



NFI Virtual Investor Day 2021

Panel Recording with Public Transit Mobility Experts & Customers: Full Transcript

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Moderator: Jennifer McNeill, Vice President, Sales & Marketing, New Flyer & MCI

Good morning. My name is Jennifer McNeill. I'm the Vice President of Sales and Marketing for New Flyer and MCI's public sector markets. Today, it is my privilege to welcome our panel of industry leaders and innovators who have graciously offered to share their perspectives on the public transit industry in NFI's main markets: the United States, Canada, and the United Kingdom. I'm honored to be joined by **Mr. Paul Skoutelas, the President and CEO of the American Public Transportation Association (APTA); Dr. Josipa Petronic, the President and CEO of the Canadian Urban Transit Research and Innovation Consortium (CUTRIC); Mr. David Brown, Group Chief Executive of the Go Ahead Group plc**, joining us from the UK, and **Mr. Danny Ilioiu, Zero Emissions Fleet Strategic Planning Manager for King County Metro and Seattle**, North America's 4th largest transit system. Welcome panelists, and thank you so much for joining us today.

First of all, let me wish you all happy new year. I have to say, 2020 was quite a year, especially for those of us whose purpose in life it is to move people. When COVID hit and cities locked down, inter-city travel and tourism came to a halt. But, as an essential service, public transit has endured, providing transportation to essential workers, health care professionals, and citizens who need it most. And, at the same time, the industry was navigating the early days of planning and deploying zero-emission technologies into their bus and coach fleets.

To kick off our discussion today, I'd like to turn to my first panelist, Danny Ilioiu, to share with us the impact that COVID has had on King County Metro's planning and outlook. Danny is a transportation industry veteran, having held numerous leadership roles managing the testing, deployment, and operation of hybrid and zero-emission vehicles. At King County Metro, Danny is working tirelessly to advance the transition to zero-emissions with elected officials, utilities, industry organizations, and research laboratories. Danny, prior to the pandemic, Seattle reported gains in ridership, had zero-emission transition plans developed, and were making investments and expanding service. And then COVID came along. Can you tell us a little bit about the ridership outlook in your city and how your plans have adjusted?



Danny Ilioiu: Sure. Hi Jennifer, thank you very much for inviting me here. Before I answer the question, I want to take this opportunity to thank Paul and his staff at APTA; they've worked tirelessly for the last 10 or 11 months, and were instrumental in getting us funding. As we started going through our COVID-19 response, and as we started cutting back on service and seeing diminishing ridership and diminishing revenue, APTA's help at the federal level has been instrumental to help us go through a fairly smooth transition to today's mode of operation. We have reduced our schedules and on some routes; we've reduced the number of buses that we're putting out there; we've deployed certain measures to help our drivers and our passengers be safe, such as barriers, shields and some social distancing measures. However, even though 2020 has impacted us quite significantly, we expect that, in 2021 and 2022, we're going to restore a large portion of the service that we've had to suspend. We think that the majority of the service is going to be returned by the end of 2021, or possibly in 2022. We expect our customers' travel patterns to keep changing and evolving. We're in a largely packed area; a lot of people are working remotely, and they have options available. But we're also very aware that a lot of our customers, whether they work in the local hospital, or 7/11, or a dentist's office, will continue to need our service. We're going to respond to their needs, and we're going to adjust. We do expect to restore our service, and then we're going to reposition from there.

Moderator Jennifer McNeill: Thank you, Danny.

Danny Ilioiu: Thank you, Jennifer.

Moderator Jennifer McNeill: I do know that the combination of reduced ridership and farebox revenue over the last year has caused tremendous financial and operational strain on all agencies across North America. I'd like to now turn to Paul Skoutelas to talk a little bit about the broader outlook in the U.S. In addition to his role as President and CEO of APTA, Paul brings a wealth of transportation experience, having led transit agencies in Pittsburgh and Orlando, as well as an executive role at WSP, one of the world's largest architectural and engineering firms. First, Paul, let me say thank you, as well. In 2020, APTA has been instrumental in bringing the industry together to facilitate transit recovery, both by creating task forces to ensure the safety of drivers and riders, and by advocating for relief funding with the U.S. federal government. Can you share with us APTA's outlook for ridership recovery in 2021 and beyond?

Paul Skoutelas: Well, thank you, Jennifer. Great to be with you and our panelists, as well, to share some ideas and thoughts. Certainly, I think everyone would agree with this statement: that it's been an incredibly devastating blow in many respects to public transport. And not only public transport, but many other industry sectors. We saw ridership in the early months of this pandemic, when it struck last March [2020], with ridership on rail systems declining as much as 90%. On the bus systems, a little bit better, maybe around 70%, and that's average across the U.S. And now, in the last month or so, we saw an inching back, perhaps, with some of that ridership, but, at the same time, we've also seen a spike now in the surge of the virus, so that has had a dampening effect. I think it's safe to say that we're experiencing, and have experienced, an impact. It's been unprecedented. I know that word is often [over]used, but it does fit the description of what we've all seen. It's our view, given the great work that's being done in the industry—and I have to also congratulate Danny and Seattle King County Metro, Jennifer, New Flyer and the rest; as you know, we represent both the agencies, as well as the supply side of the industry—the



response has been nothing short of heroic. We have seen the agencies continue to operate services with all of the threats that our frontline workers have been experiencing since day one; the supply side matching them in terms of making sure that capital improvements are moving forward, bus replacements and the like continues. It has been a moment in time where I think we share a great deal of pride on behalf of the industry for how it's responded. As you rightly said, supporting and getting those essential workers to their job sites, which, quite frankly, for those of us who can work from remote locations as we have been, they've made our life tolerable. Our hats go off to them in terms of the great job that they've done. I think the reality, though, of where we sit is that it's going to take minimally at least a couple of years, if not more, before we really get back to the robust levels of ridership that we were experiencing prior to the pandemic. In fact, in the U.S., although we had come off several years of modest ridership declines, what we did see in the last half of calendar 2019 was consecutive quarters of ridership growth. And, of course, in Seattle, they really bucked the trend and saw ridership growth. They were doing some good things there in terms of making sure their services were tailored to the needs of their community. I see minimally, while we don't have a crystal ball, at least a couple of years or more before we really get back to those robust levels. Our efforts at APTA to support the industry have been focused on two areas. One, to immediately establish what we've done over the past six months, which has been a task force, looking at recovery and restoration of service. That has gone very well, with agencies adopting what we refer to as our health and safety commitments program, which is demonstrating to the public all of what's being done at the agency level, the operator level, to make sure that the services that are provided are done in the most efficient and cleanest way (disinfecting stations, rolling stock, anything that comes in contact with the rider), to give that rider and the public an assurance that, again, the agencies are doing everything possible to make sure that that service is as safe as possible to them from a health standpoint. Secondly, as you have alluded to, we've worked very hard in Washington on the Hill legislatively, both with a \$25 billion funding for the industry under The CARES Act, and then, here most recently just after Christmas, another \$14 billion, that will be coming very shortly to the agencies. This is not going to solve their problems, but it does give some time to stabilize their operations, to begin to continue to provide those services, tailor them again to what their demand levels may be, and build this bridge that we're trying to build between the pandemic and when we come out of the other side, so that we can come back in a very healthful and a robust fashion for the cities and communities that we serve.

