**AK:** Now I'm officially recording so, do you consent to be interviewed?   
**R6:** Yes.  
**AK:**  And do you consent to have a completely de-identified transcript made part of the publicly accessible data at the end of the study?  
**R6:** Yes.   
**AK:** Okay, that means that we will share with you the version of the de-identified transcript and get your feedback about whether you're comfortable with what we plan to share publicly.

**R6:** Okay

**AK:** Great. Okay, so we'll be recording the rest of the study. So, for the interview, not the study (interviewer laughs), I guess to start I'd like to hear a little bit about your background and one of the things I guess I should say in our conversation with [redacted] she was pointing us a lot to Intelligent Transportation Systems as I think a program that she thought - this is my read about what she pointed us to ITS and why we’ve been learning about ITS - is that's a place where folks within DOT were learning, were confronted, if DOT [00:01:00] has a sort of pipeline of people into the organization who had to be civil engineers, ITS was a point where all the sudden they had to kind of learn something new in order to be able to evaluate the technologies that they would push to the state and local DOTs in terms of the ways that they could kind of improve their transit systems. So, we've been learning a little bit about that, but I think in the context of that, she gave us a bunch of names of people to talk to. So, I thought we'd sort out just asking sort of what you know, where do you come into this? And what's your perspective about in AV particular?  
**R6:** Okay. well, my background comes from building companies that were in the general area of new software.  
**AK:** Okay.  
**R6:** And that includes a cross section of automotive, including a company [redacted] that did mapping and [00:02:00] communications company called [redacted] that has done a lot of things with mobile phones and other things in the past.  
**AK:** Yeah, and so were you involved with the ITS program at the DOT at all?

**R6:** Yes.

**AK**: Can you tell us more about that?

**R6:** Well depends on how far back you want to go?  
**AK:** Okay. Well, I mean, the ITS program started by, through legislation in the late 80s, correct?  
**R6:**  Right.  
**AK:** So, let's start there  
**R6:** Well the early people working in DOT had a few people out of what was Federal Highway research organization and Turner Fairbanks, a [00:03:00] guy by the name of [redacted] from the late 80s who got involved in these things. The major effort mostly started at the beginning of the Clinton Administration. Mort Downey, who was deputy secretary, took a major personal interest. Rodney Slater who became Federal Highway administrator was a major participant. And they worked through various kinds of, figuring out things of what to do and trying to build up these capabilities that were looking at how in general ITS, this means applying computer and communications technologies to [00:04:00] transportation. There's been many many waves of that, each of which required some changes. On the state level, ASHTO, which is the Association of State Highway Transportation Organizations, was also a major participant from the beginning and the ASHTO leadership did a very good job bringing in some of the state highway, state transportation leaders into the ITS area. That's still... that's 20 years ago.  
**AK:** Right.  
**R6:** It doesn't have a lot of impact on our things where things are now.

**AK:** Well, maybe we should focus a little more on where things are now. I think we're interested in thinking about… we're learning about sort of a number of different ways that…so state, you know, we're looking at what Arizona is doing what California is doing - that there are companies that are putting vehicles on the road and kind of test cases and so there's an interaction between the companies that are actually testing out vehicles. But we've also seen something, you know, sort of a different lens I think from the DOT side, in the sense that that DOT is often working with stakeholders who, you know, like the Federal Motor Carrier Safety Administration, like the trucking companies. And so trucking companies are thinking about: well how might this improve our bottom line? And it seemed to me that when we're learning about the ITS Program, that much of what the federal government was doing was sort of assessing technologies and the ones that they thought were going to improve efficiency, improve safety, improve [00:06:00] ridership or mobility, they were pushing to the state and local level saying “hey, we have assessed these. We think these are worth adopting.” So, in that sense the DOT seem like they're trying to be sort of a neutral mediator between those who would acquire new technologies or new ways of trying to improve transit systems, but they're trying to be the assessment level. They're not really the regulator in any sense.  
I mean DOT obviously has a regulatory function, but a lot of what the ITS program was doing was trying to sift through what was out there and make assessments about efficiency, safety, and ridership. So, we're kind of interested in: is that playing out? Does that experience or setup, you know the network of relationships between the federal the state level for example, that set up in ITS - does that mean that there's going to be the same sorts of relationships going on? Where the federal level is really kind of assessing what's coming to the pipeline in terms of AV?  
**R6:**  [00:07:00] If you're seriously talking about automated vehicles that represents less than 5% of the environment.  
**AK:** Okay.

