and design of indoor/outdoor lighting systems, grounding systems and electrical room layouts for the cement plant in Illinois.

### Workroom Environment Ph. 5, Vale Inco, Sudbury, ON, Canada

Electrical Engineer. Part of electrical team to provide 600V electrical services for new bag house fans, conveyors and other mechanical equipment. Revise existing single line diagrams, control schematics and layout drawings.

### No. 3 Oxygen Plant Upgrade, Vale Inco, Sudbury, ON, Canada

Electrical engineering and design to provide 600V electrical services for upgraded exhaust fans and makeup air unit.

### Nickel Araguaia Project, XSTRATA, Brazil

Electrical engineer. Generation of conceptual design study for the Nickel mining job in Brazil.

#### Electrical Power Study, Brock University, Hamilton, ON, Canada

Electrical engineer. Assisting in Brock University new feeder 13.8kV study and campus upgrade.



# Plant Balcones New Line No. 2, CEMEX, TX, USA.

Electrical engineer. Electrical engineering and design of indoor/outdoor lighting systems for the cement plant in Texas. Power engineering and design of process and building equipment.

# ESSO Gas Stations (various), Imperial Oil, ON, Canada

Electrical engineer. Site inspections and site report generation for electrical systems (power, lighting and auxiliary systems) for a number of ESSO stations in Ontario.

# David Braley Cardiac-Vascular and Stroke Research Institute, Hamilton Health Sciences, Hamilton, ON, Canada

Electrical engineer. Partial design of electrical single line diagram for temporary services during the construction.

### Security Upgrade, Exel, Brampton, ON, Canada

Electrical engineer. Assessment of existing security system in the plant and upgrade to the existing system.

# Energy+ Inc., MTS #1 230kV/27.6kV Substation upgrade, City of Cambridge, ON, Canada.

Electrical engineer. Design of four additional 27.6kV circuits for MTS #1 Substation.

# Greenwood, Jane, Wilson Station and Lakeshore Garage, Toronto Transit Commission, Toronto, ON, Canada

Electrical engineering for design of wheel spinning facility and car wash in Greenwood yard (Greenwood); Electrical engineering for replacement of mechanical units, fume extracting machinery and car washing equipment at Wilson station (Wilson); Electrical engineering for heat tracing system (Lakeshore garage); Electrical engineering of lighting and systems (Jane).

### Darlington and Pickering Plant Development, Ontario Power Generation, ON, Canada

Electrical engineering of power, lighting, telecommunication and auxiliary systems in new security building.

### Bruce Plant Development, Bruce Power, ON, Canada

Electrical engineering of power, lighting, telecommunication and auxiliary systems in part of the new plant.

### New Plant Development, Toyota Woodstock, Woodstock, ON, Canada

Generation of short circuit study for plant distribution system (range: 115kV-480V) using EDSA short circuit program.

### Toyota Cambridge and Scarborough, ON, Canada

Electrical engineering of power, lighting, telecommunication and auxiliary systems for new plant. Survey of lighting distribution system at assembly lines.

### Paint Facility Development, GM, Oshawa, ON, Canada

Electrical engineering of power, lighting auxiliary systems for new paint facility. Design of 80kW UPS system data room.

### Office space development, Accenture, Mississauga, Ontario, Canada

Electrical engineering of power, lighting, telecommunication and auxiliary systems for tobacco plant. Design of 80kW UPS system for data room.



# Plant Development, Imperial Tobacco, (undisclosed)

Electrical engineering of power, lighting, telecommunication and auxiliary systems for tobacco plant.

Terminal III Trans Border Lounge, GTAA, Toronto, ON, Canada

Electrical engineer. Electrical design of power, lighting and auxiliary systems for terminal III lounge.

# Airport lighting and power systems, Hong Kong, China

Electrical engineer. Analysis of electrical lighting and power systems for future improvements.

# Apron and Taxiway Upgrades, Lester Pearson International Airport, GTAA, Toronto, ON, Canada

Electrical engineering and inspection of power and airport lighting systems.

# Apron and Taxiway Upgrades, Hamilton International Airport, HIA Hamilton, ON, Canada

Electrical engineering of power and airport lighting systems.

# Bouvaird Drive Roadway lighting, Peel Region, ON, Canada

Electrical engineering of street power and lighting systems.

# Dual Taxiway Stage IX, GTAA, Toronto, ON, Canada

Electrical inspector for airport lighting system at Pearson International Airport. Main duty was verify electrical installation during construction which includes lighting and power distribution systems and testing of the medium voltage system (5kV). Other responsibilities were to attend weekly meetings, issue design changes, generate field reports, process payments and other administrative duties.

# **Professional History**

- Wood, Electrical Lead, Oakville, 2007-present
- Giffels Associates Limited, Electrical Engineer, Toronto, ON, 1999-2007
- Sensors and Software, Inc., Software Developer, Mississauga, ON, 1999-2001 P/T

#### Peter Meyerhofer, P.E.

Peter has more than 20 years of engineering experience in California and Nevada, primarily focused on planning and design for transportation facilities, including BRT, complete streets, and transit facilities. He has specialized experience in site civil and transportation infrastructure, construction phasing, agency/stakeholder coordination, utility design, multimodal design and circulation, and construction cost estimating. Peter's extensive experience with design and programming of various types of roadway and transit facilities gives him a strong understanding of the needs and requirements for multifaceted projects. His background managing complex projects dealing with large operational transit networks, life cycle costs, logistics, obtaining consensus of stakeholders, preparation of construction documents, and construction phasing will all be important for this contract. Peter's recent managerial experience includes the Vasona LRT Double-Track and Conceptual Engineering Project, Mountain View Transit Center Grade Separation and Access Project 35 Percent Design, Riverside Transit Agency Temecula Bus Transit Center Expansion, Downtown Connector BRT in Las Vegas, and leading a Kimley-Horn team of 40+ engineers on the SANDAG Mid-Coast Corridor Transit Project, which is under construction.

#### **Professional Credentials**

Bachelor of Science, Civil Engineering, University of Arizona, 2002

Professional Engineer in California and Nevada

#### **Relevant Experience**

AC Transit, Division 2 and Division 4 Battery Electric Bus (BEB) Facilities Infrastructure Upgrades, Oakland and Emeryville, CA — Project Manager. AC Transit is enacting its Zero-Emissions Bus Rollout Plan that provides a comprehensive path for the agency to transition to a 100 percent fleet. As part of this plan the District must upgrade and expand its battery electric bus (BEB) charging infrastructure to additional facilities to service its growing BEB fleet. Kimley-Horn is providing the District with facilities planning and design services at the Emeryville (D2) and East Oakland (D4) Divisions. For the smaller D2 we are supporting the District with designing 16-20 atgrade BEB plug-in chargers, and for the larger D4 we are helping the District upgrade existing plug-in pedestal chargers with 50 overhead plug-in chargers installed with a new overhead canopy structure. Both Divisions and associated designs will include electrical infrastructure upgrades, assisting the District with EV manufacturer procurements, assessment and design of a reliable battery backup system for added resiliency, and staging/phasing plans.