Moderator Jennifer McNeill: Thank you, Paul. We all look forward to that day. And I agree with you: it's been an unbelievable collaboration across the industry in terms of both the health and safety measures and the advocacy efforts. Moving over to the UK, I'd like to direct our next question to David Brown, Group Chief Executive of the Go Ahead group, one of the UK's leading public transport providers. The Group employs over 30,000 people and connects communities each day, on its trains and buses, with services that run from Plymouth to Newcastle, as well as operating a quarter of all London's buses. David was previously Chief Executive of Go Ahead's London bus division, and Managing Director for Surface Transport at Transport for London. Welcome, David.

David Brown: Thank you very much. Thanks for the invite, and for letting me join the other panelists.



Moderator: David, the UK public transit model is a very different model than North America, with private companies operating public routes, and a more focused reliance on the fare box. Can you share with us your experience over the past year and your view on ridership recovery in 2021 and beyond?

David Brown: It's a very similar picture. To be clear, we run in the UK a combination of regulated and deregulated services, so, in London, they are regulated by Transport for London (I used to run all the buses in London, for instance), and, outside of London, they're deregulated, so you set up a bus route and you take the risk in terms of the fare box, basically. But, in the end, it doesn't really matter; whether you're public sector or private sector, you have to have customers, and you need that customer income in order to survive, whether you're trying to run buses publicly in Transport for London, or myself commercially outside of London at this moment in time. So, we're all dependent on customers. What we've seen in the UK: we're now in a third lockdown, and the fluctuating numbers of passengers reflect what's been going on in terms of government messaging, what's happening on lockdowns, what's happened about the local environment, and we've also had regional variations depending upon how strong the virus has been in those different areas. So, we went down in March [2020] to about 25%, this is on buses, and, as Paul said, we had a similar experience on trains, except it went down 90% on the trains. And then, it's fluctuated as the lockdowns have changed, and government messages have changed. So, we did get up to, in early autumn, 60% to 70%, and we started to feel more confident at that point. There is a relationship with the amount of service provision we're putting out. The service provision we're putting out is enough to take all the key workers, so we're key workers taking key workers, and enough to do social distancing because we wanted people to feel comfortable and confident that traveling by buses. We've been reliant upon government funding; in the end, the government has stepped up and actually contributed to both public sector and private sector in providing key services. We're really pleased that we've been seen to be a key service. Everybody's stepped up, whether it's been the trade unions, whether it's been our drivers, whether it's been the local authority people, whether it's been people providing money—people really have stepped up and played a brilliant role in making transport work. So, the question is, you know, what happens next; how quickly and how many are going to get back traveling on buses. Now, I think there's there is going to be a difference between buses and trains. On the bus side, people are dependent upon buses, key workers are dependent, but demographics are different. And so, I'm confident that we will get that ridership back; it won't be 100% during 2021, but we will get that ridership back. But it is so dependent upon government messaging. If we can't get government messaging right, to tell people it is safe now to travel by public transport, then it's a much harder uphill battle. So, we need this combination of more service provision, plus government messaging, and we will do the rest, is my sort of view at the moment. The positive side of all of this is that, you know, car traffic has gone back to its previous level, if not worse, and the messaging we're trying to say is that you cannot have a car-based recovery. Car-based recovery will just bring all the problems that we've had before. And what we're hoping is the government will stick to its promises of saying we want to invest in buses, we want to address air quality issues, and we recognize the benefits that public transport brings for air quality and for health and well-being, because people get exercise by traveling by public transport. We're hoping that the wider government messaging will come back, plus government messaging about being safe to travel, and we're ready and waiting to take people and get that ridership back.



Moderator Jennifer McNeill: Thank you, David. We agree the government plays a key role in the recovery and re-mobilizing cities through transit and through transportation. Looking forward, I think it's safe to say that future policy decisions, and mobility investments, also need to have this longer view to help the communities navigate through not just public health, but also social, environmental and financial shocks. I'd like to turn my next question over to Dr. Josipa Petronic, President and CEO of CUTRIC. Josipa is leading the formulation of several national transportation technology trials, including the Pan-Canadian Electric Bus Demonstration & Integration Trial, the Pan-Canadian Hydrogen Fuel Cell Demonstration & Integration Trial, and the National Smart Vehicle Demonstration Project, all of which, and, this is a shameless plug, I'm proud to say NFI is a part of. Dr. Petronic has built up CUTRIC's consortium to include more than 100 private and public sector organizations across Canada. Welcome Josipa. The Trudeau administration recently announced the plan, "A Healthy Environment and A Healthy Economy," which includes additional investment in zero-emission public transit. Can you share your perspective on how this plan aligns with CUTRIC's 5-point plan to build back better public transit, and what additional actions are needed to accelerate zero-emission bus adoption across Canada?

Dr. Josipa Petronic: Yes, absolutely. That's a loaded question, but there's a lot of answers there, and I'm sure that David, Paul and Danny have a lot to add to that query, as well. In general, the federal government in Canada has most certainly given the right signals to transit agencies in the last 12 months during the pandemic, handing over a lot of money to municipalities so transit agencies could continue thinking about zero emissions, transit, new technologies like automated and smart vehicles, without having to worry about how they're going to pay for their systems and their regular operations. That's not to say there's not a concern, but there has been a lot of money and a lot of signaling from the Canadian federal government that general operations will stay stable. And so that's allowed agencies to really think about zero-emission buses and fuel cell buses and the new zero-emissions technology of the future. The federal government also released, at the end of last year, an environmental plan of action that identified public transit is critical in core to greenhouse gas emissions reduction, but, even more importantly, for the first time ever, it identified transit as a place where there could be a hotbed of technology innovation. So, it was a place where jobs could be created in Canada in greenhouse gas emissions reduction technologies, and transit could be at the forefront of that. Those are all the right signals. Now, having said that, government plans really have no meaning or weight unless there's cash behind it. And, heading into the next few months, as we head into what is Canada's budget cycle, we're going to find out how many billions of dollars are going to be pumped into this sector. And, certainly, we've been advocating for several billions of dollars towards zero-emissions transit electrification. Thinking about that, we have a 5-point plan out there, and we've said to the federal government, look, it's pretty basic, after these years of experimentation, we know that you have to pump some money into very specific areas. One is feasibility planning: you could put all the cash on the table that you want, and lots of transit agencies don't know what to buy, because it's not a one to one bus replacement. It's a systems engineering issue. It's an energy overhaul. It's a deep technology transformation. So, put billions of dollars out there, and most of our transit agencies actually don't know what systems to buy (battery electric chargers, fuel cell systems, demand management systems; it's a lot of technology). So, that was point number one: fund the feasibility stuff, because that's the cheap stuff to get to the more expensive stuff, and that's going to save us all a lot of headache down the road. And then the next point that we raised with the federal government was, basically, you have to set some targets. It's not enough to say let's all go green and hope that we're green