**R6:** This is a much bigger environment just Department of Transportation. If you want to look at it overall, you have major participation from FCC, major participation from NASA, big pieces in Department of State, the US government, all of it funnels into the UN and Geneva and these pieces fit together. They're very complex, time consuming and long-term things and they have a continual overview of [00:08:00] actions coming out Congress that both are legislation, as well as committee staff interfaces  
**AK:**  Right.   
**R6:** Etcetera, that are involved in these things. On just from the governmental side, all of which has different levels of impacts with different sides of the commercial side.  
**MT:** So, can I just follow up on that?  
**AK:** Sure.  
**MT:**  So, I understand how FCC, right, because of Spectrum and Connected, Connectivity, I can understand that NASA and also, possibly DOT, because of things coming out of, you know, automated vehicles from a defense context, [00:09:00] right? But State Department? I was wondering if you could say more about that one…

**R6:**  Okay well first of all, a key part of the interface with NASA is GPS.  
**MT:** Okay   
**R6:** GPS is jointly, well, it's managed by NASA with Co-chairmanship of the oversight committee with the Deputy Secretary of Transportation and the Deputy Secretary of Defense. That’s one side. Communications structures go through the State Department. It’s an international activity. There has been, for a [00:10:00] long time an ambassador for communications. That role has not been filled in the Trump Administration, but the staff is still there. So, all of the activities related to GPS go into the international level or they go through the state department to (inaudible), which is the UN Agency for space activity in Vienna. The communications pieces go through the state department to go to IT, which is a UN agency that covers all ICT. That has a current activity that's very important to the current industry on trying to harmonize [00:11:00] the Spectrum for the vehicle to vehicle communications. And then ITU goes into the UN transport division, which is responsible for working party one, which is the rules for traffic signs and similar things. And working party 29, which is the world forum for working harmonization of vehicle regulations, which is coordinated on the US side between EPA and Department of Energy and it's a Department of Transportation and continued fights on how much is done in US, with US agrees on the regulations of the industry, pushing that they want independence as well as consistency. So, these are massively complicated things.

**AK:** Would you say the conversations in these working parties…would you say that the folks who are representing the US side understand the technologies well, or you know relative to their counterparts from other countries, are they kind of up to speed or are they…? I don't know if you have been part of the working parties or followed what the conversations in the working parties are like?

**R6:** Yes. Okay, so…however if we…the world for forum for harmonization of vehicle regulations is [00:13:00] built as a Treaty Organization. Eventually, the final decisions are by the governments. By sort of logical agreement everything goes through informal groups that bubble up to structures. They get approved. Some of them end up having to go to New York for final sign off and stuff. The structures almost uniformly are a regulator as chair, and a representative mostly from ICA as the secretary. ICA is the organization International [00:14:00] Constructors Automotive in French, which is membership is made up of the Automotive associations like AAM here in the US or Japan Automotive associations, etc. So, then the car companies within the ICA delegation provide their representations (inaudible) participant strongly in most of these things. They get componentized into pieces, is the to work on separate pieces. NHTSA doesn't have the money, doesn't have the travel budget. [00:15:00] So, Japan, China European Commission outnumbered NHTSA participation by at least 10 to 1. Because limitations in travel funding and those, for a lot of the work, things are brought in from ISO committees SAE communities. Both ISO and SAE are participating observers as they would be called in there, as well as the associations of automotive suppliers as well as the automobile associations [00:16:00], and various other, like representatives of the blind. All are present and participate in these things.  
**AK:** So, in terms of saying that NHTSA folks are really outnumbered by their counterparts - does that mean that… are they still able to hold their own and represent the US perspective? Or does that outnumbering really make a difference in the dynamic?

**R6:** Well, the last meeting in Geneva last month, there was a decision to restructure how things were done in automated ready. And NHTSA asked for more time [00:17:00] on trying to work out what to do and was voted down.   
**AK:** Does that mean that regulators in the European Union or in Japan are just more ready? They are more prepared to do this and they feel like they don't need a longer timeline?

