CORVALLIS AREA
Metropolitan Planning Organization

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Policy Board Meeting
Wednesday, March 13, 2019
4:00 pm to 6:00 pm
Sunset Building, 4077 Research Way
Corvallis, OR 97333
Sunset Meeting Room

AGENDA

I. Call to Order — Policy Board Chair, Barbara Bull

II. Agenda Review — Chair

III. Minutes of February 13, 2019 Meetings — Chair
Review and decision on minutes. (Attachments A)
ACTION: Decision

IV. Previous Meeting Business — Meltzer
-CAMPO Glossary
-Regional Boundary Map
-Safe Lane Coalition (Attachment B)

V. Loop Board Business — Meltzer
The Loop Board is made up of a member of the CAMPO Policy Board, AAMPO Policy Board, and Linn-Benton Community College. With the retirement of Councilor Brauner, CAMPO will need to elect a new representative to serve as a Loop Board member.
ACTION: Decision

VI. Electric Bus Study *(Attachment C)* — Meltzer/Nappa
Discussion of study to date.

VII. State Transportation Improvement Process — Meltzer
Discussion of process and schedule.

VIII. Regional Performance Measures *(Handout)* — Meltzer
Begin discussion of goal setting and potential performance measures.
ACTION: Discussion

IX. General Updates — Chair
CAMPO Staff Report
Jurisdictional Reports

X. **Other Business & Announcements** Chair

Meeting facilities are accessible to persons with disabilities. If you will need any special accommodations, please contact Emma Chavez at least 72 hours prior to the meeting. Emma can be reached at 541-924-84051. TTY/TTD 711

METROPOLITAN PLANNING ORGANIZATION
POLICY BOARD MEETING
Wednesday, February 13, 2019
ODOT Corvallis Office
MINUTES

Policy Board Members Attending: Pat Malone, Barbara bull, Eric Niemann, John Huestis
Policy Board Members Absent: Alan Rowe
TAC Members Attending: Gary Stockhoff, James Feldmann, and Mary Steckel
Staff Attending: Phil Warnock, Nick Meltzer, and Dana Nichols
Guests Attending: Bill Holmstrom, and Terry Cole

TOPIC	DISCUSSION	DECISION / CONCLUSION
I. Call to Order	The Vice Chair, Eric Nieman called the meeting to order at 4:06 pm. Introductions were conducted.	
II. Agenda Review		**There were no changes to the agenda.**
III. Minutes of January 16, 2019	Correction: Mayor Erick Nieman was voted to serve as Vice Chair, not Chair and Councilor Bull to serve as Chair.	**Consensus by the Policy Board to approve the January 16, 2019 meeting minute with correction.**
IV. 2019 Meeting Calendar	Nieman directed Staff to provide an overview of the 2019 meeting schedule. Staff Nick Meltzer presented the calendar and noted that the Board wanted to alternate the meeting location throughout the CAMPO communities. The meetings will be held on the 2nd Wednesday of the month, from 4:00 to 6:00 pm. Since this is a change from the prior meeting schedule, Meltzer asked for confirmation from the Board. The Board confirmed. Mary Steckel asked if staff needed assistance in finding locations in each of the communities, to which Nick replied yes. Nieman asked if there would be calendar invites sent by email as a reminder, to which Meltzer replied yes. Nieman stated an appreciation for moving the meeting location around the CAMPO region.	**Staff will send calendar updates to members with the meeting locations as they are set.**

V. Appointment to OMPOC and Loop Board	Nieman requested for staff to explain the composition of the Loop Board. Meltzer stated that there is one member from LBCC, AAMPO, and CAMPO. He went on to advice that CAMPO needs a new representative as long-time Board Member Hal Brauner is no longer on the Board. Nieman asked for volunteers. Hearing none, the Board agreed to table this discussion until the next meeting so that everyone could check their calendars. Meltzer stated that CAMPO also needs to appoint a representative to the Oregon Metropolitan Planning Organization Consortium (OMPOC). Commissioner Pat Malone attended the previous OMPOC meeting and found it useful. He agreed to be the CAMPO representative for OMPOC and will attend the Loop Board as the interim representative. Nieman asked about meeting dates for the Loop Board, to which Meltzer replied that they meet quarterly, on the last Tuesday of the month from 3:00 to 5:00 pm at the Albany COG office.	**Consensus for Commissioner Pat Malone to serve as CAMPOs OMPOC representative.** **Consensus for Commissioner Pat Malone to attend the next Loop Board meeting as an Interim Representative for CAMPO.**
VI. OMPOC Update & Safe Lane Coalition	Meltzer explained that the COG hosted the most recent OMPOC meeting in January at the City of Albany Carousel. The meeting was attended by 24 people. Topics discussed were speed, road design, and safety. Doug Bish presented from ODOT regarding road speeds, and OMPOC had a discussion about policy priorities for the 2019 legislative session. Meltzer stated that he brought up the three topics discussed by the CAMPO board at the meeting. Those included; speed limits, SRTS Match, and ConnectOregon funding. However, OMPOC approved their priorities as-is. Drew Pfefferle from Safe Lane Coalition presented about the grant received from ODOT by LCOG to run the program. Meltzer included the presentation as part of the packet and since Commissioner Malone attended and enjoyed the presentation, invited him to share his thoughts and opinions with the group. Malone noted that he appreciated that they had a staff person dedicated to implementation (not just planning) and	