by 2025. You have to say, here's a bunch of money, and here's a target, and you have to show us a plan of how you're going to achieve this target, and then we'll hand over the money. You have to associate the money with the targets, and, if there's no money, and there's no target, there's no action, and there's just failure on day one. So, we believe it can be successful, but there has to be the targets, and that's feasible these days. The last items that we raised with the federal government was that you also have to recognize that all these innovation funding programs we have out there have historically been tied to automotive and aerospace, not transit. So, open up your R&D funding programs and allow transit as a technology hotbed (the manufacturers, the integrators, the transit agencies) to apply to all this R&D funding, this research and development funding, meant to build out intellectual property; allow us to go in and apply for that stuff, as though public transit is any other industry player. That will allow us to meet those targets using Canadian technology, achieving GHG plans using the money that you're going to put, hopefully, on the table most effectively, and, within that, you're going to get a whole bunch of zero-emissions technology. So, that's essentially the 5-point plan that we put out there, and all of the strategies that the federal government has released in the last 6 months, 8 months during COVID, has indicated that they're walking along the pathway that we have tried to clear for them. So, those are all good signals, but time will tell in the next few months. Now, having said that, to the second point of your question, Jennifer, about what is needed to go to zero-emissions buses. There was a time back in March last year [2020], when there was a little bit of talk in the transit world of a return to diesel. Everybody was worried about the loss of revenue and fare and ridership, and should we go back to cheap diesel? And, you know, how are we going to get to all this expensive zero-emissions technology? I am happy to say that that has disappeared; it was like a momentary, brief, existential crisis that has disappeared. I don't see any city in Canada or the United States that has a Climate Action Plan reversing course; if anything, there's mostly cities and mayors and councilors and transit agencies saying, okay, maybe we modify the timeline, but nobody's going backward and saying no to transit electrification. But, having said that, they are facing the ongoing issues. The ongoing issues are systems overhaul, the systems engineering issue, the fact that you can't get away with a one-to-one bus replacement; very few communities will. That systems overhaul is a big problem. You need to hire some new people, need to do a lot of feasibility planning; it's a lot more complicated than everybody had hoped for. And then the last thing that everybody's facing is now we have the standards for high power charging and low power charging, but standards on a piece of paper are very different from interoperability in real life. And now we have the demonstrations showing us that we've got the standard, we have the SAE standard, but even if we follow it to a tee, getting these buses and chargers and fueling systems out on the road functioning is going to take a couple more years of hard work, lessons learned, loss leadership, and all of the headache that comes with adopting new technology that hopefully, and we all know, will one day save our lives. So that's essentially where we are. Good news from the federal government, good indications from the cities, good signals from our public policy leaders, but now the technology hard work is ahead of us.

Moderator Jennifer McNeill: I totally agree. It's very encouraging to see that the messaging is pretty well aligned at all levels of government, but there is quite a bit of work ahead of us to actually get there. So, David, the UK Government has also recently announced significant short-term support for private operators to adopt zero-emission buses. How effective do you feel Prime Minister Johnson's green funding scheme will be, and what's your view on zero-emission bus adoption rates across the UK?



David Brown: There's a lot in that question, as well, and a lot of the proposals were this time last year which seems an awful long time ago now that I put some bids in for zero-emission buses. I completely agree with Josipa that, yes, people aren't going to go back that way. There's only one way, and it's going to be ZEBs into the future. It's not going backwards towards diesel; that's just not on the agenda. We are confident that the money that was being allocated this time last year is still going to be there. That was £5 billion for our bus strategies, £120 million for ZEBs, and then electric city. Literally yesterday, we had the announcement of electric city funding of which is one of the cities I operate in, Oxford. And then another one is Coventry, which we have to bid for. And this is now where it becomes the crunch time because the rules of the game that were there last year can't apply anymore. I've been saying this for the government: I was up for it last year, but there are different circumstances, and you need to tell me how this funding is going to work. So, where I am, in my mind is splitting between the capex costs and the OPEX costs. No government likes to provide operational cost, but they're really happy to provide capex cost. So, I'm trying to get into a position where it is the capex cost that the government funds, and there are means and mechanisms which we're trying to encourage them to think about doing this. It can be done on a leasing basis, you could get other operators in the market that currently do rolling stock on trains to do something on buses, you can change the business model that exists if you want. But you've got to fund that capex because the jump from Euro 6 to electric is double the price for anyone, it's 200 to 400 roughly. There's no way you can pay for that in the current climate. And then we will look after the operational cost, and we need to work through understanding those operational costs of ZEBs going forward. I think part of the question was, you know, is it going to happen? I used to work for Boris Johnson when I was working with Transport for London. I actually introduced his Routemaster buses for him. I saw him recently, and one of the second things he said to me was, "4,000 buses, David, it's still 4,000 buses." So, he's got that in his head. It's going to be 4,000 ZEBs, and my job is to work with government officials to try and find a way of delivering that. And I think that will happen, yes.

Moderator Jennifer McNeill: I think so, too, but I do think that flexibility is going to be key. Now in the United States, the U.S. federal government funds a large percentage of public transit, capital and operating expenses, with each surface transportation bill having nuances that reflect the priorities of the current administration. Paul, the Biden-Harris transition team has a stated goal of providing every American city with 100,000 or more residents with high-quality, zero-emissions public transportation options through flexible federal investments. Can you tell us a little bit about your initial conversations with the transition team, and what we can expect to see over the next year?

Paul Skoutelas: Sure, Jennifer. You know, it's interesting, and I'm afraid we've been in the news much too much here in the last couple of days about what's happening with presidential elections and such in the U.S., but we will have a new president in Joe Biden. He takes office on the 20th of January [2021], but we also have a new Congress, since Congress concluded its last session at the end of December [2020]. So, we have a totally new Congress with many new members. And, given the elections that just occurred in Georgia, we will have two new U.S. senators, both Democrats. It really sets up a very interesting set of dynamics, politically, for us. We are very enthused about the outlook. Joe Biden has often gone by the nickname of "Amtrak Joe," I don't know if that means much to everyone, but, in the States, Amtrak is our inner city rail, and in the States they are the best we can do for high-speed rail at the moment until we get a new line built or two. But he very much has embraced and does embrace