**R6:** Yes.  
**MT:** I am very excited to get a chance to talk to you about this international comparative point of you because it’s been very interesting to watch the different international regulatory regimes coming up, and being at the conference during the Germans and others talking about this. I'm very excited that expanding this now to this level - I just want to make sure that we're cognizant of our time, because oh man I would love to talk to you all day about this actually - so I want to make sure that we are…so I’m loving (inaudible) [00:18:00] standard regulations, United Nations, and this broader ecosystem now, of how this actually happens and then this connection between the public and private and getting…right, so our fundamental question is like how does government function in this space, right? In terms of training people, retaining them, travel budgets – that is totally part of our thing actually – I have seen them in a lot of ways. So, how is government trying to do what it can, not just in the resource constraints, well actually yes as in resource constraint times…(interruption) but also as in total numbers that are also intermittent

**R6:** Has any of your discussions come across the Vienna Convention that says that the driver shall always been control of his vehicle or his (inaudible)?

**MT:** I think I heard reference to it over the conference once, I think

**R6:** That’s an underlying regulation of which there's actually two: Vienna Convention and earlier Geneva Convention that say basically the same thing. And these are responsibilities alignments in working party one. And it's well understood that they're out of date and…so there was a major effort to update this and they screwed it up two ways: one, they only updated the Vienna convention and not the Geneva Convention, and the US is a party to the Geneva Convention. [00:20:00] And two, what they actually did doesn’t work because it technically would prohibit things like stability control. They did an amendment that basically said it counts if you can take control of the vehicle. Well, you can't take control the vehicle on stability control and if you ever got to level 5 or whatever you can’t take control, anyway, so they're back to redo that.

**MT**: Okay.

**R6:** Okay, so NHTSA was able to come to one of the meetings then (inaudible) who's the NHTSA Associate Administrator was supposed to go to Geneva would give a presentation of what you, and then that ended up being pulled because conflicts. He did make the last meeting in Geneva, but the other meeting he did not make.

**AK**: Oh, he got pulled because of conflicts with his [00:21:00] schedule?

**R6**: Yeah

**AK**: Not like conflict of interest?

**R6**: No

**AK**: okay, because I was like…

**R6**: Because there is limited staffing. So, these things rumble on. They sort of informally get winked at for the short term until you get serious volumes. And it’s pretty well understood that all this stuff has to get fixed in serious time. So, two of the big efforts right now are task forces of on software updates over the air and cybersecurity. In both of those GM has been [00:22:00] one of the major leaders. NHTSA has only attended the meetings that are in the US. That’s at like four o'clock in the morning, but nobody is formally assigned to these activities. Now technically, if you look at software activities over the air, to fix something is a recall. And there’s recall regulations, which basically say you send out notices, the person’s supposed to go to the dealer, and what have you, and it's been again sort of winked, no problem for updating multimedia, or what have you…

**AK:** They’ll send a patch over people's [00:23:00] phones and say download this to your car or something like that?

**R6**: But Tesla has been updating actual braking control things, which clearly does violate the current federal motor vehicle relations and NHTSA knows that they're not going to press it right now. But the other major car companies all know they absolutely have to be able to update software over the air if they're going to do automated driving because there's going to be fixes, and they can't try to go through the dealer. But meantime the National Association of Automotive Dealers, which is very strong organization, has been working hard via Congress to get legislation that would prohibit updating cars because it's dangerous and they are [00:24:00] trying to protect their position. And of course it's big money and obviously particularly in the House car dealers are very large contributors with lots of…

**AK:** Every district has its car business!  
**MT:** They are Little League sponsors. I've come across them in the electric vehicle purchase!

**R6:** Okay, so, so, that the full underlying regulations on what's going to happen on that. So, that starts all the way from the UN level down through, and goes across different countries. And there’s major issues also on the non-US because they mostly have their structures as type approval.

**AK:** Their structures are? I missed that…

**R6:** Type Approval. [00:25:00] Technically in the US the car companies self-circuit through what's called self-certification. They certify they follow the regulations. Okay.  
That's why Volkswagen is paid very large amounts of money in the US because they lied. They have not paid money in Europe because technically they submit their cars to type approval agencies. So - this is one of the areas where US doesn't have any problem - and the type of approval agencies approved the cars, so therefore Volkswagen is not liable for having cheated because type approval agency gave them approval.

**AK:** So interesting. That's interesting.

**R6:** So that's all trying to be sorted out, The type approval made a lot of sense 50 years ago when all you were doing is [00:26:00] checking that did the car actually drive right and the right brakes work and what have you - they all know that it's out of date.  
**MT:** So, this VW thing is fascinating to me because it was an NGO ICCT that caught the cheating and it wasn't a government agency, right? Other than it was like people trying to figure out ‘oh this is seems to be working the diesel, right?’ So, I've always wondered if that's it…was that a capacity… was the capacity the government agency at all an issue here or was that a pretty effective structure that cars and others would actually like go to ICCT - like where the source of the expertise was to catch that scandal?