	especially liked the project on distracted driving. He explained that they used sandwich boards at an elementary school loading zones to alert parents to not drive distracted. Meltzer explained that they received two years of funding for the position from ODOT, though the exact amount is not known. Nieman shared an experience from Philomath, explaining that he has heard many concerns regarding the intersection where Chevron and McDonald's are because there are a series of crosswalks without any flashing lights or indicators to drivers that people are crossing the road. He thought it could be an opportunity for CAMPO to look into and asked for feedback from the rest of the board. Meltzer explained that the Safe Lane program has a focus on county and urban areas. He thought it could be an opportunity for CAMPO to look into and asked for feedback from the rest of the Board. Malone also shared that a lot of materials and programming ideas are already available from Drew and could be a "plug and play" opportunity. John Huestis asked Nieman to clarify if he was looking for infrastructure or non-infrastructure support, to which Nieman replied probably both. It's well trafficked and needs help. Phil shared that he wanted to make it clear that they wouldn't put the signs on roadways, as that would just cause more distraction, but that it could be an opportunity to put them at schools. He suggested perhaps getting two signs made and having them shared around the school district, with support from the district and schools. Steckel added that moving them around the community would reinforce the message. Barbara Bull asked for clarification on whether these would be traveling signs or stationary. Phil said they could be rotated to maximize	

	resources, though it would require coordination, perhaps from SRTS. Steckel said she would like to see the school district partner. Meltzer also explained that COG is doing SRTS work and this could be premiered at some of their summer events. Members noted that the Chair and Vice Chair information needed to be updated on the CAMPO website.	
VII. Regional Transportation System Plan (RTSP)	Meltzer gave a high-level overview of the Regional Transportation System Plan (RTSP). The State requires that if cities don't meet vehicle miles traveled (VMT) requirements, then the MPO was to develop a regional plan to lower VMT. Corvallis recently adopted their Transportation Systems Plan (TSP) and it does not meet VMT requirements. Meltzer requested for Bill Holmstrom from DLCD to explain the process further. Holmstrom explained that the transportation planning rule states that over a 20 year period, cities in MPOs must develop a plan to reduce VMT by 5% per capita. This used to be 10%, but many entities could not reach this goal. He explained that the federal government requires a Regional Transportation Plan (RTP), the local government requires the TSP, and the states requires an RTSP (often developed in tandem with RTP), though not always. The RTP is adopted by the Policy Board, and the city-specific RTSP chapter is adopted by local governments. Terry Cole from ODOT explained that sometimes these documents are one in the same, and sometimes they are two separate documents. Holmstrom went on to elaborate that at the State level, the rules are currently unclear because of the potential changes this legislative session. Starting in 2017, there were changes proposed to clarify the MPO requirements relating to the RTSP. Former CAMPO Staff person,	**Barbara Bull made a motion for CAMPO to move forward with developing voluntary performance measures. Seconded by Pat Malone. Motion approved unanimously.**

	Ali Bonakdar, was on the rulemaking committee. Right now, DLCD has "put the brakes on" the process because they don't have a clear idea of what direction the legislative will move in. The priorities of the commission are clear, however, in that they want to see climate concerns being addressed through lower greenhouse gas (GHG) in the form of decrease dependence on single occupancy vehicles, and increased transportation options. Holmstrom said that he doesn't want to see MPOs go too far down the road to develop an RTSP without the full picture from the legislature about what will be required of them. Cole clarified that the RTSP/RTP process may be redundant, but it could be a useful planning tool. He wants to see local TSPs consistent with the RTP and any state requirements, which by nature, should already be true. Holmstrom stated that DLCD is working with local governments and MPOs through the process, but stated that they will not have an update until next summer. He said that once a decision is made, they could come back together to discuss performance measures and better define regional goals and objectives. Cole added that performance measures are going to be the biggest deal for Corvallis because they already have some of the lowest VMT levels statewide. Corvallis is different than Albany in that Albany has a high VMT, making it easier to see a 5% reduction over the next 20 years than Corvallis. He asked the Board to consider, for CAMPO, what are the easiest or most feasible data to monitor over time. He cautioned them to look for things that already have data for or things that are meaningful to the community to best implement performance measures. Holmstrom reiterated that though he doesn't know the ins and outs of Corvallis, if they're working to increase transportation options and to decrease auto dependence, and working towards statewide climate	

	goals, then they're headed in the right direction and DLCD will support them. Cole added that he felt there's too much focus on VMT at the state level. Driving alone is already low in Corvallis and it might be better to show progress on developing better transit or bike/ped infrastructure. Bull mentioned the Strategic Assessment that Corvallis participated in that showed land use and parking changes need to be made in order to lower VMT, though the TSP did not look at that. Holmstrom and Cole explained that Corvallis participated in a scenario planning project (along with other cities in the state) focused on reducing greenhouse gas emission. Portland had to participated and adopt a plan, Eugene had to participate, but was not required to adopt a plan, and other cities were given a target, but were not required to meet it or plan for it. Cole noted that there's a concern that the greenhouse gas emission reduction requirements may become an unfunded mandate. Holmstrom countered that DLCD will request money for technical assistance if the state makes lowering GHGs a requirement. Bull asked for clarification that VMT is a state requirement. Holmstrom responded yes, and that regardless of legislative changes, the TPR will live on as a "safe harbor". Bull then added that VMT has been measured only on a local level, and not at the commuter level (between Corvallis and Albany), even though it's a regional issue. Holmstrom clarified that VMT is only measured within an MPO boundary and Cole added that the numbers are also only accurate within 5-10%, so it's not an ideal tool for measuring actual results. Bull stated that commuting affects quality of life and asked how CAMPO can use the RTP/RTSP process to make Corvallis better. There is a serious housing and commuting problem.	

	Cole stated that performance measures will help CAMPO work towards that goal. He posed the question, “What will move the needle the most?” It could be densification. CAMPO could use the Strategic Assessment to determine what their steps should be, though they would need money for implementation. Meltzer clarified that he sees three options moving forward: (1) wait until legislation is passed, (2) wait until after the legislative session to see what the rulemaking committee will be working towards in regards to the climate, and (3) still move forward with performance measures at the local level. Meltzer stated that Staff could work with each jurisdiction to determine PM that work for them and then bring them to CAMPO to see if everyone is moving in the same direction. Steckel agreed that it would be helpful for MPO staff to take the lead. Bull asked about the regional approach from the ACT. Nieman stated that in Philomath, bus ridership is at a six-year low, but the city is seeing a high for traffic congestion. Perhaps regional growth could drive ridership. Cole added that a regional approach is good, as long as they’re looking at increasing transit options and decreasing auto dependence. They could look at higher frequency transit. Gary Stockhoff reminded the group about the Special Transportation Improvement Fund (STIF) and the pending expansion of routes throughout the region. This could bring in more money. Cole thought that the STIF would not be used for expansion but rather to not lose existing lines, though Gary said the money could be used for back-fill.	