Public Utilities (DPU) Operations and Maintenance and Public Safety Fleet Maintenance Analysis and Preliminary Facility Plans, Fresno, CA — Project Manager. Kimley-Horn was part of a consultant team assisting the City of Fresno with planning and programming space needs for its new corporate yard facility. The facility will serve Fresno's Public Utilities Fleet, including its growing safety department fleets. Kimley-Horn completed a due diligence assessment for proposed facility sites, examining potential site constraints, utility capacities, traffic due diligence, high-level environmental impacts, agency design requirements, and approval processes, including layout and operations review. Our due diligence study included water, sewer, drainage, access, traffic, dry utility, on-site operations review, and conceptual grading and drainage assessments. Summit County Transit, Fleet Facility Headquarters Design and Engineering Plans for fleet storage building and site design, Summit County, CO — Kimley-Horn is working with D2C Architects to prepare the design plans for Summit County Transit's new fleet storage facility. Kimley-Horn is developing revised programming and new design and phasing plans to assist the transit agency for the conversion to a 100 percent electric bus fleet. The facility will accommodate over 50 battery electric buses (BEBs). Key areas of work include site layout and design, structural engineering, electrical design including battery electric charging assessment for fleet resiliency, roadway and site civil design.

Santa Barbara MTD, Facilities Master Plan and Electric Vehicle Conversion, Santa Barbara, CA — Project Manager. Serving as a primary subconsultant, Kimley-Horn helped prepare a transit facilities master plan for Santa Barbara MTD. The agency operates out of a terminal that hosts approximately 200 staff including bus operators, mechanics, and administrative staff and serves as a bus yard for 114 revenue vehicles (buses ranging from 30-60 feet in length) and 23 non-revenue vehicles. The agency is seeking to expand to a second terminal site and aims to make significant upgrades to existing electrical infrastructure at their bus yards to accommodate battery electric vehicle (EV) charging. Our team provided Santa Barbara MTD with site assessments, master planning, and programming for required electrical infrastructure for both its original facility and a proposed new facility. Kimley-Horn performed detailed site assessments that involved confirming utility locations and comprehensive evaluations of existing electrical infrastructure supporting each MTD-owned facility. Kimley-Horn prepared a series of recommendations based on these site assessments including for necessary improvements to site work, utilities, and electrical infrastructure, including load studies, recommended electrical upgrades, and alternative options for renewable energy and resiliency in the form of battery backup systems.

**Design Services for the Napa Valley Transportation Authority (NVTA) Bus Maintenance Facility, Napa, CA** — **Project Manager.** Serving as the prime consultant, Kimley-Horn is preparing the design (PS&E) for a new bus maintenance facility for NVTA in support of the Vine transit service. The Vine's existing operations facilities have been stretched to efficiently accommodate the growing bus fleet, house the necessary number of bus maintenance bays, and accommodate service expansion. Kimley-Horn is assisting NVTA with updating its facilities master plan and space planning/programming, preparing a schematic design, preparing PS&E (60, 95, 100 percent), and preparing the bidding and construction documents. The project has progressed on an accelerated schedule. As part of the project scope the Kimley-Horn team is designing the electrical service and infrastructure on the site to accommodate a future bus fleet that will be 100 percent electric. This has required extensive coordination with PG&E regarding an upgrade to a medium service power system. Kimley-Horn will be supporting NVTA through the bid and award of the contract and provide construction support services as needed. As part of this project, our team also will prepare independent opinions of probable construction costs.

# Abhishek Raj, PhD, PMP® Senior Consultant, Sustainable Transportation & WOOD Infrastructure

# Summary

**Years of Experience** 11

# **Office of Employment**

Burlington, Ontario

# **Areas of Expertise**

- **Project and Program** Management
- Knowledge and Innovation Management
- Standards Development
- Utility & OEM Engagement •
- Zero-Emission Bus (ZEB) • **Deployment Strategy** Development and Implementation
- Autonomous Shuttle (AS) **Deployment Planning**
- Funding and Financing Pursuits for ZEB and AS
- Economic, Environmental, Social and Governance (EESG) **Benefits Estimation**
- Business Case Development for • **ZEB** Adoption
- Policy Development •

# **Sectors**

- Transportation
- Infrastructure
- Innovation .
- Sustainability •
- Financing/Funding
- **Public Sector Policy** Development

# **Professional Summary**

Abhishek has over eleven (11) years of experience in the sustainable energy and transportation sector out of which seven (7) were focused on technology innovation and four (4) in sustainable transportation technology deployment across public fleets in Canada. He is experienced in assisting public and private sector clients in managing the entire fleet transition process including business case development, EESG benefit estimation, pursuing funding/financing, RFI/RFP development, and operational performance analysis. He has experience in managing large scale fleet transition Program comprising multiple municipalities while also assisting individual municipalities in capital budget forecasting, business case development and knowledge management. He has been closely associated with the development of the SAE J3105 high-power charging standard for electric buses.

Dr. Raj has liaised with the utility sector in Canada and vehicle and charging equipment manufacturers in Canada to develop standards focusing on charging and operational performance assessment for ZEB.

Dr. Raj has also managed a Program focusing on enhancing Innovation in Sustainable Transportation sector and developing commercialization pathways in close collaboration with public and private sector industry and academia. This has resulted in the development of Industry white papers, industry standards, policy documents focusing on sustainable transportation.