public transport and rail, so we are looking forward to an administration that will have public transport investment as the centerpiece of this infrastructure plan. We have met with the Biden review transition team twice now. In fact, we were the first organization to meet with them. We're greatly encouraged with the dialog that we have. First of all, Phil Washington is chairing that group. Phil is the CEO of LA Metro, and there are a number of participants on that review panel that are active at APTA, so they understand our issues extraordinarily well. We have let them know that our biggest priority here in terms of the dynamics of it all is to come out early with an infrastructure plan. And, because we believe this is a once in a generation opportunity, to make this a very bold set of proposals around public transport. We've gotten very positive signals about that. Specifically, we have shared with them the details of our priority recommendations that as an association we've been working on now for two years. It's a very detailed set of proposals, but they also include very targeted investment in buses, and that's where I think that we're going to get quite a bit of support. We're looking for dramatic increases in bus investment. And, likewise, complimentary, significant increases in low- and no-emission bus fleets. I think electrification is very much on the minds in the States, of our elected officials, our communities, and, certainly, our transit operators, because they want to make sure they're meeting the needs of their communities. It's interesting to note, California is typically the bellwether in the States; they're usually a few years ahead of the rest of the country. They've got a 2040 mandate, of course, to go to fully electric; we'll see if that can be achieved. I think our agencies, by and large, are very much supportive of moving forward. The question always is how rapidly can they do so when they do have to deal with the economics and the realities about what buses cost and the like, but I think the federal investment and the priority that we're looking to see highlighted will go a long way to picking up the pace in the States for that investment. As others have talked about here clearly, it's not just the acquisition cost of the vehicle itself, the rolling stock, which is significant, at least a couple times more, but the infrastructure to support it, the charging. And then from an operational standpoint, the reality that the operators have to face with the range limitations at the moment that exists, how quickly that can be solved and brought about to a more acceptable range. These are all the things that everyone is dealing with. But, I think in the States, it's happening to two levels: there's a technical level, which you have to deal with the reality of getting the service out and trying to do it cost effectively; and there's the second piece of the marketing, nobody wants to be in the corner, not moving forward aggressively in terms of meeting some of the climate issues and the sustainability issues that electrification provides. So, interesting time. I think we will see a pickup in the pace in the States here very shortly.

Moderator Jennifer McNeill: It is absolutely exciting to have this idea of building back better, which I think is resonating all the way through the different levels of government in the United States and around the world. I'd like to turn the discussion over to the transition to zero-emission public transportation and talk a little bit more about some of those very practical operational requirements. Josipa, CUTRIC has played a pivotal role in Canada's first zero-emission bus deployments, both from the route modeling perspective, as well as facilitating some of the very first demonstrations. Can you give us an idea of some of the unexpected complexities faced and the lessons learned by transit agencies during these early deployments?

Josipa Petronic: I'd love to. Now there's a whole book and an exegesis around these issues, but I think if we were to summarize maybe the top three, one of the big things we've learned in deploying electrified



buses is the point that I raised earlier that, on paper the specifications may be there, but the actual deployment is a lot more challenging. The big issue is that systems engineering issue. And, from our large systems to our small systems, there are not a lot of staff on a team that are available to actually deal with all of the complexities of electrification, whether that's battery-electric, or hydrogen fuel cells. The competency and staff capability, just the capacity. And, as an example, you know, our colleagues at TransLink and some of the other agencies said, you know, originally, when we started this electric bus project with these high-powered chargers and multiple bus manufacturers, we assigned maybe two or three people to the electric bus team, and now that team is 30 people. Well, how many transit agencies have 30 people who have extra time on their hands to deal with all the complexities, from garage installation, to on-route installation, to fueling systems, to dealing with the OEMs, to dealing with the integrators? It's really complicated. The big issue right now is that systems engineering complexity that most agencies just didn't see coming, and it's going to take a lot more staff than they had originally planned with different skill sets. The second issue that we've seen crop up is—and I think this is a bit of a hangover from the, “Is it battery electric or hydrogen fuel cell; which one's better?” era of the 2015's when Tesla and Toyota were going at it; and that's really not an engineering issue, that's a PR issue around those automotive manufacturers, that then seeped into the transit world— that we've had a lot of folks in the transit world thinking it's one or the other. We've come out of that, but the second big challenge is not everybody's come out of that. So, a lot of our transit agency partners are still struggling with, “Is it one or the other?” And based on our own modeling, the vast majority of our systems will not be able to get away with battery-electric only at the depot. So, you're looking at, is it on-route charging, or hydrogen, or combination of the two, and that combined systems deployment for the larger and mid-sized systems means the big challenge ahead is the fueling system. Whether you have access to hydrogen, and whether you have access to the real estate in your city for the on-route chargers, and access to real estate, or to hydrogen, is problem number two, because that's not something transit can solve on its own. It needs a lot of partnerships, municipalities, provinces, private sector owners with pieces of real estate, and a hydrogen economy that hasn't been built out yet. So, that's problem number two. Problem number three then is, of course, we can always say it's down to the funding (“where's the money going to come?”); I would say it's not so much that there's not enough money, but that there's not the right kind of money available over the right time periods. And what I mean by that is there was this belief, and for good reason, that transit agencies that went electric would just start saving money tomorrow. And we know that, over the long term, economically and physically, you will save operational costs, but not in the first three to four years. There's going to be a lot of unknown costs, and there's the upfront capital costs that Paul [Skoutelas] pointed out. And so, that kind of funding doesn't exist, where you have funding now for upfront capital costs, and we're going to help you amortize it over 20 years so you can see that payoff. That kind of dynamic financing and funding model, those things don't exist in government right now. So the three problems coexist: 1) that systems engineering staff capacity issue; 2) the getting over the battery electric versus hydrogen fuel cell hump, and trying to understand what partners can get you the fueling you need and what partners get you the real estate you need; and 3) that funding financing set of solutions that actually map on to how electrified transit systems work, not how diesel procurement worked over the last 15 or 20 years. So that's what I would say is what we're seeing right now going forward, but the signals are good that we've got a lot of leaders in the industry willing to roll up their sleeves and kind of take a hit, and a lot of counselors and mayor's willing to swallow the costs and complexities to get us to a zero-emissions future.



Moderator Jennifer McNeill: Thanks Josipa. I would tend to agree I know that, for some of the very early procurements of zero-emission vehicles, the customers actually weren't actually aware of all the right questions to ask, and that's one of the reasons we built out our Vehicle Innovation Center: to educate so that we can have the right conversations through a procurement. But it also meant that these procurements were lasting two or three years before vehicles actually hit the street. So Danny, King County Metro (KCM) has actually been on the forefront of zero-emission public transit, beginning with the deployment of electric trolley buses more than 75 years ago. During the last few years, King County has been testing multiple vendors' battery electric buses. Can you tell us a little bit about how KCM has approached the vehicle assessment and transition, including maybe some of those lessons learned and major areas of concern related to adoption at scale?