	Nieman said that Philomath is requesting STIF funds to buy a new bus for the Philomath Connection. Meltzer asked the Board if it would be helpful for the MPO to help communities determine their Performance Measures. Mary concurred. Meltzer explained that with new capacity at the COG, the MPO could assist jurisdictions in the process. Nieman posed the question to the Board: should we want and see or do something now? He is in favor of keeping the inertia going and working on the performance measures. Holmstrom added that if CAMPO were to move forward with performance measure discussions, CAMPO could use this information to inform how the TPR fleshes out at the state level. Nieman and Malone agreed that they should move forward, and Holmstrom agreed that they would be putting themselves in a better position for when the conversation about TPR starts at the state level. Nieman asked for a motion.	
VIII. General Updates	CAMPO Update: Meltzer explained the Unified Planning Work Program (UPWP) process. He advised that the UPWP review is scheduled for Friday, March 1st with FTA, FHWA, and ODOT. The Board is invited to attend, though it's not required. Meltzer asked Warnock to explain the COG applications for STIF Discretionary funding. Warnock explained that the 99W Transit corridor project is a planning and demand analysis for a pilot service between Junction City and McMinnville. Meltzer added that this service would connect the two largest transit service providers in the state; Portland and Eugene. Warnock then explained the Seamless Transit Experience project as a two prong approach: (1) NEMT travel training, driver training, and	

	paratransit, and (2) soft side of transit experience – one click/one call, mobil ticketing app, one ticket to use across the region, real-time bus data. Steckel asked for clarification about what the “region” is and Warnock clarified that it’s the COC region of Linn, Benton, and Lincoln counties. Warnock also clarified that the COG applied for STIF discretionary funds, not the QE formula funds, though that may be match. Cole explained that having real-time bus data and centralized service lines up with the goals of NWOTA. Warnock explained that with international and national travel to the Portland area, travelers like to be able to plan their trip far in advance, however current trip planning tools only allow a rider to view schedules and book tickets 90 days in advance. Warnock elaborated that anecdotally he had heard that the number of trip assistance calls has been increasing. Meltzer explained that Lincoln City adopted real-time bus data and Swiftly, and noted that trip planning questions decreased significantly. Nieman asked for clarification on timing of STIF funds. Meltzer explained that the OTC will meet in August to make a decision, and IGAs will be signed in October of 2019. In between, the COG will be in contact with agencies and partners affected by the applications. Nieman added support for the projects stating that his city council would like to see more ridership. They have looked into increasing their marketing, however he would like to see them wait until after STIF money is allocated as many routes may change. Stockhoff explained that at the ACT TAC meeting earlier that day they looked at the STIF projects and the ACT Full Commission will make a recommendation to the OTC. Steckel clarified that the ACT is not the final decision maker, but that it’s ultimately a statewide committee that will make the decision.	

	Nieman asked for any future agenda items. Meltzer said they will be following up about the Safe Lane Coalition, Performance Measure, and getting a new Loop Board representative. Cole wanted to add some additional advice about Performance Measures. He stated that CAMPO should look at relevance and feasibility. Stockhoff reminded the group that the Benton County STIF Formula Fund applications are due this Friday for the May 1st deadline to submit the QE STIF plan. Bull asked for a list of common acronyms and a flow chart to map all the transportation entities and how they interact. Stockhoff added that Benton County has their 2nd reading of the TSP on Tuesday and after 30 days it will become active. Feldmann asked if Adair Village is included in the Benton County TSP. It was noted that, It is, although it has to be adopted by the jurisdiction. Corvallis – Steckel said that Corvallis is applying for STIF federal funds to implement the short term phase of their TSP. Philomath – Nieman stated that Philomath is moving forward with the repaving of their couplet, though it has now become more restricting. Huestis added that the price tag is rising with time, ADA requirements, and ODOT objectives. It will be a two-season job that will cost $10-12 million. ODOT – Huestis also added that they will be working on the Van Buren Bridge area. Consultant OBEC will start design work. There will also be work on the Highway 20 safety corridor, though some changes will be made to the Granger intersection. Looking at 2021 for construction.	

	Corvallis – Steckel then added that they will be resurfacing 9th to Circle and south, and there is an Arts safety circle planned for Spruce that will restrict left-hand turns. Warnock asked if they will also be looking at the timing of lights, and Steckel said they are. Bull added that they are looking at the Van Buren Bridge and picking up where they last left off. Steckel said the last document is from 2005, and Huestis was going to look it up and find it for Bull	
IX. Adjournment	Eric moved to adjourn the meeting at 5:50 pm.	

MEMORANDUM

Corvallis Area Metropolitan Planning Organization
777 NW 9th Street, Suite 202C
Corvallis, Oregon 97330

Date: March 5, 2019
To: CAMPO Policy Board
From: Nick Meltzer, CAMPO Staff
Re: Safe Lane Coalition Informational Update

This memorandum summarizes information requested by Policy Board members at the February 13th meeting. After discussion of the Safe Lane Coalition, CAMPO staff followed up with the LCOG lead on the project. Questions regarding funding, printing of the posters and scheduling the poster displays were asked.

Follow Up Information

Funding

The position is funded through ODOT TSD and part of LCOG's MPO STBG funds. It's partially funding through ODOT for five years, beginning in the fall of 2017. During the initial five years, the goal is to build up the program and show the value of it to our regional partners, so when the ODOT funding ends our regional partners will contribute in funding the position.