# **Qualifications**

# **Education**

Doctorate of Philosophy (Ph.D.) in Mechanical Engineering University of Waterloo, Canada, 2017

Masters of Science in Mechanical Engineering Masdar Institute of Science and Technology, UAE, 2012

**Bachelor of Technology in Mechanical Engineering** Vellore Institute of Technology, India, 2010

# **Accreditation / Certification**

Project Management Professional®

# Software / Skills

- C++, MATLAB, NVivo, Microsoft Office
- AutoCAD, ANSYS Fluent, GHGenius

# Abhishek Raj, PhD, PMP<sup>®</sup> Senior Consultant, Sustainable Transportation & WOOO. Infrastructure

# **Experience**

Senior Consultant, Sustainable Transportation & Infrastructure, Wood (November 2021 onwards)

# ZEB Project Lead and R&D Funding Program Manager, Canadian Urban Transit Research and Innovation Consortium (CUTRIC)

# Pan-Canadian Battery Electric Bus Demonstration and Integration Trial (2017-2021)

CUTRIC initiated a multi-stakeholder Program with municipalities, utilities and manufacturers to deploy standardized electric buses and chargers across various jurisdictions in Canada. Dr. Raj served as the Lead and was involved in all the aspects of the program that include standardization of charging (EVSE) and performance evaluation criteria, benefit estimation, business case development, funding application development, operational deployment, data architecture development, and program management. Dr. Raj has been associated with the development of SAE J3105 charging standard for high-power charging. He has contributed to several industry white papers emanating from this project that present the global scan of the technology, identify existing gaps and provide overall recommendations. Dr. Raj developed a robust Program Management framework and guidance documents to ensure regular updates from Program participants and sharing of insights based on the analysis of the operational data collected from all ZEB operators.

Dr. Raj has closely worked with municipalities and have successfully pursued multiple funding and financing opportunities for them in line with the municipal byelaws and have also developed successful bids in response to RFIs and RFPs. In order to address the inverted cost structure that zero-emission bus exhibits, Dr. Raj has conducted financial modelling for revenue flows and have conducted consultations with various banks, infrastructure companies, utilities and manufacture to explore different financing models. The findings of this exercise were shared with Federal Government agencies in the form of a report with recommendations for a new funding mechanism design. Dr. Raj has also contributed to the design and development of a Joint Procurement model for ZEB that can provide cost benefits to the municipalities.

# Consultation outreach initiative with policymakers and utility stakeholders (2017-2021)

Multiple outreach initiatives with the focus of educating the policy makers were made to the Federal, provincial and municipal governments to identify the opportunities, challenges and policy solutions associated with large scale fleet transition. He also participated in close dialogue with the utilities all across Canada to understand the opportunities and challenges that utilities face with respect to providing charging services on behalf of the transit agencies. The outcome of this dialogue with key stakeholders among government, utility, City representatives and the manufacturers around the opportunities and challenges associated with fleet electrification were presented as policy recommendation in the public launch of a report developed by Dr. Raj. Dr. Raj has also contributed to various feasibility analysis for utility clients to assess capability of the utilities to support bus fleet electrification for municipalities.

# Abhishek Raj, PhD, PMP<sup>®</sup> Senior Consultant, Sustainable Transportation & WOOO, Infrastructure

# National Smart Vehicle Joint Procurement Initiative (2021)

CUTRIC initiated a project focusing on the standardization and deployment of electric, low-speed automated shuttle technologies. Abhishek served as the interim Project Manager for this project and was instrumental in managing outreach with clients and the suppliers with respect to the finalization of specifications, routes and the quantification of benefits. This initiative will standardize communication, charging (EVSE) and infrastructure requirements across the spectrum for the manufacturers in order to make this technologically viable for public implementation across routes.

# Research and Development Funding Program (2020-2021)

CUTRIC provided funding to promising multi-stakeholder, collaborative projects focusing on Sustainable Transportation between industry and academia across various stages of development. Abhishek served as the Program Manager for this funding initiative and have assessed funding applications, conducted the contracting, assessed the Key Performance Indicators (KPIs) from these projects, monitored the progress, and identified commercialization pathways for the Intellectual Property developed. This Program has served to address the gap between Industry research requirements and the capabilities available in Canadian Academia.

# **Researcher, University of Waterloo, Canada**

## Emission reduction pathway development for natural gas and ethanol fuels (2013-2017)

Abhishek worked as a Researcher at University of Waterloo to develop catalyst technology to reduce the emissions from natural gas and ethanol combustion. Abhishek designed and fabricated a novel particle diagnostics system by integrating fueling, ignition, optical sampling, and pneumatic sampling systems to evaluate emissions from catalytic hydrocarbon combustion. He also developed numerical models for the predictive assessment of carbon emissions and pollutant particle evolution from natural gas and ethanol fuels. He designed and managed the installation of the drop-tube combustion reactor at the University of Waterloo to simulate the fuel combustion process and integrated diagnostics systems for ease of analysis. He also designed and engineered a particle sampling and diagnostics system to conduct analysis on Particulate Matter emanating from diesel fuel. Abhishek also He was awarded the Waterloo Institute of Technology NanoFellowship Award due to his groundbreaking findings that resulted in several peerreviewed publications.

# Research Assistant, Masdar Institute of Science & Technology, United Arab Emirates (UAE)

### Design and development of hydrogen fuel cell vehicle test rig (2010-2012)

Abhishek designed and developed a fuel cell vehicle test rig by integrating electric and fluidic components to simulate the actual driving cycle of a vehicle. He also developed a numerical code to assess the performance of hydrogen fuel cells in vehicles under standard driving conditions in terms of GHG reduction, water production, and power output. He also made quantified measurements with respect to water accumulation in the fuel cell stack and correlated it to fuel cell stack failure.

# Design of HVAC system and estimation of carbon footprint (2011-2012)

# Abhishek Raj, PhD, PMP® Senior Consultant, Sustainable Transportation & WOOO. Infrastructure

Abhishek contributed to the design of a 30 MW district-cooling based urban HVAC system and conducted carbon footprint estimation with respect to the existing conventional HVAC system.

# Academia & Industry Teaching

Dr. Raj has worked with various academic universities to promote educating the next generation of leaders. His pedagogical focus is on Engineering as a profession and his focus is on the following courses:

- Engineering Thermodynamics
- Fluid Mechanics
- Introduction to Combustion
- Engineering Workplace Skills II: Developing Effective Plans
- Professionalism and Ethics in Engineering Practice

# **Professional History**

- Wood (November 2021 Present)
- CUTRIC (2017 2021)
  - Zero Emission Bus (ZEB) Project Lead and R&D Funding Program Manager (2020 2021)
  - National Project Lead (2018 2020)
  - Junior Project Development Officer (2017-2018)
- University of Waterloo (2013-2017)
- Masdar Institute of Science & Technology (2010 2013)

# wood.



Years of Experience 4 (<1 with Wood) Office of Employment

Vaughan, ON

# Languages

- English
- Tamil

# **Areas of Expertise**

- Business Case Development
- Vehicle Lifecycle Analysis
- Transit Maintenance & Policy
- Alternative Propulsion
  Technology
- Engineering Asset Management
- Process Improvement
- Bus OEM audits
- Operations Research
- Maintainability & Reliability Engineering
- Operations Management
- New Process Development
- Fleet Sustainability Feasibility and Implementation

# **Professional Summary**

Saravanan is a Consultant with 2 years of experience delivering consulting projects for public sector clients including transit agencies and municipalities. He has experience in areas such as alternative propulsion technologies, reliability engineering, business case studies, and project management. Before joining Wood, he mainly worked with the Toronto Transit Commission (TTC) and Metrolinx over the last 2 years where he managed and coordinated various operational management and supply chain improvement projects. He was also managing various projects internally within Metrolinx's Bus Fleet Maintenance group including advisory services for RFP specification development and warranty management.