Danny Ilioiu: Quite a bit to unpack there, but I'm glad Josipa started a little bit earlier with some of the complexities. We operate battery-electric buses, we operate electric trolley buses, and we operate diesel-electric hybrid buses. Through all the bad things that happened in 2020, one of the good things that happened with us is that we retired our last straight diesel buses, and that was a big moment for us. Unfortunately, we didn't get to celebrate the way we wanted to, so maybe we'll do something in 2021. That being said, in order for us to prepare to evaluate the technology, we tried to look back at our experience with introducing diesel-electric hybrid buses into the fleet. That was a much smaller transition than battery-electric buses, or for the folks that go with hydrogen, will be. But we looked internally, we leveraged our knowledge from our trolley system, which has infinite range (trolley buses can operate 24-7, they never really have to come back to the bases have to get cleaned; kind of a weird model that there's not a lot of experience in the transit world with unless you go to Europe, of course). And then we looked at what do we do with our hybrid buses? What do we want to do with battery-electric buses? Is hydrogen a good fit at this point in time (and the answer was not really, not at this time; it's in our toolbox, something we're going to review periodically to see if it makes sense at some point in time). But, currently, battery-electric buses can meet about 70% of our range requirements with the current technology, and we expect it to get a little bit better. Again, when we found that number, that 70%, that's also tied into a mileage, 140 miles; we also have about 6 hours of service. So, we started putting all these things together, calling them KPIs (key performance indicators). And then, most recently, we did an 18-month lease with New Flyer (one of our major providers; our trolley fleet is with New Flyer trolley buses, and they've been operating very well for the last 5, 6 years since we last refreshed the fleet), and with two other manufacturers. And what we did is, we took these KPIs and we did an 18-month lease. And we wanted to see, can these buses do this 140-mile range, and what can we learn in the process of trying to operate them for this 18-month period. We were pleasantly surprised that most of the equipment out there can get close to or exceed that range requirement in our service profile (service profiles going to change from city to city and from geographic area to geographic area). We also learned the importance of a strong partnership, and New Flyer has been a very good partner to us throughout this lease. It's very important because, what happens after you buy the bus? What happens after you put the infrastructure in place? You need to have a strong partnership with a company that has the resources, the will, and the ability to support the product. Because we all know that every time we deploy new technology, they're going to be seeing some glitches for the first couple of years of fielding these new buses. Based on the outcome of these tests, based on these KPIs that we put together on which products were able to meet



that, we decided that we're going to purchase 40 buses from New Flyer: 20 standard length 40 footers; and 20 articulated, or bendy buses for you David, 60 footers in order to go to the next level of scaling up. We are currently building infrastructure for those 40 buses, but we're also designing infrastructure for layover charging, or undercharging as Josipa called it earlier, because we understand that that's one of the critical components for battery electric buses. It gives you a better flexibility, it eliminates some of the deadheading time, it allows you to keep the buses out on the road. And then, if the base is away from the routes or from the terminals, it allows you to switch routes and switch operators without really having to bring the buses back to the base and recharging them again. So that's where we are right now with our battery electric buses in our program. Jennifer, please thank your staff for supporting us in this testing and for allowing us to get to this next step. And, Paul, again, I'm going to mention back to your staff: we did work with the National Academy of Sciences, Engineering and Medicine on two documents that were published recently, to help our partner agencies. One of them was on the state of the industry, and the other one was sort of a guidebook on the deployment of zero-emission buses. We focused on fuel cell and battery electric buses because, as Josipa mentioned, some of the smaller agencies do not have the resources to understand that technology and the impact of technology is going to have on them, and then how to match that up with the grant money that's available at federal, state, and local levels. Thank you to APTA staff for this, and, Josipa, you know me, we've also worked with Toronto transit, Edmonton, Coast Mountain Bus, a couple of our Canadian colleagues. And, David, I guess it was before past year after your time at TfL, that we're also working with Transport for London, again, to keep in touch with our technical colleagues to see what we learn from each other so we can have this very, very fast and rapid information exchange that's necessary and a key ingredient for successful deployment of this technology. Thanks, Jennifer.

Moderator Jennifer McNeill: Thanks, Danny. We are absolutely thrilled with our partnership with King County Metro, so thank you. We have found that, over these multiple new top technology introductions, it's really important that we as the manufacturer, and service provider, are actually there with you. We found it important to have people on the ground with the vehicles every day, as well as our telematics installed, so that we can monitor and make sure that things are actually operating as planned. So, David, Go Ahead has been one of the early adopters and the leading zero-emission bus operator in London, and the UK for that matter. You currently have 200 zero-emission buses in your fleet, and a further 70 on order. What are the key lessons Go Ahead has learned about range charging strategy, driver performance, and maintenance?

David Brown: I'm going to be saying some similar things, actually, because it all sounds very familiar story. We started in 2016, converting a whole depot at Waterloo into electric buses; we were the first to do it, we were the early adopters, and we took all that heat of trying to work out how you're going to do it. And, I think, some of the lessons we would learn, I can succinctly say them, really, are: one, you take up depot space, and you've got to think laterally about how you're going to put the infrastructure into a depot; and you've got to recognize that, certainly in London, depots are of all different sizes, shapes and everything. And it gets more difficult, and you lose space, and, if you lose space, you lose an income; that's my view as a private operator, that you have to reconcile how you're going to fit all the infrastructure into the depot. The second thing is, actually, in terms of drivers in terms of customers, it's all upside. Drivers love it; it takes very little for them to actually get used to drive in electric buses. I did have one



amusing story that came from Boris Johnson, in very early days. I said something quite almost flippantly, I said, "They're so quiet, we're going to have to put some artificial noise on them," which he thought was absolutely hilarious. I was sort of a little bit embarrassed that he was laughing, but, guess what's happening now? We're putting artificial noises onto electric buses so that people can actually hear them in the street. That's what's started now. I think some of the lessons we learned would be the variability of the National Grid affects the pricing of what you're putting into your infrastructure, and public sector bodies can think differently about how you can equalize that out. But if you're bidding for work, don't bid without knowing how you're going to link up with your substation. That sounds a really simple, basic thing, but it's so true. If your substation is a long way away, you've underbid the price of bidding for electric vehicles. Dealing with drivers and customers is absolutely fine. The next really, really crucial bit is the warranty on the batteries. How long is that warranty is going to be, and what's going to happen when it falls out? Because if we could guarantee that warranty of the batteries for the life of the vehicle, let's say we're talking 12+ years, and at the moment that the warranties are for half of that, that is a big unknown for us. So, though we've been running electric buses since 2016, we still are not 100% sure of the operational costs of running electric buses. We think they're about 20% to 30% cheaper, but the big unknown is what's going to happen with the warranties on the batteries. And that goes back to my earlier comment. What I've tried to do with government and everybody is to separate out the capex cost, which is double and is a different issue and a different way of solving it, from the operational costs, which becomes my problem, and trying to work that one through. That is still an unknown element. But there are upsides. We're also trying to think about ways in which we can allow other users to use our depots to charge up because we've got this massive bit of kit sitting around in depots. We've got a place called Northumberland Park in North London, which will now become the largest depot in the world, I'm told. Don't quote me, but I'm told it will actually feed back power into the National Grid at night from the batteries that have not been used during the course of the day. We're trying to see other ways in which we can use the power. So, we started thinking about the real estate above the depot, so you can actually feed off the power and actually have the whole of the housing and residential housing above. One of the reasons, as I'm sure a lot of you know, it's very difficult for people to get planning permission for depots when they're diesel and you're starting up the diesel engine at three o'clock in the morning. If it's electric, it changes the dynamic. We're thinking laterally about how we make these things work. We're just about to invest massive amount of money in East London and Silvertown to do this very thing. How do we capitalize on what we've now got as an asset for wider things? But one of the things that it always goes back to is about range. And once it's in the depot for us, we get about 150-mile range, we will need about 200; that's sort of where we need to be, 75% of all the routes to be adequately covered by it. Because then you get into the opportunity charging issue and the pantograph issue. And then you get into the visual effect of that, where you can put it, whose land it is, the time it takes, the dealing with the public authorities. When you're in control of your own depot, you can do whatever you like. When you're relying on third parties, it just slows the whole thing down. We are keen for the technology to advance so that we can get better ranges than we are about trying to do opportunity charging along the line of route. In the end, it'll be a combination of all of those things. I think that covers some of the lessons we've learned. We've been on a very steep learning curve, and we took some commercial advantage from doing that. Unfortunately, people have now followed us and understood some of these things. And we have, I think Danny [Illoiu] you said it, we have honestly been very upfront, and I've had more visits to Waterloo Depot



from around the world than the United Nations has got countries. We've had everybody there looking to see how we've done it, and we've shared what we've been doing with anybody that wants to come.