Posters

We have just added the posters to our web site. You can find them at https://safelanecoalition.org/distracted-driving. I can't provide much information on the cost of the signs. Each Safe Routes Coordinators printed their own signs and the Springfield SRTS Coordinator already had the sandwich board frames. I printed the poster on the LCOG plotter and they looked good.

Sign Scheduling + Deployment

I haven't been involved with the deployment of the signs, but the Springfield SRTS Coordinator has. Below is our previous conversation where he detailed his deployment plan for the rest of the school year.

"The goal is to divide the rest of the year into two week sections, and rotate them accordingly. Maddie Billings (Springfield SRTS intern) will create a shared spreadsheet. It will have a tentative schedule, and actual dates upon completion, as well as any relevant reflections or feedback we receive through the process. That way, it's easier for both of us for reporting purposes."

Next Steps

The policy board can consider the following options, among others:

1. Staff cam explore timing and funding opportunities for a Safe Routes to School/Safe Benton County position
2. Staff can prepare a memo to submit to regional safe routes coordinators or district staff
3. Staff can dedicate time to working with regional school officials to implement the signs over the spring

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MEMORANDUM

DATE: February 20, 2019
TO: CAMPO TAC and Policy Board
FROM: Stephanie Nappa and Nick Meltzer
RE: **Battery Electric Bus Feasibility Study**

This memorandum evaluates the feasibility of utilizing battery electric buses in the Corvallis Transit System. It includes potential costs, social benefits, and a summary of technology decisions for Corvallis to consider.

Introduction

Electric Buses are becoming increasingly popular in transit fleets across North America, and the world. Transit providers in Los Angeles, Seattle, and Vancouver, BC have pledged to purchase exclusively zero emission vehicles starting in 2025. Furthermore, electric buses are currently being tested in Washington, DC, Park City, Utah, Chicago, Louisville, KY, Albuquerque, NM, and Portland, Oregon. The technology is evolving exponentially, the market is expanding and a new US manufacturing sector is under development. [1]

But what does this mean for Corvallis? What differences exist between their transit system and those listed above? Does it make sense to invest now in electric buses?

The Corvallis Area MPO previously examined the feasibility of compressed natural gas (CNG) buses for Corvallis Transit System. During the review of the study, the community provided feedback that the life cycle impacts of CNG are not environmentally friendly due to the processing methods for the gas, primarily extraction through fracking. The evolution of this discussion is the starting point for this study. Specifically, the 2018-2019 Unified Planning Work Program, from which the Corvallis Area MPO's work is guided, has the following description:

> ***330 – Feasibility Study of Electric Buses for CTS***
>
> ***Purpose***
> *The purpose of this study is to identify the logistics, the costs and the benefits of an environmental-friendly energy source for CTS buses.*
>
> ***Description***
> *In the past CAMPO studied the feasibility of converting the existing CTS diesel buses to Compressed Natural Gas (CNG), which is a cleaner fuel. The study examined the costs, logistics and the Return on Investment (ROI) for purchasing CNG buses compared to retrofitting the existing fleet. The conclusion of the study pointed to the fact that the current method of extracting*

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[1] Roberts, David "Electric buses are coming, and they're going to help fix 4 big urban problems." Vox. April 28, 2018

CNG, known as fracking, is harmful to the environment and due to this extracting practice, CNG is no longer considered an environmental friendly energy source. Therefore, the next phase of this study will be exploring the benefits, the cost and the logistics of using electric buses. The study will be conducted with assistance from the Oregon Department of Energy and in consultation with the City of Corvallis. Activities under this task will include:

- *Data collection on the environmental benefits of electricity as a source of energy and its comparison with diesel and CNG;*
- *Estimation of the costs, identification of grant opportunities for covering the cost;*
- *Identification of needed charging facilities and charging logistics.*
- *Programming fleet renewal and replacement plan, calculation of Return on Investment.*

Product
A report that provides necessary information for making decision on the conversion of the fleet to electric buses.

Glossary

BEB: Battery Electric Bus
NREL: National Renewable Energy Laboratory
CNG: Compressed Natural Gas
DGE: Diesel Gallon Equivalent. A term used to compare the fuel efficiency of electric buses with conventional diesel buses
LONO: Low Or No Emissions, used to describe low emissions transit vehicles as well as a specific Federal Transit Authority Grant for electric bus replacement.
MBRC: Miles Between Road Calls, a term used to describe how often a vehicle is in maintenance
Slow Charge: Bus charging method which uses a plug-in station and typically takes 4-6 hours for a full recharge. Also called depot charge or plug-in charge.
Fast Charge: Bus charging method which uses overhead or wireless charging and typically takes 10-15 minutes for a full recharge. Also called on-route or in-route charge.

Literature Review

To obtain a better understanding of electric buses, their current use in the United States, and existing information on their implementation, staff reviewed current literature on electric buses. Gathered via internet sources, the literature includes articles from general interest news sites as well as peer reviewed papers and articles from research centers across the country.

Eudy, et al. *Foothill Transit Battery Electric Bus Demonstration Results*. National Renewable Energy Laboratory, 2016.
Sponsored by the National Renewable Energy Laboratory (NREL) and in combination with the California Air Resources Board (CARB), this study compared battery electric buses (BEB) with buses operated on compressed natural gas (CNG) for the Foothill Transit District, located in Los Angeles County. The evaluation spanned 14 months and the operating cost, availability, overall usage, fuel economy, and maintenance needs were compared. While the buses were utilized on different routes, the BEBs has lower maintenance costs, much better fuel economy, the same availability, and similar maintenance intervals. One challenge noted on distance between charges involved the length of time idling in traffic as the bus requires a minimum amount of energy to

maintain climate conditions and lighting needs. It should also be noted this study was exclusive to one manufacturer of BEBs.