He is also a Manufacturing Engineer with 2 years of experience in the auto parts manufacturing industry that demands continuous improvement. He holds a Six Sigma Green Belt certification from the Institute of Industrial & Systems Engineers (IISE) which has helped him lead several lean and continuous improvement projects. He has comprehensive skills in systems and documentation for new process developments, quality control audits, and reliability analysis. He has used his strong analytical skills to perform several financial and reliability analyses for transit and municipal projects. With his sound research skillsets, he has helped perform cost-benefit analysis and evaluation for fleet and transit clients including Metrolinx, MassDOT, TTC, TransLink, and YRT.

# Qualifications

# **Education**

Master of Engineering, Mechanical & Industrial Engineering, University of Toronto 2019

Bachelor of Engineering, Mechanical Engineering, Anna University, India, 2015

# Training

Six-Sigma Green Belt Certification, Institute of Industrial and Systems Engineers (IISE), 2018

# **Professional Associations**

• Young Professionals in Transportation, since 2019



# **Experience**

# **Consultant: Wood Canada Limited, Sustainable Transport & Asset Management Solutions**

# **Project Coordinator**

# Grande West Transportation Vicinity Bus Corrosion Inspection (2021 – ongoing)

Project Coordinator supporting the audit and frame material corrosion inspection of 7 Vicinity buses for one of Grande West Transportation's clients. This includes coordinating the on-site material testing, chemical composition tests, peer reviews, in-house maintenance practices review, and reporting.

# Canadian Infrastructure Bank (CIB) Lender's Technical Advisor – Zero Emission Bus Program (2021 – ongoing)

Project Coordinator supporting the CIB to establish operating cost savings for the implementation of electric school and transit buses in Canada. As part of the project, currently developing normalized approach and methodologies to measure operating and maintenance cost savings of electric buses over conventional diesel buses. The project scope includes identifying the cost savings for each fleet operator (i.e., school districts and transit agencies) that will be used to structure loan repayments. BC Schools, Quebec Private School Bus Operator, BC Transit, Edmonton Transit and Brampton Transit are borrowers currently Wood is working with for performing due diligence.

# TTC – Supply Chain Support & Strategy (2021 – ongoing)

Project Coordinator supporting Wood's Project Manager and Subject Matter Expert to provide on-going strategy and consulting services to the TTC's MM&P department pertaining to bus parts sourcing, alternative parts brand identification, aftermarket warranty and core management.

# **Consultant: WSP Canada Inc, Sustainable Transportation (July 2020 to January 2021)**

# Project Manager (August 2020 to January 2021)

# Metrolinx On-Call Retainer (2020 – 2021)

Managed and delivered an on-call consulting retainer worth \$1 million for Metrolinx's Bus Fleet Maintenance (BFM) Division. Lead for developing the technical scope for a Request for Proposal (RFP) which requires a sound understanding of the transit vehicle maintenance and servicing functions. Delivered a detailed report to strengthen the agency's latent defects campaign with a vehicle manufacturer. This engagement also included managing the sub-consultant who provided 17+ contract staff who supported various functions within the BFM. Proactive client relationship management and satisfaction resulted in the continued addition of new scope and budget increases throughout the retainer.

Acted as interim Project Manager within the BFM to manage and coordinate various initiatives with Metrolinx, specifically supporting the mid-day touchpoint cleaning program during the COVID-19 pandemic. This effort included representing the BFM in various organization level meetings to lead the effort on improving the mid-day cleaning processes, training, and KPI monitoring.



As part of this engagement, coordinated the development of a real-time web portal that updates KPI, vehicles that require mid-day cleaning by integrating the reporting and scheduling into one single tool.

# TTC eBus Manufacturers Quality Review (2020)

Managed and completed the delivery of the TTC eBus Manufacturers Quality Review project where 4 eBus manufacturers were audited for the TTC's eBus program. This included managing and delivering the final presentation, final report, individual manufacturer's summary report, and project feedback.

# Metrolinx ZEB Preliminary Business Case (December 2020)

As Project Manager, supported the delivery of a Zero-Emissions Bus (ZEB) Preliminary Business Case Study for the Metrolinx's GO Buses. The business case was delivered within a short turnaround time by managing the subject matter experts, scope, and budget.

# Associate Consultant: WSP Canada Limited, Advisory Services - Transportation (May 2018 to July 2020)

# **Operations & Management**

# **Metrolinx Fleet Retainer (2020):**

As Project Coordinator supported the Project Manager on various operation strategies and improvement initiatives for Metrolinx's Bus Fleet Maintenance (BFM) Division as a response to the COVID-19 pandemic. Performed a service line process improvement project with the implementation of industry-best cleaning and disinfecting practices.

Delivered a business case assessment for understanding the benefits of certain in-house vs secondsourced services within BFM. Supported the development of detailed SOPs for various cleaning programs such as nightly, weekly, and semi-annual cleaning for a fleet of 400+ buses.

# TTC Supply Chain Improvement Project (2020):

Project Coordinator for an initiative to determine methods to improve cost efficiencies in the TTC's supply chain and implementing recommendations of the Auditor General study from 2018. Focus on aftermarket warranty, OEM parts, core tracking, and aftermarket parts.

# **Business Case & Asset Management**

### Halton Region, Fleet Management Review, ON, Canada (2019 – 2020):

Support staff for conducting a fleet management review on Halton Region's Fleet Services for Police, Paramedic, and Public Works fleets. The project scope included analysis of current cost recovery structure, maintenance practices, stakeholder needs, and department functions (i.e. Fleet Services, Stores, and Finance). Performed market research on available Computerized Maintenance Management Systems (CMMS) for fleet management and developed a report section highlighting key findings and lessons learned from peer municipalities.

# Town of Oakville, Fleet Utilization & Right-Sizing Study, ON, Canada (2019 – 2020):

Support staff for a fleet utilization and right-sizing study for the Town of Oakville's municipal fleet vehicles that included a green fleet peer benchmarking, performance, and business case development.



# TransLink Asset Renewal Program (2018):

Associate consultant assisting in developing capital and asset renewal plans for transit buses with lifecycle analysis and optimization studies.