Moderator Jennifer McNeill: Thank you, David. I agree that the utilities have become a very important part of the discussion. And we've experienced the same sort of interesting challenges with our Infrastructure Solutions™ business. Our very first foray into managing the project to install on-route chargers, or opportunity chargers, involved—and Danny is quite familiar with this because he was part of it in another life—involved putting opportunity chargers in Manhattan, as well as getting permits from 13 different agencies, which was a complexity that we were, quite frankly, not prepared for at that moment. We've learned a lot over the last couple of years, but it definitely means that you have to have broader relationships and new people and stakeholders become part of this conversation the whole way through. Switching gears, I'd like to move over to the topic of hydrogen fuel cell. I'll switch gears, and I'll have one more shameless plug. NFI has invested into three types of zero-emission vehicles: battery-electric buses and coaches, trolley electric buses, and hydrogen fuel cell electric buses. Recently, we've been really pleased with the growing interest in hydrogen fuel cell propulsion. We keep a five-year bid universe that looks at all the upcoming procurements over the next five years. We've watched the zero-emission portion of that grow from about 5% in sort of the 2015 timeframe, to 38% this year. You can see that the transition is going to happen. The hydrogen fuel cell portion of it has been growing recently, and it's actually about 10% of the zero-emission, so maybe 3% or 4% of the total bus purchases over the next five years, which is actually a really high number and something that we were surprised and actually pretty pleased about. Josipa, in December [2020], the Trudeau administration also announced the Hydrogen Strategy for Canada. CUTRIC has been involved with operators that are evaluating both battery-electric and hydrogen fuel cell electric buses. Can you share your perspective of pros and cons for each approach?

Dr. Josipa Petrunic: Yes, I first have to say, it's great that a hydrogen strategy finally came out at the federal level because we've been working on this for years. And it goes back to that whole idea that it's one or the other, and, finally, we got to a stage where we're all recognizing that hydrogen is part of the electrification platform of the future. And, you know, in Canada, we have the, I guess, shameful reality right now that we have the world leading technology in hydrogen fuel cell stacks, we have North America's leader in hydrogen fuel cell bus manufacturing, New Flyer, and we have hydrogen supplies that are green hydrogen, and yet we have zero hydrogen fuel cell buses on the road, or even in the process of being procured (outside of a project that we're leading with Mississauga right now with New Flyer support). So, it's that very bizarre scenario, and, what I can say about it is, it has taken the last few years to convince transit agencies to even allow us to model out, physically, the benefits of hydrogen fuel cell in tandem with, and complementarity to, their battery electric buses. This was the culture, deeply opposed to hydrogen, for all sorts of historical reasons that no longer hold. Now, where we are circa 2021, and 2020 certainly, is a number of agencies (over half a dozen) that have now asked us to model out how hydrogen fuel cell buses work in their communities. How far can they go? What's the fueling system? Can we get green, gray, or blue hydrogen? What's the GHG picture look like? So, a definite culture shift for the new decade, and that is a good sign. The next 12 months ahead, though, we'll be really leveraging that federal strategy to get some cash into a demonstration project that gets 10 to 20 fuel cell buses out on the road, likely in the Greater Toronto and Hamilton area, likely in Mississauga, very definitively with New Flyer



buses, as the only provider in Canada of these fuel cell buses, and being able to show them build out a green hydrogen supply chain with one of our partners, Enbridge. That has to happen. And one of the big challenges we had over the last 6 to 8 months was convincing our federal government that the hydrogen strategy has to look at heavy duty power trains, trucks and buses and coaches; that trying to convince tens of thousands of Canadians to buy hydrogen fuel cell cars is not the way of the hydrogen future. Maybe down the line, but you're trying to convince households to make very expensive purchases, versus working with fleets that buy 10, 20, 30, 100 buses all at once, that drive the industry forward in a stepwise function. So, positive indications ahead. Mississauga leading the way. New Flyer leading on the manufacturing. Enbridge leading on the green hydrogen. Finally, circa 2021, Canada's coming back for a hydrogen homecoming, and I expect in the next 24 months we'll have those buses out on the road. It's been a bit of a trek, but now, culturally, the industry has shifted fundamentally. And I would say, you know, Jennifer, to the issue of challenges ahead, people often ask us, well, physically speaking, where should hydrogen buses go and where should battery electric buses go? Well, physically speaking, from an engineering perspective, as everybody knows on this panel, the hydrogen fuel cell buses in Canada are battery electric buses with range extenders. They're not fuel cell stock heavy; they're battery heavy. So, they perform as well and as beneficially in the same places that battery electric buses perform, which is: stop-start heavy, dense downtown traffic. Put them out on a highway, and they're going to perform less efficiently in terms of the comparison to how a diesel engine is designed. We see three areas where hydrogen fuel cell buses are really going to have a strong performance. That is one in the areas where the blocks are very long, lots of interlining, lots of blocks, lots of trips along kilometers, with no downtime, because, if you have on-route charging, you have infinite range. It doesn't matter how big your battery pack is. So, if you don't have access to on-route charging, you don't have a charging solution, or you have very low downtime, then hydrogen is probably going to be your solution. The second area where we're seeing it really take off is on those high-speed routes. Not because it's more efficient to apply a fuel cell bus to high-speed routes from the laws of physics perspective, but it's because of the low downtime and high-speed burn-through-your-battery situation. And, so, we're seeing the high-speed routes, the highway routes, plus those long blocks where you don't have downtime, you can't structure it into the schedule—that's really where hydrogen is the low hanging fruit for deployment. Thereafter, it's going to be exactly as you say David: after some years of experience, where are the pennies being saved of capex versus operational costs. But, right now, those are some of the early deployments that are necessary must. The last area where we're seeing deployments are, like in Mississauga, where it's a real estate issue. It's not an energy systems issue; it's a real estate issue. Their facility does not have the space for chargers in depot or the property rights on-route. So, you're looking there at hydrogen on day one because of a real estate issue, and none other than that.

Moderator Jennifer McNeill: The fueling process for hydrogen fuel cells is very similar to CNG (compressed natural gas), and so, I think, agencies who have a lot of experience with CNG will find it attractive just from the deployment and the ease of integrating it into their fleet if they can solve the infrastructure challenge of hydrogen fueling. So, David, the Go Ahead Group has stated that, by 2035, you plan to have your entire bus fleet zero-emission. What are the key features of a bus or provider that you look to meet these needs, and has Go Ahead also assessed fuel cell electric versus battery-electric?