Federal Transit Administration. *King County Metro Battery Electric Bus Demonstration—Preliminary Project Results*. US DOT, 2017
The National Renewable Energy Laboratory completed a third party evaluation as part of a Federal Transit Administration TIGGER grant in 2010. King County Metro purchased three Proterra 40' Catalyst Battery Electric Buses. Proterra was chosen due to comprehensive test period with a leased bus. King County Metro drove 32,000 miles over 106 days and operated 24 hours a day, covering 325 miles, across an 18.6 mile route. The test also involved rapid charging infrastructure at a Park and Ride, where the bus has a layover.

The analysis compared battery electric buses with diesel and diesel hybrid buses, as well as an electric trolley. FTA uses Miles Between Road Calls (MBRC) as a measure of reliability. With a target of 4,000 MBRC, the battery electric buses at King County Metro had 2,433 MBRC, which is both below the target, and significantly below the hybrid and diesel MBRC, of 10,009 and 14,699, respectively. In terms of energy use, the study converted electricity to miles per diesel gallon equivalent (mpdge). The BEB averaged 16.7 mpdge, compared to 6.4 and 5.4 mpdg for the hybrid and diesel buses respectively. Though the electric buses have better fuel economy, fuel prices were twice as high on a per mile basis due to electricity time of use and demand charges. Maintenance costs over the study period were lower for the electric bus ($0.18/mile), though the study noted this was because the vehicles were under warranty and most of the maintenance was covered by the Proterra technician.

Transit Cooperative Research Program. *Battery Electric Buses – State of the Practice*. Transportation Research Board, 2018.
Sponsored by the Federal Transit Administration and the Transit Development Corporation, this synthesis report provides a comprehensive analysis of BEB deployment considerations including planning, procurement, infrastructure, operations, and maintenance. The report included a literature review, a summary of current BEB deployment in the US, a survey of 18 transit agencies operating BEBs, and five case examples.

Results showed that extensive planning and analysis in partnership with stakeholders was critical to successful BEB deployment. Selecting the appropriate battery size, charging infrastructure type and location, and electricity rate structure are dependent on the needs of each transit agency. Survey respondents recommended including maintenance staff, union representatives, utility providers, local government, and community organizations in the planning process to ensure the bus fleet and charging infrastructure will meet the long term goals of the transit agency.

Capital costs for BEBs are higher than for diesel or CNG buses, primarily due to the cost of the traction battery and the charging infrastructure. Most agencies used external funding to purchase their electric buses. Depending on local utility rate structures, energy costs were also higher for BEBs than for diesel buses for several agencies. However, the study noted that electricity rates are generally more stable than diesel costs which can be useful for budget forecasting. Fuel economy for BEBs is significantly higher than diesel or CNG buses, though driver training is important for achieving consistent fuel economy and ensuring sufficient operating time between charges. Maintenance costs have reportedly been similar to or cheaper than for diesel buses, though lead time for parts is longer. It should also be noted that the relatively young age of BEBs in operation means none of the buses have needed a mid-life overhaul (i.e. a battery replacement), so the

associated costs are yet unknown. The availability and reliability of BEBs is approaching that of conventional buses and the reliability of charging infrastructure has been excellent.

Overall, 12 of 13 agencies were satisfied with their BEB deployment, with 8 agencies stating they felt very positive. 86% of the agencies plan to purchase more BEBs in the future.

Levy, Alon. "The Verdict's Still Out on Battery-Electric Buses." CityLab. https://www.citylab.com/transportation/2019/01/electric-bus-battery-recharge-new-flyer-byd-proterra-beb/577954/ (accessed January 18, 2019).
This article describes the variety of challenges that North American transit agencies have experienced while testing BEBs in their transit fleet. The most common complaints included poor performance when the buses ran on hilly routes, in cold or hot weather, or got stuck in traffic. Most agencies found the battery range did not meet manufacturers' claims. Additionally, charging time posed challenges for route design, and often required the agency to use more buses to provide the same level of service as their diesel fleet. Overall, the agencies interviewed for the article think BEB technology is not ready to meet the demands of providing full day transit service. The article states this is why most European transit agencies have been hesitant to convert their own fleets.

It should be noted that the agencies included in the article have a service area much larger than that of CTS, and many experience weather conditions more extreme than Corvallis' relatively moderate climate. While the caution expressed by these agencies should not be overlooked, it conflicts with the findings from the 2018 Transit Cooperative Research Program report which described overall positive transit agency experience with BEBs. Experiences from Oregon transit providers that have tested BEBs are likely to more accurately predict BEB performance in Corvallis due to similarities in climate, terrain, and service area size.

Interviews

Staff interviewed transit providers across Oregon that are implementing, or planning to implement battery electric buses. This includes Tri-Met, South Metro Area Regional Transit (SMART), Lane Transit District (LTD), and Josephine County Transit (JCT). Summaries of the interviews are below, and full transcripts are available upon request.

The following findings are summarized from the interviews:

- **Investing in Electric Buses is Different for Small Versus Large Transit Agencies.** Larger agencies have more substantial concerns to address when it comes to electrifying their entire fleet. They require buses than can travel longer distances, over longer periods of time, and in turn, more charging infrastructure. In this sense both large agencies are spending more time on "proof of concept" as they think about rolling out electric buses for their entire fleet. On the other hand, the smaller agencies see battery electric buses as a way to save money and reduce maintenance over the long term while diversifying their fleet and preparing for future technology.
- **Good Project Management of the Process is Vital.** If electric buses are to be implemented, one of the biggest recommendations is to insure there is an appropriate amount of staff time, or even an entire staff person, to dedicate towards figuring out all of the moving pieces, and insure the bus manufacturer is meeting approved standards during construction

of the bus. Some agencies outsourced this to a consultant, which was included in their grant application

- **Charging Infrastructure is a Challenge in and of itself.** Determining which routes to run, the type of manufacturer to use, the impacts on maintenance costs and staff are all important considerations for implementing electric buses. However, charging infrastructure adds an additional level of complexity. Some manufacturers have proprietary chargers, there is slow vs. fast charging infrastructure, and significant impacts on electric costs, as well as considerations for how "green" the electricity is. Additionally, no one in the country has had to replace a battery in a bus yet.
- **Battery Electric Buses are New Infrastructure, and Many Unknowns Remain**. Diesel buses have been around for decades, and their technology is both well known, and refined over the years. Compressed Natural Gas technology, while newer than diesel, has also existed for more than a decade. In this sense, buses have gone through a complete life expectancy using either diesel or CNG. However with electric buses and electric bus infrastructure, no public agency has owned or operated one for the entire life expectancy of a bus. Batteries have not been replaced and the longest any agency has been running electric buses is seven years.