# Ontario Northland, Asset Management State-of-Good-Repair, ON, Canada (2019):

Support staff assisting the project manager to develop asset hierarchies, State-of-Good-Repair (SOGR) assessment tools to identify asset renewal needs, project prioritization framework, and improvements to organizational asset management practices.

# City of Brampton Light Duty Fleet Review, Brampton (2019)

Supported the Project Team on a light-duty fleet assessment study for the City of Brampton fleet services. This included performing data analysis on various asset and service efficiencies and conducting peer agency benchmarking.

# Zero-Emission Vehicles, Fleet & Facilities

# **County of Kings Green Fleet, NS (2020)**

Supported the Project Manager for performing fuel consumption and GHG emissions analysis to explore a green fleet strategy of vehicles in use for public works and county operations in the County of Kings.

# TriMet Battery Electric Bus Feasibility Study (2020)

Assisted the project team in performing electric bus simulations to identify routes/blocks that can be served with battery-electric buses. Scope includes feasibility of depot vs on-route charging along with charging infrastructure requirements.

# Brisbane, Australia Transit Bus Testing (2020):

Project Coordinator assisting the SME in delivering a vehicle testing regime for double-articulated transit buses. This project is for the first double articulated vehicle being brought to Australia for BRT.

# TTC eBus Manufacturers' Canadian Content Audit, Toronto (2020)

Supported the development of project methodology and approach for auditing the Canadian Content of 60 electric buses from 3 manufacturers as part of the TTC's eBus program.

# Humber College Shuttle Bus Electrification RFP development (2019):

Project Coordinator for developing the Request for Proposal (RFP) and reviewing technical proposal responses for Humber College's parking shuttle electrification. Developed the RFP and reviewed RFP responses based on fleet electrification expertise.

# TTC eBus Manufacturers Quality Review (2019 - 2020):

Project Coordinator for a project inspecting four OEM eBus production across 8 manufacturing sites for quality assurance for upcoming TTC eBus build. Developing summary reports consolidating findings from the audits. Developed the extensive manufacturing audit review checklist based on expertise from quality control.

# City of Abbotsford Refuse Truck Lifecycle Modelling, BC, Canada (2019 - 2020):

Support staff for developing lifecycle models of diesel, diesel with propane injection, CNG, renewable diesel, and battery-electric refuse trucks. Evaluation of lifecycle costs such as capital (including facility upgrades), fleet maintenance, and lifecycle GHG emissions.



# LA Metro, Zero Emission Bus (ZEB) Program Master Plan, CA, USA (2019 – 2020):

Support staff for performing electric bus route simulations (route completion, depot/on-route charging) and market research.

# City of Calgary Refuse Truck Alternative Fuels Study, CA, Canada (2019 – 2020):

Assisted the technical lead in evaluating alternative fuels for the City of Calgary's refuse truck fleet. Performed a market scan and case study with lessons learned on the implementation of alternative fuels refuse trucks with various propulsion technologies such as natural gas, battery-electric, and diesel-hybrid.

# Halifax Alternative Fuels Study, NS, Canada (2019)

Supported the project team to perform market research and identify trends in alternative propulsion technology and associated costs for a triple bottom line feasibility study.

# MassDOT Electric Bus Feasibility Study, Boston, MA (2018):

Assisting the deputy project manager to conduct simulations of Battery Electric buses for various routes and garages to develop an adoption plan of battery-electric buses into the public transit provider's fleet.

# Lethbridge Alternative Fuel Study, AB, Canada (2018 - 2019):

Support staff for an Alternative fuel study for the City's public works and transit operations of over 500 vehicles and 3 fueling/vehicle storage facilities. The scope included a Triple Bottom Line (TBL) assessment of fleet technologies. Examining infrastructure, fleet, and the operating impact of various technologies (CNG, battery-electric, hydrogen, and diesel/gasoline hybrids).

# Lima, Peru, Electric Bus Feasibility (2017 – 2020):

Support staff assisting the project team in generating technical specifications of 12m and 18m electric buses that will operate on a pilot program in Lima, Peru. Also supported the Project Team to perform a triple bottom line study to determine the feasibility of electric buses in Lima.

### York Region Transit, Fleet Retainer, Reliability Studies (2018 – 19):

Performed various reliability studies for YRT buses to the level of bus subsystem and developed various dashboards to present the results. This included interfacing YRT's bus maintenance data in a SQL database with PowerBI to create powerful visualization.

### YRT Bus In-line Inspection (2018 – 2020):

Supported the Project Manager to manage the Quality Assurance of Transit Buses for the YRT, specifically developing schedule and pricing for each engagement.

# **Consulting – Graduate Student, University of Toronto (2018 – 2019)**

# University Consulting Group, Toronto, Canada (2019):

Consultant for a not-for-profit firm providing pro-bono consulting services to help strategize their organizational growth over 3 years in expanding their services Canada wide. This included an in-depth study of the organization analyzing several factors and delivering a growth plan for the organization along with a detailed implementation plan.



# York Region Transit, Toronto, Canada (2018):

Business Process Improvement for transit bus maintenance using principles of Business Process Management (BPM) through process discovery, re-design, and simulation to optimize maintenance operation to bring down costs by improving resource utilization.

# Major Aircraft Engine Manufacturer, Canada (2018):

Reviewing internal innovation methods and developing a methodology for implementing open innovation methods to improve R&D propagating path-breaking technology. Work included recommendations for change management and process improvements.

# Manufacturing

# Assistant Manager, Sundram Fasteners Limited (2015 – 2017)

- Worked with several OEMs such as Toyota, GE, Ford, Cummins, and Tier-1 suppliers such as Honeywell, NTN, SKF to develop processes for manufacturing auto-parts.
- Established 10 new manufacturing processes and improved more than 30 existing manufacturing processes
- Reduced new business feasibility assessment lead time by 40% with the implementation of a new database which increased the new business acceptance rate by 15%

Spearheaded the machining process development for Cummins Heavy Engines Limited's Sintered Valve Guide. Innovatively engineered a machining process to counteract the erratic variation resulting in 99% conformance ensuring completion of the project and saved USD 3,000 in the development stage.

# Lakshmi Machine Works Ltd., Coimbatore, India (2015):

Developed a layout and plan for converting traditional batch production systems to manufacturing cells using Group Technology.

### Sundram Fasteners Limited, Madurai, India (2014):

Developed the `Life Cycle Assessment` methodology for Fasteners to evaluate the environmental impacts of its production process from cradle to grave.