**R6:** It's mostly… the way it's structured like I said… both NHTSA and EPA the structure is [00:27:00] self-certification, you file saying your meeting and what have you. And they rely on something happening to show that they're not - the fact that is self-certification, they're not testing. And whether it comes out on the diesel case or GM emission or what have you - the issues are determined by some external occurrence. And then the legal liability is there in the car manufacturers because they didn't do it right.   
**MT:** I’m just trying to think like… to be able to be effective at self-certification there have to be people monitoring that are looking for discrepancies, right?  
**AK:** My sense [00:28:00] with the Volkswagen case is that it was completely accidental in a way, in that there was somebody studying and trying to kind of replicate it. I mean if I understood self-certification – and maybe I don't, I should actually premise the preview by saying I don’t - but it seems like, the analogy I use is from aftermarket monitoring for drugs, like drugs have to sort of pass a certain level proof of safety and effectiveness, but then once they're out in the market, you look at their performance. So, if something looks like it's not safe, then FDA can kind of pull it.

**R6:** Right. That’s the exact same structure. If they find that there's something, then they initiate an investigation, if there's a reported set of a number of accidents or what have you, then they will do. And NHTSA was *way* short of the staff it needed for an investigation and what have you, so they've got to be very [00:29:00] careful and limit what they can tackle because they don't have anywhere near the staffing to be able to do it. But they're still, in this area, better off than our European friends. Because the net result of something being found wrong only is that in the future they can pull the type approval, and they have to fix future but they're not liable for anything. And the European Regulators know it's a pretty big problem and they fall and they don't know how to fix it because the type approval agencies have a lot of money and they're the counter to the dealers in the US - their money supporting protection and…

**AK**: One of the things that I've heard so far is that [00:30:00] regulators in the US around AV are saying, you know, ‘what we need to do is we need to step back and let things develop before we take any stance at all because we need to sort of not get in the way.’ And one of the things I heard them saying is ‘what we're doing is we're looking at the’… in particular, I mean this would be particularly with respect to NHTSA…is that they’re looking at the way regulations are written, where they can tell that there's going to be a real mismatch between you know, like references and in the regulations that refers to things on the driver side. So, their attitude right now is, to the extent that we think about what we have to do, they're thinking about ‘how do we write existing regulation so that they can kind of encompass AV? Also, let’s sort of get out of the way and not try to do anything that would prevent innovation.’ I wanted to get your reflection on that. Is that the right [00:31:00] approach that regulators at this time should be taking? Should regulators be thinking about this differently?

**R6**: Well there’s certainly the one part which is to go look at things both at the federal and the state level. If you go back in history, mid-80s, almost uniformly laws against having a display type thing in the front seat of the car. At that point it would have been your movie thing or what have you. So, there was a major effort that has to have been gone through to go change all the regulations so that it would allow a navigation system. Because, literally they, almost every place, but that was at the state level (inaudible). But there are huge issues on [00:32:00] regulations that do have to be fixed. A good example is that the general regulation says that automated steering cannot work more than 10 kilometers an hour. That was put in to allow automated parking - so you push the button (on one of those advanced things) and they’ll go park your car. Okay, that's working on being fixed. Now the problem on work on being fixed is it’s very complicated and it was a big fight between car companies - just because there is an understanding that if you're going to allow these things you better make sure the drivers paying attention until you get there. So, there is a relevant important argument about what should be done to make sure that the [00:33:00] driver’s paying attention.

**AK:** Right, so reading about stuff that they're tracking driver's attention and if the driver is not paying attention the whole system's slowly shuts down.

**R6:** GM is a good example of what they put out (inaudible) put out what is a reasonable approach.

**AK:** Okay

**R6:** Tesla what they put out is clearly not a reasonable approach. So, that is an area that is being worked on both internationally and NHTSA is aware that something has to be done. And so far my understanding is that NHTSA not going to go do it themselves. They're going to try to wait.