Lane Transit District (LTD)
Lane Transit District invested in electric buses for two major reasons: 1) they serve a community where people care about greenhouse gas emissions and want to see investments in cleaner technology, and 2) they have an aging fleet and are looking to replace buses, especially those with a lower maintenance cost. They are experiencing a number of challenges including manufacturer reliability, locating and installing charging infrastructure, and determining route effectiveness.

LTD is currently piloting a 40' electric bus from BYD, with 4 more on order once the first is accepted. Their current fleet consists of 82 vehicles at peak pull out, including multiple engine types and bus lengths. Mainly 40' buses, LTD also runs 60' articulated buses. All of their para transit vehicles are gasoline. LTD has had multiple issues with the quality of the buses they received from the manufacturer. Initially ordered in 2015, it took two years to receive three buses, all of which had quality control issues. Those were sent back and the issues were fixed on the pilot bus they're currently testing.

Josephine County Transit (JCT)
Josephine County Transit decided to invest in electric buses to diversify their fleet and save money on both maintenance and fuel. The original motivation came from a private citizen who arranged for Proterra (a BEB manufacturer) to stop by and give a tour of their buses. This inspired their Transit Program Supervisor to examine the issue in more detail and when presented to the county commissioners, the proposal received broad based support due to the cost savings as well as environmental benefits.

JCT has 14 buses at peak pull out, of which 4 are standard 40' and the remainder are Class C cutaways (short bus). Part of JCT's transition to electric buses is they were in need of new buses and additional capacity. They are purchasing 2 vehicles from Complete Coach Works, which are remanufactured Gillig or New Flyer buses converted to electric. Complete Coach Works was chosen due to an existing state contract in Washington, which allows Oregon municipalities to purchase through their approved vendors. Furthermore, JCT chose Complete Coach Works because they use Gillig or New Flyer buses, which are buses first, and electric vehicles second, as opposed to some of

the new manufacturers that are strictly electric vehicle manufacturers. This was the quickest way to get a new bus.

South Metro Area Regional Transit (Wilsonville)
South Metro Area Regional Transit (SMART) is the provider for the City of Wilsonville, but connects with the larger Portland Metropolitan system, and as such receives some funding from Tri Met. Interest in electric buses has been ongoing over the last couple years, as the city applied for FTA grants twice before receiving it on third try, in 2017. The new transit program manager sees electric buses as the natural progression of compressed natural gas (CNG), of which Wilsonville has been involved with for 10 years. He also is looking to diversify at the start however, and not going full electric.

They have 32 vehicles at peak pull out, which range from 40' conventional buses to 26' cutaways. Two thirds of their service is free, while routes that leave the city charge a fee. They are purchasing two 35' Proterra buses, along with infrastructure for charging. In addition to the buses and infrastructure, Wilsonville included the cost of a consultant in their application, provided preliminary route analysis, as well as provide quality control/assurance during manufacturing. The buses will likely go into service in May or June of 2019. They're using slow charge infrastructure on their lot, which they are currently working through.

TriMet
TriMet, the regional transit provider for the Portland Metro area, is currently testing an electric bus, with the expectation to receive four more once they have approved the first. After winning a LONO grant in 2016, TriMet received their New Flyer electric bus this year. A number of factors contributed to TriMet's desire to test electric buses, including community interest, pressure from advocacy groups, and the desire to explore new technology. More recently, TriMet's adopted long range plan includes a provision to convert their entire fleet to zero emissions, and use HB 2017 to start the transition. A conversion plan was developed in September 2018 which describes the process of converting to BEBs by 2040 which involves a 5-year "trial phase" ending in 2023.[2] In this sense, they are being very methodical about testing and implementing electric buses.

TriMet has 670 buses at peak pull out, and uses exclusively Gillig and New Flyer buses. Nearly all of their buses are diesel, with 9 diesel hybrids. They decided to use New Flyer primarily because of their relationship and history with the manufacturer. In terms of maintenance, TriMet is less concerned then other agencies due to the fact their technicians also work on light rail vehicles, so they are more comfortable with different vehicles. They have faced challenges with implementation, including delays and quality control issues.

TriMet's conversion plan states that slow charge buses are currently the agency's preferred technology, but a pilot project for Line 62 will test fast charge bus performance. This pilot involves a partnership with PGE, the local utility provider, in which PGE is responsible for the design, implementation, and maintenance of the fast-charge infrastructure. This reduced the infrastructure cost for TriMet and allowed them to purchase an additional bus instead.

Corvallis Needs & Challenges

[2] TriMet. *Non-Diesel Bus Plan*. TriMet, 2018.

Corvallis has 15 buses and one trolley, using 10 vehicles at peak pullout. Buses are 35' Gilligs that operate 30,000 revenue hours and 445,000 miles annually.

Several CTS buses are in need of replacement in the near future. This creates an opportunity to begin transitioning the fleet to BEBs if Corvallis chooses to move forward. However, the Corvallis Transit Development Plan (2018) calls for increased bus service frequency on all routes which will require an additional bus within 10 years, and 9 additional buses within 20 years. The TDP assumed a diesel bus fleet and calculated costs accordingly. Switching to BEBs with higher capital costs will likely require additional funding or a change in the proposed improvements to service frequency.