# **Professional History**

- Wood, Consultant: Sustainable Transportation & Asset Management Solutions (Jan 2020 Present)
- WSP Canada Inc, Consultant: Sustainable Transportation (Jul 2020 Jan 2020)
- WSP Canada Inc, Associate Consultant: Advisory Services Transportation (May 2018 July 2020)
- Sundram Fasteners Limited, India, Assistant Manager: Design & Development (Jul 2015 Jun 2017)

#### Carly Macias, LEED Green Associate, ENV SP

Carly brings 10 years of experience in multimodal transportation planning with a specialization in transit planning and zero-emission vehicle planning. Since joining Kimley-Horn, Carly has worked with transit agencies to develop zero-emission bus plans & deployment projects and supported clients through program management contracts. Prior to Kimley-Horn, Carly was a senior planner at RTD in Denver, Colorado where she led zero-emission bus planning for the agency and served as the project manager for several ZEB projects including the Reimagine RTD Zero Emission Bus Plan. Carly led RTD's interdepartmental Fleet Electrification Task Force and represented RTD in the Colorado Electric Vehicle Coalition. She is also the Vice Chair of the American Public Transportation Association (APTA) Zero Emission Fleet Committee.

#### **Professional Credentials**

- Master of Urban and Regional Planning, University of Colorado, Denver
- Bachelor of Science, Civil and Environmental Engineering, University of California, Los Angeles

### **Professional Certifications**

- Leadership in Energy and Environmental Design (LEED) Green Associate
- Envision Sustainability Professional (ENV SP)
- Asset Management Certificate, Institute of Asset Management
- Project Management Certificate, Rutgers University

#### **Professional Associations**

- American Public Transportation Association, Zero Emission Fleet Committee Vice Chair
- Women's Transportation Seminar, Former Committee Chair and Current Member
- Colorado Electric Vehicle Coalition, Transit Subcommittee

### **Relevant Experience**

# Arlington County, ART Fleet Zero Emission Bus Transition Plan, Arlington, VA — Project Manager. Kimley-Horn is helping Arlington County develop a Zero Emission Bus Transition Plan for the ART Fleet in order to reduce emissions from transit vehicles while ensuring continued high-quality transit service. The plan includes a market overview, best practices and lessons learned, fleet and facility assessment,

route modeling, GHG emission impact, resilience strategies, stakeholder and public engagement, funding strategies and grant writing assistance, and an implementation plan. Carly is leading this planning effort as the project manager and zero- emission bus planning subject matter specialist.

Utah Transit Authority (UTA), FrontRunner Forward Program Management, Salt Lake City, UT — Project Planner. Kimley-Horn is providing program management services for UTA to assist with successful delivery of a series of investment packages to improve FrontRunner commuter rail service. Kimley-Horn is providing program leadership to assist UTA with the development, implementation, and general oversight of the FRF Program including the development of a Strategic Business Plan to provide the long- term vision and guide the investments over time and an Implementation Plan to articulate how and when the operational and capital improvements will be executed. Carly is supporting day-to-day program management activities and she is leading several tasks for the FrontRunner Strategic Business Plan.

#### Carly worked on the following projects prior to joining Kimley-Horn:

**Regional Transportation District (RTD), Zero-Emission Bus Planning, Denver, CO** — **Project Manager.** Prior to joining Kimley-Horn, Carly was the project manager for the Reimagine RTD Fleet Electrification Plan and was responsible for developing strategic partnerships with key players in transportation electrification in the Denver Metro Region. She also managed the submission of state and federal grant applications for zero-emission vehicle funding resulting in grant awards totaling over \$11 million. Carly led RTD's interdepartmental Fleet Electrification Task Force and represented RTD in the Colorado Electric Vehicle Coalition. In late 2019, Carly worked with RTD legal staff to submit a motion to intervene in the Xcel Energy EV Rate Case and represented RTD's interests through multiple testimonies during the case, which resulted in lower operating costs for the electric bus fleet. In addition, Carly represented RTD while speaking about the agency's ZEB experience at a variety of regional and national conferences.

**Regional Transportation District (RTD), Quality of Life Study, Denver, CO** — **Project Manager**. The Quality of Life (QoL) Study is RTD's data-driven evaluation of progress toward meeting the FasTracks Program goals. The Study focuses on the "quality of life" in the context of those areas most affected by transit improvements and those specifically addressed in the FasTracks Plan: mobility, environment, economic activity, development, and land use. Prior to joining Kimley-Horn, Carly was the project manager for the QoL Study for 3 years and was responsible for expanding the study to include overall system metrics as well as COVID-focused metrics in 2020.

**Regional Transportation District (RTD), Sustainability Report, Denver, CO** — **Project Manager.** The RTD Sustainability Report was developed in 2020 as an extension of RTD's Quality of Life (QoL) Study. This report is inspired by the FasTracks Sustainability Policy but expands the area of focus from the FasTracks Program to the entire RTD service area. The metrics within the report are categorized in four primary areas where RTD has made an impact on regional sustainability including: air quality, transportation greenhouse gas emissions, electric vehicles, and public health. Prior to joining Kimley-Horn, Carly was the project manager for the RTD Sustainability Report and was responsible for developing this report as an extension of the RTD QoL Study.

**Appendix B – Equal Employment Opportunity (EEO) Policy** 



# EQUAL EMPLOYMENT OPPORTUNITY (EEO) POLICY

This is to affirm Wood Environment & Infrastructure Solutions, Inc.'s policy of providing Equal Opportunity to all employees and applicants for employment in accordance with all applicable Equal Employment Opportunity/Affirmative Action laws, directives and regulations of Federal, State and Local governing bodies or agencies thereof.

Our organization will not discriminate against or harass any employee or applicant for employment because of race, color, creed, religion, national origin, sex, sexual orientation, disability, age, marital status, familial status, membership or activity in a local human rights commission, or status with regard to public assistance.

We will take Affirmative Action to ensure that all employment practices are free of such discrimination. Such employment practices include, but are not limited to, the following: hiring, upgrading, demotion, transfer, recruitment or recruitment advertising, selection, layoff, disciplinary action, termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. We will provide reasonable accommodation to applicants and employees with disabilities.

Wood Environment & Infrastructure Solutions, Inc. will evaluate the performance of its management and supervisory personnel on the basis of their involvement in achieving these Affirmative Action objectives as well as other established criteria. In addition, all other employees are expected to perform their job responsibilities in a manner that supports equal employment opportunity for all.

I have appointed Diane Woodall, Vice President P&O-E&IS to manage the Equal Employment Opportunity Program. This person's responsibilities will include monitoring all Equal Employment Opportunity activities and reporting the effectiveness of this Affirmative Action Program, as required by Federal, State and Local agencies. I will receive and review reports on the progress of the program. Any employee or applicant may inspect our Affirmative Action Program during normal business hours by contacting the EEO Coordinator.