**AK:** Okay

**R6:** Until the international rules are put together and will look at following but it is [00:34:00] the typical thing that's in this gray area. It's not right automated driving as such it's much more in the middle of what is Automotive Safety and as it gets further into the ground of consumer NHTSA is going to do something. The international side may get done in time – so that they can use it - parts of it are done but it’s not complete yet. But that’s a simple example. Cybersecurity NHTSA is going to do something about it - not clear what. The US side has an informal group called Auto ICE that is feeding into the [00:35:00] UN taskforce on cybersecurity on over the air issues. Those may or may not get ready in time and there’s massive fights about how long the car company should be responsible for protecting the car. And it gets in a regulatory start, was well, ‘it should be for as long as the car works.’ The car industry came back with ‘three years.’ Everybody laughed at that like it’s sort of gotten up to 10 years. There is a discussion to look at making the regulation be as long as the vehicle Communications [00:36:00] capability works, which then pushes the responsibility back on the regulators. So, car now is put out with a LTE capability if FCC would allow the carriers to shut down LTE the old cars then no longer be able to be updated. Of course, the auto (inaudible) would just require people to buy a new box to put in, so they can go sell boxes and nothing is ever going to happen.

But there's one of these over (inaudible) which is very complicated it appears. The European side is more focused - Basically says that they have to figure out how to avoid the situation where the [00:37:00] rich Dutch and Germans get these capabilities that protect them from being killed but it's all right when the old used car ends up in Portugal or Greece. It’s ok to (inaudible) the Greeks or the Portuguese. So most of the automated driving structures will end up requiring communications. Okay, It’s pretty well understood by the car companies that can't charge of subscription for the that part of the communications that’s related to the safety, but it is really an open issue of how to make sure that the 15-year old car that goes into the slums of Oakland still works.

**AK:** Interesting

**R6:** And that's a major public policy issue that will [00:38:00] be part of this regulatory structure and they say. I know in these discussions - the only logical solution is that it ends up being FCC responsibility to make sure for whatever period and whatever it decides that they in the future, when the cars are dependent on Communications, that they can't allow the carriers to shut down the communications capability Now, that's a serious issue that is understood at a theoretical level on both sides – two sides [00:39:00] the car side and the NHTSA side. I do not believe it's understood at all and NTIA and FCC. But it will become a very basic issue. There's lots of these side things. I go back to GPS. We have major problems with GPS jamming. You go stand on a street corner around here and average maybe 100 times a month GPS is jammed. Somebody buys the cute little thing to plug into your seat cigarette lighter, that's your privacy protection, so that [00:40:00] they can't be tracked - whether it's somebody in their pickup truck going to see the girlfriend for lunch or whether it’s somebody who wants to make sure that their nighttime activities are not tracked or what have you. Those things are completely illegal.

**AK:** So, do they just mask the vehicle that it’s plugged into…

**R6:** No, it just sends out a signal that blocks GPS.

**AK:** So, for anybody around…

**R6:** GPS is a very very, it’s a satellite, very low. So, one of these things will hit half a mile or more. There’s been a few cases – FCC is responsible, FCC mostly doesn’t give a damn -- except when it becomes very big. So there was a well-known case, because [00:41:00] GPS is used for timing as well as for location. The radars at airports use GPS for timing and there was a problem well known about three four years ago where the radar is kept getting knocked out of Newark airport. When you look at Newark Airport it’s right up against expressways and what have you. And finally that one they investigated and finally found it was some guy who had … literally it was a pickup truck that was the company construction or what have you and the guy didn't want to be tracked what he did on his lunch. So, he got one of these things off the internet – illegal - just what have you. They finally tracked him and it was a large, relatively large, individual some 20-some thousand dollar [00:42:00] fine. But most of them they don't because they don’t care. FCC basically doesn't care. But they’re illegal. You can go on the internet buy them from China or what have you and very, very rarely, once in a while Customs has done a few raids to go and catch some of them, but it's not seriously being tackled and it's a major issue for…

**AK:** for AV

**MT:** for public safety

**R6**: Well, it goes across all these things. You get problems with impacts. So, your 911 call once in a while may not get the right location. (casual exchange between MT and R6, not audible; MT jokes about her maps app getting frozen) But that’s their sloppy maps and GPS isn’t quite so accurate. [00:43:00] So, they’re transient they may last for a couple of minutes. These are the kinds of things - for automated vehicles are going to be trying to rely on some way on GPA. It may be that they just have to give up. These are major issues. The US DOT is very aware of it. There is activity within DOT specifically on the GPS and the GPS protection, but their issue is that they can't do anything about it. It's not their responsibility. It is FCC’s responsible.