David Brown: I'll answer the second part first: we're in the early days of trying to work through about hydrogen fuel cells. It's all the same stuff again. We've got the largest scheme being put together at the moment using European funding for about 54 hydrogen fuel cell buses in Surrey and Sussex. We're trying to get that across the line, and there is millions and millions put together from about four different sources trying to get across the line in order to make this work. We're nearly there, but not quite there. So that's one of the things we're planning on. It goes back to what I said before: if someone else is putting the capex up, I will get everybody together, and I'm just worried about the OPEX cost. This is getting into the granularity of UK operation, but there's something called a fuel duty discount that you can get on buses, and it was there for diesel, and I'm trying to say they should turn it into a green fund. That would help in the operational costs going forward. Those are the sorts of things you need to play with government to say, "You can't eliminate this money; now it's an electric bus, so you've actually got to think in the same way that you've always done and turn it into a green funded bus for operational." So, that's something particular to the UK. It's not one or the other; it's about the circumstances that are best. And one of the things that I'm guided by at the moment is thinking... So, I run operations in Plymouth, and there's a naval dockyard that is thinking about investing in hydrogen and a hydrogen plant. You know, hey ho, this doesn't sound like a bad idea; I've got a massive depot in Plymouth, I think I can actually tag onto the back of this, you've got an easy supply of hydrogen. I'll convert my vehicle to hydrogen; it seems like a no brainer. In other places, I'm not going to do that. And I was interested to see what Josipa was going to say there, whether it was the sources of supply that drive it rather than the type of routes you're operating that drive it. And, at that moment, in my mind, it's the sources of the supplier rather than the type of routes that is going to drive it. I often give people the example of when I was at Transport for London, and we did a hydrogen fuel cell operation in a depot. The gas was developed and liquefied in Rotterdam, put on a boat that was belching out sulfuric fuel because there were no controls over it; it got to the Tilbury docks, and went to a diesel vehicle, and the diesel vehicle took it to the bus, and we put it into the bus and we went, "Fantastic; it's zero emission!" But, no, not really. I mean, I think we need to start looking at the whole cycle, the whole environmental and sustainable cycle of that process. That's one of the reasons why, if we've got a hydrogen plant on our doorstep, that's why we should be looking at that, in my view. I think there's a danger we kid ourselves if we're not thinking about where it's sourced from in the first place. And then the second part of the question is about the... and, I think, it's really interesting, again, that Josipa said...because I've often thought it's all about the electric because it's electric car technology; you've got technology transfers between all the research, it's going into cars. I was quite interested in what Josipa said, because actually, you know, there's a scale here that you should think about with fleets and with trucks and other things away from cars, and then you can get that lift off from that in itself, because that's a massive volume. I think I need to start thinking about how we do that in the UK, as well. In terms of how to get to 2035, this pandemic has thrown us, there's no question. Because if you're not making money, you can't invest. I need profits to invest into my vehicle fleet, it's as simple as that. So, we are literally at this moment, trying to do a top down and bottom up, looking to see at what point can we actually get to completely zero-emission vehicles. And we're looking at 2035 as a backstop, but we need to be thinking about doing it much quicker than that. And what we're trying to say is, what is the cost of doing it over that time? What is the replacement vehicle cost? What's the cascading cost of that? How do we do that through leasing? What's the residual value of these vehicles? Who's going to pick up the residual value? Is the government prepared to put in a leasing cost, which is a differential between a Euro 6, and a hydrogen fuel cell or electric bus? We are literally going



through that process at the moment, trying to work out so that we're not just having a nice sort of aspirational target over there, which everyone feels good about, we're actually saying, "These are the stepping stones that will get us there." And, no great surprise, we're going to need some help. We're going to need some help to get there along the way. You'll be pleased to know, Jennifer, that part of my story is that it's also about the manufacturers. I find that constantly, as I talk to politicians, if I talk about the manufacturing industry as being part of this, and how it preserves jobs in Scotland and Northern Ireland and Northeast, I get politicians to wake up a little bit more. I'm very much battling on behalf of the manufacturers of all of this as much as anything and talk to Paul [Davies] in ADL to get this happening. Because we have to do it on a combined approach. If you want good air quality, if you want all the health and wellbeing benefits, we've got to work together to get government money to put it, because it's not going to happen otherwise. Thank you.

Moderator Jennifer McNeill: I totally agree. And 2035 is coming really, really fast when you're dealing in vehicle lives of 12 to 15 years. Action needs to happen right now, and we are with you if you need our voices to assist in the advocacy efforts, we're there. So, last shameless plug. In the next few weeks, New Flyer will be officially launching our Xcelsior AV™, the industry's first SAE Level 4 automated transit bus. And so, while we're very excited about this technology, and it will be shared throughout our Investor Day, I'd love to hear our panelists' perspectives on when we might see fully autonomous buses on public roads. I'd like to start with Josipa and get your thoughts.

Josipa Petronic: It's great topic, because it's one of those topics where there was a lot of sex appeal around autonomous vehicles back in 2016. Lots of money went into it, and then nothing happened. Right? 2018, 2019, today, where are the big procurements? Why aren't the fleets adopting it? Because a lot of those early deployments, those pilots from the US to Canada, proved out some of the system issues, but also proved out that a lot of cities didn't have a goal around AVs. So Jennifer, to your question, when will we see AV technology rollout on buses in particular—or transit vehicles, I would say, whether they're small shuttles, autonomous pilots or buses or midsize shuttles of some sort—when will we see it roll out? We'll see it roll out when two things happen. And I think this can all happen in the next five years if cities are serious about it. 1) Cities dedicate time and effort to urban redesign, because a lot of the hype in 2015 and 2016 was SAE Level 5. Why do we need SAE Level 5, a fully driverless vehicle that can navigate any mixed traffic scenario? A lot of our city design is terrible. Our streets are terribly designed; they're not designed to privilege transit. We have problems getting dedicated laneway for regular buses, let alone smart vehicles. The reality is, there's no reason why we need to wait for SAE Level 5 transit technology. SAE Level 4 is what we need, but the step that has to happen is that cities have to dedicate laneway. There has to be dedicated bus, trolley, streetcars, shuttle—transit has to be privileged over vehicles or in tandem with vehicles. Once that starts to happen, then SAE Level 4 is here. Apart from the pilot projects and the demonstrations that that new flyer has led, the technology is sufficient for dedicated laneway deployment. So that's issue number one. Cities need to get serious about privileging transit and dedicated laneway; then you can have AV tech deployed as a first kilometer-last kilometer supplementary technology. 2) The second thing that has to happen is that cities have to set a gold standard or target for why they're deploying AV shuttles or buses. And the target has to be: "Move more people and kill cars." It has to be that. If it's anything else, there's no point in deploying AV technology. So, what is the goal? If you look at all these pilots from 2016, 2017, 2018, again, across North America, a lot of the cities had no



target. The target when you look at, why did they do these deployments from Los Angeles to Calgary to Quebec City, was just to see how the technology would work. You're not seeing how the technology works when you deploy it on a temporary pathway with no ridership target. The target has to be that we're deploying AV tech, whether it's buses or shuttles, to get more people into transit, more people out of their car, because we can deliver a more frequent service at less operational cost. So, if the second thing happens, a city sets targets of, "We will move 10% more people by integrating AV technology, and eliminate 10% of parking spots at first starting points and endpoints where these AV shuttles or buses operate," then we will see SAE Level 5 transit buses out and deployed and in regular tech. So, you've got to dedicate the laneway and privileged transit, and then you have to have the target of increasing ridership and decreasing car travel in those routes and areas where this technology is deployed. With that, SAE Level 4 buses could be deployed in the next 12 months. The big problems are that, politically, we don't have those two things. That is a problem. It's not the technology on the vehicle.