Because Corvallis operates a fare-less transit system, annual revenue is not dependent on ridership. Thus, Corvallis does not face some of the challenges peer transit agencies will have to contend with due to the increased popularity of ride hailing and other transportation services that compete with public transit. This allows Corvallis to make investments with the benefit of near term revenue stability.

A key component of the transition to BEBs is the training of maintenance staff, drivers, and first responders. Corvallis directly employs maintenance staff, but drivers are a contracted service. Significant training on BEB operations and technical components will be necessary and new contracts and/or job descriptions may be necessary to accommodate changes to the work flow and responsibilities of both groups. First responders will also require training on how to safely engage with BEBs in an emergency event. Corvallis benefits from the Advanced Transportation Technology Center at Linn-Benton Community College which offers training for first responders and technicians.

Proposed Cost

Utilizing information from the literature search, transit operator interviews and potential vendor contacts, understand the costs of vehicles and any associated infrastructure. This section will also include exploration of grant opportunities that could help offset the cost of vehicles and infrastructure.

Average Capital Costs[3]

- Bus - $887,308
- Slow charge infrastructure – $67,050 (generally serves two buses)
- Fast charge infrastructure - $698,447 (can serve up to six buses per hour)

Electricity Costs

- $0.112/kWh[4]

Maintenance Costs

- Bus maintenance – $22,067/year[5]

[3] Transit Cooperative Research Program. *Battery Electric Buses – State of the Practice*. Transportation Research Board, 2018.
[4] Average 2018 utility cost for City of Corvallis, per Scott Dybvad.
[5] Per Tim Bates, City of Corvallis. Total fleet maintenance costs $331,000 for 15 buses.

- Slow charger maintenance - $200/year[6]
- Fast charger maintenance - $0.026/kWh[7]

Table 1: BEB vs Diesel Bus Cost Comparison

Cost Category	BEB Cost vs Diesel	Notes
Vehicle	Higher	Vehicles at least 40% more expensive, primarily due to battery cost[8]
Fueling Infrastructure	Higher	New infrastructure needed, significant capital and installation costs
Maintenance (Vehicle)	Lower	May initially be higher due to training needs, long term lower due to fewer parts
Maintenance (Fueling Infrastructure)	Equal/Higher	Slow charger maintenance estimated equal to diesel fueling station maintenance. Fast charger maintenance estimated more expensive
Fuel Costs	Varies	Depends on utility rate structure, charging type, and local diesel price
Lifecycle GHG Emissions	Lower	74% lower lifecycle GHG emissions vs diesel[9]
Tailpipe Emissions	Zero	BEBs have zero tailpipe emissions

Social Costs

Electric buses produce no tailpipe emissions and are quieter than conventional diesel buses, and given the high percentage of hydropower in Oregon's electricity mix, lifecycle GHG emissions are reduced through BEB use. These social benefits can't be captured in real dollars by transit providers (unless cap-and-trade policies are adopted at the state or federal level) but they can justify the increased bus and infrastructure costs for transitioning to a zero-emission transit fleet.

Table 2: Vehicle Emission Social Cost per Metric Ton

Emission Type	Cost	Impact Area
CO_2	$45	global
NO_X	$8,335	local
SO_X	$25,794	local
PM2.5	$35,120	local
PM10	$3,307	local

Source: ODOT Alternative Fuel Bus Cost Calculator

With a 74% reduction in GHG emissions and zero tailpipe emissions, BEBs represent an annual savings of over $7,500 per bus in social costs for the Corvallis community.

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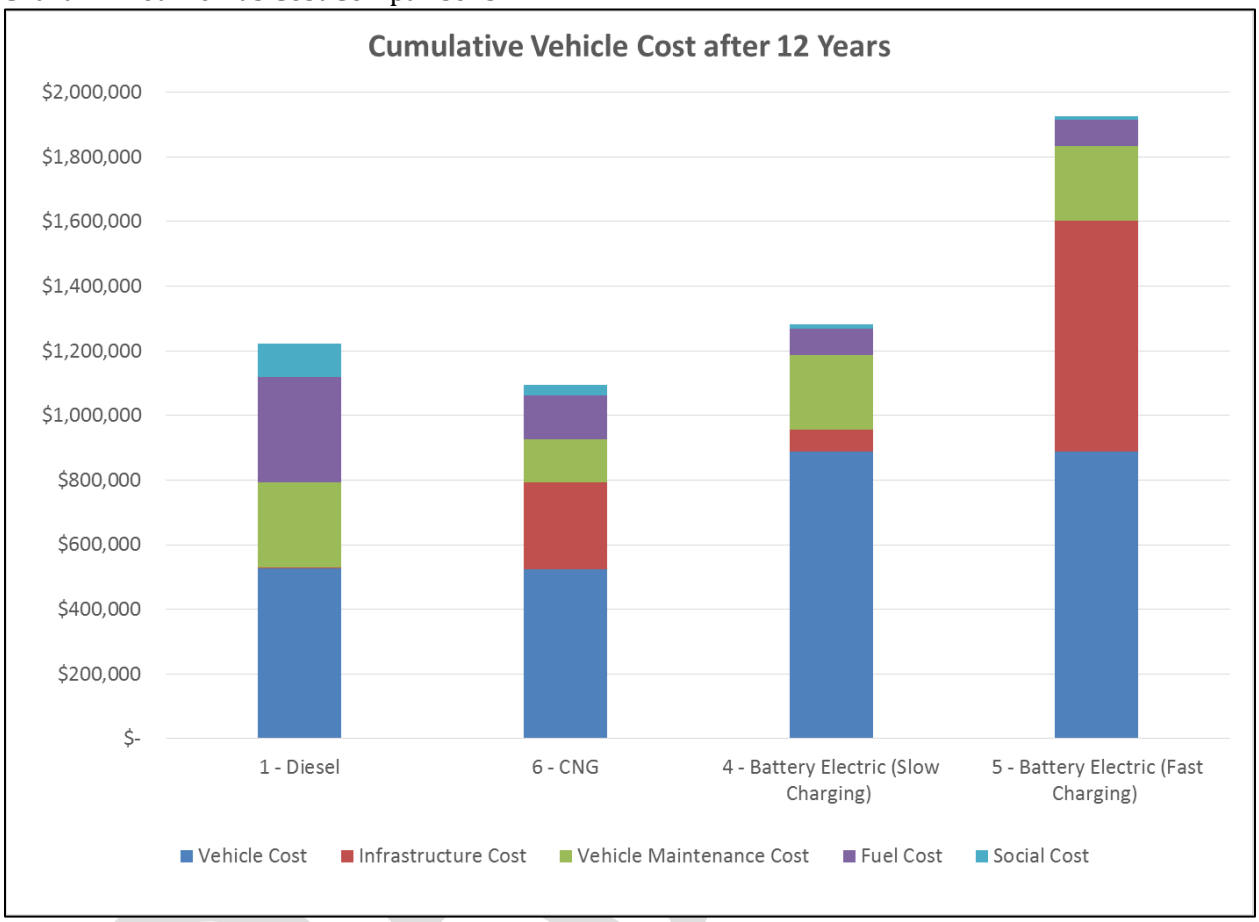
[6] King County Feasibility Study Metro Transit Division. *Feasibility of Achieving a Carbon-Neutral or Zero-Emission Fleet*. King County Metro Department of Transportation, 2017.