**AK:** Do you know when this hit the DOT’s radar? If they have activity around this that's…

**R6:** Oh, it’s been going on for years.  
**AK:** So, it's [00:44:00] not new.

**R6:** Right. The actual person who controls it is [redacted] and VOLPE. It’s included in the general DOT technology and they don’t cooperate very much with DOV(?) on it. But so the FCC - there's the other side on the FCC. Technically it is illegal to use a non-GPS GNSS signal in the US, even though all the smartphones now you get your iPhone or what have you - the Russian GONAS(?) system [00:45:00] picking up the (inaudible) or what have you - and for years the state department has requested FCC to go change their rules to allow it and FCC hasn’t gotten around to doing it. So, those are side things where you have all these different agencies, one of them has some responsibility that's theirs because it's on the side

**AK:** Right

**R6:** And, they don't care much about it.

**AK:** It's not as much of a priority for them. But it sounds like in that case, it's not I mean, it sounds like, at least informally, FCC is not trying to prevent, they’re not enforcing

**R6:** They’re not enforcing it, but it looks stupid.

**AK**: Okay

**R6**: And view us when we go negotiate [00:46:00] on other things like fighting with China about whether to allow - China is trying to ban, pretty much has banned use of GPS in China - we look pretty dumb when we say, ‘Well you should let… but then technically we don't allow it.’

**AK:** Right.

**R6**: So, there's many little things that get into this.

**AK:** One thing I was going to ask, in some of the examples that you were giving, about the positioning and where people, where the regulators kind of you know… some of these International working groups all sort of see that there's a need to update something or any kind of come up to speed with where technology is -- It seemed like the kinds of things that are slowing down those negotiations have to do with sort of the existing market share of somebody who doesn't want, you know, for example, the car dealers who don't want to lose the recall [00:47:00] business for example. And, really that's very typical of international negotiations is that there's some businesses, some industries, or some sectors stand to benefit some stand to lose so they’re sort of fighting that out, but it doesn't sound like from what you were saying that some of these things are running off ground because the people with regulatory authority themselves don't understand the issues or don't have the capacity to sort of deal with -- it seems like sort of more typical kind of market politics going around…

**R6:** It’s both sides. In theory the government agencies are supposed to protect the public interest. And they do have basic capabilities to spend time and effort trying to educate Congressional staff [00:48:00] and what have you, if they have enough resources to try to counterbalance this. Well, there's right now, a big problem now that NHTSA is starting to spend a lot of time on, which is protecting the spectrum that we got assigned for FCC, from IFCC almost 20 years ago almost (inaudible) for vehicle safety communications. About five years ago the Wi-Fi guys got stuck in a bill to demand FCC look at sharing that Spectrum would WiFi. That was a legislative. DOT didn't have the resources. They had heard that it was coming along. They didn't have the resources to go…they can’t legally lobby it…but to [00:49:00] educate how much problem that is. So, the sharing is in there. So, it's now wasted a lot of NTIA time, a lot of DOT now is having to ramp up, because they're afraid that FCC will just go say, “okay, we don't really care that much. If they want to share it, share it. Go away and don’t bother us type thing. So, they're trying to balance that, which had they had the resources in the first place to go…  
So, the issue, I would say for the dealer of wanting to protect the safety of cars to make sure they come into the dealers for updating – DOT is aware of it, but they don't have the resources. It’s a major [00:50:00] effort. The counterbalance a association that has a big point in Congress, they have their own people, they bring in their staff, people of all their members, to counterbalance that isn’t done by a meeting once a quarter to mention it. But that's basically the resources that NHTSA has that they can devote to this.

**AK:** Right and so they want to convince congress to do the right thing, but they don't have a person power to be there to be talking to the staff, to be…

**R6:** Right. So, it's a major part. Again, if their responsibility is to protect and [00:51:00] handle the public interest then they should have the resources that are really seriously spending a lot of time out here and they don't. History, you know, the ITS program wasn't asked for by DOT. It showed up because there was a senator from New Jersey who came from an IT background who decided to stick one hundred million dollars into DOT legislation for ITS. That's literally how it happened. So, they got the money then now they got people who can work on it and then it all built up and what have you – but it was not a DOT request. They had, like I said, a small group in the late 80s and I think this was 92 93 to legislate, but the money got stuck into the…(MT asks a question about who the senator was; exact language inaudible). No, no, I can't remember. He used to be the Democratic senator, who in the 90s, who had I think created one of the payroll processing companies or something like that and ended up - it wasn't Bradley - he came out of the IT business. […] But it was somewhat let’s say 92 93 that it got into the appropriates bureau.