Moderator Jennifer McNeill: Totally agree. And so, you know, with this initial pilot program that we are doing on autonomous transit buses, we are hoping to encourage that really uncomfortable conversation around, where are you going to put these? Is it mixed traffic? Let's talk a little bit about regulations, standards, testing. All this stuff remains to be developed, but we feel like, if we can demonstrate that the technology is there, we can stop talking about that, and start talking about how to actually deploy different ADAS technologies into cities. David, what's your perspective? Is anything different for you in the UK?

David Brown: I thought that was a brilliant summary and synopsis from Josipa. The only things I would add are, I mean, I would just reinforce one of those messages. I've talked about capex for electric vehicles, ZEBs, etc., and we're trying to do it in Oxford. They're missing the point. Just converting a bus into electric doesn't get you more ridership. You actually have to do more; you have to be holistic about everything you're doing. And the business case only stacks up in this place, Oxford, if you actually improve journey times, you actually prioritize the bus, you actually give them priority at the bus stops, traffic lights, and all the rest of it. Only then does it all stack up as a business case. Because if you increase by 10% the journey time, I can increase the passengers by 10%. It's absolutely right: you've got to have that target and that aspiration. Otherwise, it just won't happen. I've been desperately, desperately trying to get local authorities to be given, by the government, journey targets for bus users as being the catalyst for getting this to happen and change, and then they get funding. And I've got to be honest, and say that that falls on deaf ears. What politicians like is to metaphorically cut the red tape of a lovely, nice new shiny electric bus, not actually talk about the hard yards you have to do of actually getting in a bus lane and changing the traffic lights, and doing all those sorts of hard yards. The only two things I'd add are—Josipa said it's sexy stuff; that's absolutely right—if that gives me bus priority, I don't care, I'll take it. If that's the sort of thing that will get this paradigm shift and get people to think about how to get mass ridership back, then I'll take it, and that's fine. The other thing I really want, I'm not completely convinced that we'll get to a position of not needing someone on the bus, because one of the things that that I know I can differentiate myself on is the quality of the bus driver and the quality of the welcome and the quality of what they do on that journey. I think customers will be less enthralled by not having someone to speak to and not get that reassurance from somebody. Yes, they don't need to be driving the bus, but you're still going to have the cost of somebody, is my view. But I think the other aspect that I'd like to see is the incremental improvements that you can get from the technology that needs to get to autonomous, put on



buses now. I want more of that now to make the drivers job easier, produce excellent costs, make the customers ride better. I'll take all of that. I'll take all of it now. Get it on the bus, get all those diagnostics, get the automated braking, get the camera lights, the cameras into the wing mirrors, and wing mirrors into the buses. Do anything that we've got, that we've learned, from autonomous vehicles, get them on the buses now. Call them all sexy stuff, get the bus priority in, and then we'll get ridership back.

Moderator Jennifer McNeill: Totally agree. And one of the reasons that we have deployed Level 4, with a person in the driver's seat, is we actually do think that, long term, there is a need for an attendant at the very least on the bus. All of the ADA equipment, all of the passenger needs as you go through a journey, need to be met by someone. That's part of our model. Your comments around transit priority are really interesting. The lockdown of cities over the last year has actually proved several things to the world. It showed us that reduced traffic could produce a significant impact on CO₂ emissions, and, therefore, climate change. It also showed us an increased demand for urban space and this need for complete streets where cities are designed for people and not cars. And it showed us that many jobs could be accomplished in the work-from-home scenario, kind of like this one. Paul, final question. Can you share your thoughts on how cities and public transit will be shaped by these lessons in the long term?

Paul Skoutelas: It's an interesting question that we're spending a lot of time thinking about with many of our partners, our members, agencies, and the like. And, I will say, you know, no one can predict exactly what this return to the office will be like. I happen to be a big believer in the importance of cities, and that our cities aren't just going to go away. Even though, in this moment in time, albeit this longer moment that we have (it's 10 months now, likely to go at least another 6 months or more), we're all doing and adapting as we need to. Not because we want to, but because we need to. We've got all the lockdown orders, the shelters-in-place, the social distancing; we're doing everything that is expected of us in order to be safe, and not to contract the virus, and not to spread the virus. I don't think that's the mode that we want as a society to be in. And, I think, once we get through the vaccinations, once we make the transition to this other side of the pandemic, I believe our cities and our public transit systems will come back to life. You know, we've got cities that are the engines of our jobs, they're the engines of culture, the amenities, the kind of lifestyle that I believe most of us really want. And I think that what we're going to see is, in all likelihood, some percentage of jobs that, yes, can be done at home may want to continue that way, but I believe that the great majority of people want to be out with others, and interacting, sharing ideas, creating new thoughts. I think that's where transit plays an incredibly important role to help our cities come back. We have some dangers; David talked about this very early on in our session and that is, you know, what we saw with these lockdowns is people naturally being fearful of the virus, moving back to their private automobiles to get into our cities. That is a recipe for disaster. That's not what we can be doing in order to preserve the quality of life that we want, the cities that we expect to be vibrant. So, public transit plays a critical role in that. As our economy comes back, as people begin to return to some degree of normalcy, public transit needs to be there. There's a relationship there. The transit needs cities, and viable, vibrant cities, and viable, vibrant cities need transit. I think we're in a good place, but it's going to take, I think, a closer working relationship with our policymakers and our decision makers at the city level and the like, to make sure that these decisions that are made are done looking at this broader picture. How does this relate to not only mobility? How does it relate to our economic development? What about the goals that we've established and are aspiring relative to climate change



and sustainability and the like? We've got to bring all those issues to the table. And, as a transit organization, whether it be a transit operator, or transit planning agent, we need to be at the table to help formulate and shape these decisions.

Moderator Jennifer McNeill: Thanks, Paul. We totally agree. You know, cities are basically the fabric of our society. And, throughout many of our presentations [today], you'll hear the folks at NFI call public transit the spinal cord of cities. On behalf of Paul Soubry, and the leadership team at NFI Group and all of our businesses, I'd like to say a heartfelt thank you for joining us today and sharing your perspectives and expertise. We are truly grateful to consider all of you partners in our collective journey towards solving big urban problems with smart, resilient mobility solutions. Thank you.