[7] California Air Resources Board. *Transit Fleet Cost Model Spreadsheet*. 2018 https://www.arb.ca.gov/regact/2018/ict2018/appk-transitfleetcostmodel.xlsx?_ga=2.117480393.1599391041.1549383500-1021018514.1549383500 (accessed February 5, 2019).

[8] Transit Cooperative Research Program. *Battery Electric Buses – State of the Practice*. Transportation Research Board, 2018.

[9] O'Dea, Jimmy. "Electric vs. Diesel vs. Natural Gas: Which Bus is Best for the Climate?" Union of Concerned Scientists, 2018 https://blog.ucsusa.org/jimmy-odea/electric-vs-diesel-vs-natural-gas-which-bus-is-best-for-the-climate (accessed September 11, 2018).

Chart 1: Lifetime Bus Cost Comparisons



Source: ODOT Alternative Fuel Bus Cost Calculator

Potential Funding Sources

There are a number of federal grant programs Corvallis could apply for the purchase of battery electric buses. These include:

- FTA Lo-No program grants
- FTA TIGGER grants
- FTA Clean fuels grant program

In addition, some opportunities exist at the state level, including:

- HB 2017 STIF funds
- Tax credits
- Clean fuel credits

Feasibility Considerations

Feasibility Determination

Based on the literature review, transit provider interviews, and cost considerations, OCWCOG staff have determined that battery electric buses can feasibly be implemented in Corvallis. Many transit agencies in the US are successfully operating BEBs, and Corvallis does not have any unique challenges that suggest BEBs would not be able to meet the needs of CTS. However, there are many variables determining the cost, efficiency, and long term impacts of BEB operations within the context of the Corvallis Transit System that need to be chosen using a policy and/or economic lens.

Planning and Procurement:

- Who will be responsible for evaluating the necessary battery range and appropriate charging infrastructure?
- Who will assure a quality product is delivered by the manufacturer?
- Oregon transit agencies that were interviewed recommend dedicating a full time staff person or the use of a consultant.
- Agencies surveyed in TCRP study responded that over half relied on staff and almost one third used a consultant. Some agencies also used modeling and simulation techniques, though a key finding from the study was that the availability of useful BEB modeling software is lacking.

Fast vs Slow Charging:

- Slow charging infrastructure is cheaper, only requires new infrastructure in one location (typically the bus depot/maintenance facility), and more closely matches the fueling process of diesel buses.
- Slow charge buses generally have larger batteries and thus have higher capital costs. If the range isn't enough to run all day they can't be quickly refueled and may need to be swapped with a second bus if downtime isn't scheduled into their route.
- Fast charge buses generally have smaller batteries, and thus have a shorter range. However, smaller batteries result in lower bus costs.
- Fast charge infrastructure is more expensive and depending on the route length, multiple chargers may be needed to maintain bus charge.
- Electricity access can be more difficult for fast chargers as they are often dispersed in the community. Corvallis may be able to use the Downtown Transit Center as a fast charge hub for all buses, but additional chargers may be needed on longer routes.
- Fast charge infrastructure is route dependent, moving the chargers due to route changes would be prohibitively costly meaning routes would be less flexible.

Buy vs Lease:

- Rapid technology change makes leasing attractive as agencies could more quickly take advantage of battery and charging improvements while still gaining experience with BEB operations.
- Lease contracts can provide a safety net in case the vehicle or battery lifespan is less than the manufacturer expects. The oldest BEB currently in operation in the US is seven years old, and the full lifespan of BEBs and their batteries is yet unknown.
- Most transit agencies choose to purchase BEBs. This may be due to leasing costs or funding options that prevent leasing.
- Current cost calculations show that BEBs are more expensive than diesel or CNG buses over a 12 year lifespan.
- Buying allows for reuse opportunities of decayed batteries. Batteries are unusable for bus propulsion once they degrade below 70% capacity, but they are still useful for energy storage. Old batteries could be used as emergency backups or for solar power storage. Scott

Chancy at Josephine County Transit mentioned an idea from Antelope Valley in which they are planning to use old batteries to store solar power that will be used to power their transit fleet. When Antelope Valley plans to implement this idea is unknown as it is not referenced on their website or in their long range plan.

Conclusion & Next Steps

The Corvallis Area MPO recommends a conversation with city staff on the policy considerations outlined above. This information can then be brought forward to City Council and the general public for discussion.

In our interviews with providers around the state, agencies moved forward with electric buses for one of three reasons:

1) The environmental benefits, supported and advocated for by the community at large (Policy Decision)
2) The reduced fuel and maintenance costs seen internally (Financial Decision)
3) Both environmental and cost benefits