If any employee or applicant for employment believes he or she has been treated in a way that violates this policy, they should contact either Diane Woodall, Vice President P&O-E&IS at Wood Environment & Infrastructure Solutions, Inc. 160 Traders Blvd. E., Suite 110, Mississauga, ON phone: (905) 568-2929 or any other representative of management, including me. Responsible parties will investigate allegations of discrimination or harassment as confidentially and promptly as possible, and we will take appropriate action in response to these investigations.

Joeph Jebugahe

Joseph J. Sczurko, Executive President, Consulting

<u>06/03/2021</u> Date:



# **US - EQUAL EMPLOYMENT OPPORTUNITY**

Document number:	HRM-PRO-100339
Applicability:	USA Effective 1-Jan-2019
Document owner:	P&O President of Business Units with Operations in the US
Document checker:	Shanna Funkhouser, VP, People & Organization
Document author:	Jeanne Lee, P&O Business Partner
Revision:	0
Revision date:	1-Jan-2019
This document supports	Equal Opportunities, HRM-POL-100014
Posponsibility for this	The functional responsibility for the development review and maintenance

document:

**Responsibility for this** The functional responsibility for the development, review and maintenance of this document rests with the P&O Presidents.

# Contents

1	Purpos	se and Scope	3
2	Roles and Responsibilities		3
3	Procedure		3
4	Work	Flow	4
	4.1	Recruitment	4
	4.2	Disabled	4
	4.3	Veterans	4
5	Breach	nes of the Procedure	4
6	Definitions		
7	References		5
8	Revision History		
9	Appendices5		5

# 1 Purpose and Scope

Wood (hereinafter referred to as "the Company") is an equal opportunity employer that recognizes the value of a diverse workforce. The Company is committed to equal opportunities and will treat all employees and prospective hires in a fair and consistent manner. The Company will not tolerate any form of unlawful or unfair discrimination or harassment. Nor will the Company tolerate retaliation against a person because he or she complained about discrimination, filed a charge of discrimination, or participated in an employment discrimination investigation or lawsuit. In addition, the Company is committed to provide equal employment opportunity for individuals with a disability and veteran status, or other characteristics in accordance with applicable governing laws. The Company shall appoint, train, develop, and promote on the basis of merit, ability and suitability for work only.

This procedure applies to all worker classifications as defined in the Worker Classifications Procedure.

# 2 Roles and Responsibilities

All Company employees are responsible for their individual compliance with the terms of this procedure.

All Supervisors have a duty to ensure that equal opportunities exist in work areas for which they are responsible, and are responsible for ensuring that they observe the procedure in the treatment of their personnel. Supervisors have a further responsibility to explain the Company's procedure to their people and to take steps to promote the procedure.

The People & Organization (P&O) function is assigned overall responsibility for the coordination of the Company's Equal Employment Opportunity and Affirmative Action efforts.

# 3 Procedure

The Company will comply with federal anti-discrimination laws and will maintain annual Affirmative Action plans where required. As part of this commitment to equal employment opportunity, we will inform employees of their rights to be free from workplace discrimination and retaliation. In addition, the Company will provide avenues for employees to report their concerns if they feel that discrimination or retaliation have occurred.

The Company does not discriminate and does not permit its employees to discriminate against other employees or applicants based on race, color, religion, sex, pregnancy, gender identity, sexual orientation, national origin, age, disability or genetic information. This includes discrimination based on the perception that a person has any of those characteristics. It is also illegal to discriminate against a person because the person complained about discrimination, filed a charge of discrimination, or participated in an employment discrimination investigation or lawsuit. Additionally, we will not discriminate on alien status when the individual has qualified for employment in the United States. Equal employment opportunity will be extended to all employees in all aspects of the employeremployee relationship. This includes recruiting, hiring, job upgrading, demotion, training and apprenticeship, promotion, transfer, compensation, benefits, discipline, layoffs, recall if applicable, termination, and all other privileges, terms and conditions of employment.

Content property of Wood. Paper copies are uncontrolled. This copy was valid at the time it was printed. For an up-to-date copy, please visit <u>Wood Management System.</u>

# 4 Work Flow

# 4.1 Recruitment

Qualified applicants will be recruited for vacancies in all job classifications regardless of race, creed, color, religion, sex, sexual orientation, gender identity or expression, pregnancy, marital status, national origin, citizenship, covered veteran status, ancestry, age, physical or mental disability, genetic information, and alien status when an individual is eligible for employment in the US.

All recruiting advertisements will include the term "Equal Opportunity Employer (EOE) M/F/V/D/SO".

# 4.2 Disabled

The Company will provide equal employment opportunities for qualified applicants and employees with disabilities and individuals associated with people with disabilities as well as Veterans. P&O will be responsible for determining whether reasonable accommodations can be made to ensure equal opportunities for disabled persons.

# 4.3 Veterans

The Company will provide equal employment opportunities for qualified applicants and employees who are Veterans. P&O will be responsible for determining whether reasonable accommodations can be made to ensure equal opportunities for Veteran applicants and employees.

# 5 Breaches of the Procedure

The Company cannot eliminate discrimination unless it is made aware that it is happening. Any person who believes that he/she has been subject to or is aware of discrimination is encouraged to raise it with their Supervisors, P&O or through the Ethics Helpline.

If you believe that you may have been disadvantaged on any of the unlawful grounds listed in this procedure you are encouraged to raise the matter with your Supervisors, P&O or through the Ethics Helpline.

Allegations regarding potential breaches of this procedure will be treated in confidence and investigated in accordance with the relevant procedure.

Company employees who make such allegations in good faith will not be victimized or treated less favorably as a result.

False allegations of a breach of this procedure which are found to have been made in bad faith will, however, be dealt with under the Company's disciplinary procedures.

If, after investigation, any Company employees are proven to have violated this procedure, they will be subject to the Company's disciplinary procedures, up to and including termination of employment.

# 6 Definitions

Term	Definition
EEO	Equal Employment Opportunity
EOE M/F/V/D/SO	Equal Opportunity Employer for Minority/Female/Veteran/Disabled/Sexual Orientation

The following terms are used within this document.

# 7 References

Document title	Document no.
Ethics Helpline	1-855-260-7434
Equal Opportunities	HRM-POL-100014
US Worker Classification Procedure	HRM-PRO-100337
Ethics Reporting Website	Woodplc.ethicspoint.com

# 8 Revision History

Rev no.	Rev date	Summary of changes
0	1-Jan-2019	Issued for Use

# 9 Appendices

Not applicable.

# **Appendix C – Requested RFQ Forms**





Southeastern Pennsylvania Transportation Authority DBE Program Office 1234 Market Street – 11<sup>th</sup> Floor Philadelphia, PA 19107-3780 Telephone: (215) 580-7278 Fax: (215) 580-7261 Web Site: www.septa.org

November 23, 2020

Balaji Krishnamurthy, President & CEO OMNI STRATEGY, LLC 20 South Charles Street, Suite 1103 Baltimore, MD 21201-3219

RE: Pennsylvania Unified Certification Program **DBE Certification Approval** 

DBE Certification PA UCP No: 16420 Anniversary Date – Annually on November 23

Dear Entrepreneur:

The Southeastern Pennsylvania Transportation Authority (SEPTA), a certifying participant in the Pennsylvania Unified Certification Program (PA UCP), has reviewed your request for certification as a Disadvantaged Business Enterprise (DBE) and is pleased to inform you that your firm appears to meet the requirements established by the United States Department of Transportation in title 49, Part 26 of the Code of Federal Regulations. Consequently, your firm is now certified as a DBE to participate in the program in the following classification(s) only:

# ENGINEERING SERVICES, DRAFTING SERVICES, OTHER COMPUTER RELATED SERVICES, ADMINISTRATIVE MANAGEMENT AND GENERAL MANAGEMENT CONSULTING SERVICES, OTHER SCIENTIFIC AND TECHNICAL CONSULTING SERVICES, RESEARCH AND DEVELOPMENT IN THE SOCIAL SCIENCES AND HUMANITIES, OFFICE ADMINISTRATIVE SERVICES, DOCUMENT PREPARATION SERVICES, PROFESSIONAL AND MANAGEMENT DEVELOPMENT TRAINING

#### **NAICS Codes:**

541330	Engineering Services
541340	Drafting Services
541519	Other Computer Related Services
541611	Administrative Management and General Management Consulting Services
541690	Other Scientific and Technical Consulting Services
541720	Research and Development in the Social Sciences and Humanities
561110	Office Administrative Services
561410	Document Preparation Services
611430	Professional and Management Development Training

**Certifying Participants:** 

Allegheny County Department of Equity and Inclusion **City of Philadelphia** Philadelphia International Airport Office of Business Diversity **PENNDOT** Bureau of Equal Opportunity Port Authority of Allegheny County Diverse and Disadvantaged Business Enterprises

SEPTA DBE Program Office Balaji Krishnamurthy, President & CEO OMNI STRATEGY, LLC November 23, 2020 Page 2

DBE certification continues from the date of this letter, but is contingent upon the firm renewing its eligibility annually with our office. You will be notified in advance of your obligation to provide our office a copy of your renewal documents. These documents are also available online at www.paucp.com. However, the responsibility to assure continued certification is yours. Failure to continue your eligibility will result in immediate action to decertify the firm.

As long as your firm is listed in the PA UCP DBE Directory at www.paucp.com, you are DBE Certified in Pennsylvania. In order to maintain an accurate Directory, we are requesting that you make the PA UCP aware of any changes in your address, telephone number or specific geographical area where your firm is willing to perform work. If you wish to expand your status to include another type of business, you must contact the PA UCP for reevaluation prior to undertaking any projects as a DBE in the expanded area.

In the event of a change in circumstances affecting your ability to meet size, disadvantage, ownership, and control requirements of Part 26 or any material change in the information provided in your application form; you must inform the PA UCP by means of a Notice of Change Affidavit describing in detail the nature of such changes. You must submit a Notice of Change Affidavit (also available online) within 30 days of the occurrence of the change. Failure to do so will be deemed a failure to cooperate. We would also remind you that the PA UCP reserves the right to review your firm at any time to ensure compliance with the program.

Supplier firms that wish to act as a regular dealer must be aware that regular dealer credit cannot be given for drop shipments.

Certified firms with a "trucking" classification must be aware that certain conditions must be met in order to be considered commercially useful. Foremost, the DBE trucking firm must be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there cannot be a contrived arrangement for the purpose of meeting DBE goals. The DBE trucking firm must itself own and operate at least one fully licensed, insured, and operational truck used on the contract. For a full list of these conditions, consult Part 26.65(d) (1) through (6) of the aforementioned regulations.

We are pleased to have you as a Disadvantaged Business Enterprise and wish you success in acquiring work within the DBE Program. If you have any questions, please contact Nathan G. Heitzman, DBE Program Specialist, at <a href="https://nheitzman@septa.org">nheitzman@septa.org</a> or (215) 580-8356.

Sincerely,

Gregory & Myers

Mary E. Connell Director DBE Program Office SEPTA

MEC:NGH

Enclosures: SEPTA Disadvantaged Business Enterprise (DBE) Policy Statement Notice of Change Affidavit

#### **Certifying Participants:**

Allegheny County Department of Equity and Inclusion **City of Philadelphia** Philadelphia International Airport Office of Business Diversity **PENNDOT** Bureau of Equal Opportunity Port Authority of Allegheny County Diverse and Disadvantaged Business Enterprises

**SEPTA** DBE Program Office



# **COVER SHEET**

# **Proposer Information**

Wood Environment & Infrastructure Solutions	
th Street, STE 400	
KS, 66612	
6830	

# **Contact Person Information**

Name	Larry Sample	
Job Title	Sr. Associate Engineer	
Phone	785-272-6830	
Alt. Phone	785-207-7899	
Email	larry.sample@woodplc.com	

Signature

Larry Sample

Date:

01/19/2022



# PRICE QUOTE

Price to Complete Electric Vehicle Fleet Study	\$ 93,150.00	
Additional Charges:	\$ 5,000.00	
Travel Costs		
Total:	\$ 98,150.00	

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

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:	Larry Sample
Name and Title:	Larry Sample, Sr. Associate Engineer
Company Name:	Wood Environment & Infrastructure Solutions
Date:	01/19/2022



#### **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:	Larry Sample
Name and Title:	Larry Sample, Sr. Associate Engineer
Company Name:	Wood Environment & Infrastructure Solutions
Date:	01/19/2022





# **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 100,000 for each such expenditure or fails to file or 10,000 and not more than 100,000 for each Such 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:	Larry Sample
Name and Title:	Larry Sample, Sr. Associate Engineer
Company Name:	Wood Environment & Infrastructure Solutions
Date:	01/19/2022


## **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:	Larry Sample
Name and Title:	Larry Sample, Sr. Associate Engineer
Company Name:	Wood Environment & Infrastructure Solutions
Date:	01/19/2022



## **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;
- 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:	Larry Sample
Name and Title:	Larry Sample, Sr. Associate Engineer
Company Name:	Wood Environment & Infrastructure Solutions
Date:	01/19/2022