**MT**: Congressional capacity, right? Yeah, it’s interesting. So, besides us doing the two case studies, we also kind of quantitative data collection effort and we actually originally had something like Congressional capacity in the plan. We had to reduce our scale, you know we had some issues around how much we could do. But that's interesting Congressional capacity because around that same time is when you get rid of the (inaudible) technology. […] So, anyway that’s kind of…because you know, DOT wouldn’t have to be educating all the Congressional Staffers if the Congressional staffers had the expertise on that side, right? That’s another aspect. So, instead of just being in the executive branch. That’s interesting.

**AK:** So, given the kinds of questions we’ve been asking you, are there things that you thought we would ask about that we haven't?

**R6:** [00:54:00] You brought back the current DOT approach that let things be and that's obviously a reflection of the current Administration, but the fact is that we have no clue how this stuff is going to work. So, there's pieces around the side. We know that there has to be something to control driver attention and we've got enough evidence of that. That's a piece that [00:55:00] can get, that has to be tackled and that will be a big issue for a lot of time. I think we're a very very long ways away from real automated driving in any kind of a large-scale commercial scale. There's fundamental capabilities that I don't know anybody in the major car company – a simple example is merging. How do you 100% reliably merge, for example, if you're going to go across the Bay Bridge. You guys do that often. How do you think about how an automated vehicle would be able to do that 100% of the time? If I'm really going to have an automated vehicle capability, I can't only do it 99% of the [00:56:00] time and God only knows what you do stuck at the end of the ramp or what have you. They just don’t know how to do those kinds of things. So, those fundamental pieces are still missing.

**AK:** Right. And, in that sense, I mean it sort of seems like there's time, right? It's not like these are going to hit the…These aren't going to be on the road tomorrow.

**R6:** So, the kinds of things that are needed is to figure out a way to prevent something really dumb being done and the Tesla crashing 101 is an absolute example of as it speeds up on its way into hitting…that’s just plain bad.

And obviously the same thing with the Uber thing in Arizona where, geez, we know it's something there but we don't know what to do, so therefore we do nothing. But, you're going to have [00:57:00] some of those mistakes, the issue is how, when something like that happens, how you stop it. You're never going to get all these things right. And there will be accidents and people will get killed and it’s unfortunate, but that's any, they’re killed in regular car accidents all the time. But there's a need to… if you start trying to say ‘this is how you have to do it’ I think it really will impact. Once you see something happening that's clearly wrong that gives you some indication, ‘well let's have enough resources and capabilities to do something to make sure that this thing doesn't happen.’

**AK:** So, do you think that the California approach which is to say ‘we want [00:58:00] you to report data that we can then analyze about any event where your drivers that are in these vehicles have to take control. So that there's… is in that sense they're not saying…they're not preventing the testing of the technology, they're just saying the public sector gets to see how you're performing and what are the parameters around when the technologies, when the automated part of the technologies isn't doing well and the human driver needs take over. Do you think that's a reasonable approach?

**R6:** Yeah, I think that's fine. The issue is now when you find out that there's something not right, what do you do about it? And if we take around here, GM cruise automation is working very hard on this stuff and they say they're going to put something out. You take their statistics and [00:59:00] they're having an – last one I looked at – they’re having an accident less than every 10,000 miles. Now almost all of them were quote not their fault. Well, that's right. Legally not their fault. They stop and they get hit from behind. It's not their fault, but they are not driving, they haven't mastered driving the way we do so we don’t get hit. Nobody, I’m sure your worst friends are better than every 10,000 miles a day in having an accident.

**AK:** And there’s data out there, right. We know how long people go before fender benders. It's more than 10…They drive more than 10,000 miles.

**R6:** Okay, so [01:00:00] those are not major accidents. Not a big problem. There’s one thing I think California should do, that they haven’t done on those things, which is come back and say, ‘hey, you guys from a insurance or what have you should make the self-driving car company responsible.’

**AK:** So, they need to they need to change the liability, right?

**R6**: Yeah, and then that's a small thing, and as long as people aren’t getting hurt and what have you, it’s not a big thing but it’s still the case, I bang into you, in your automated car right now, it goes on my insurance, on my record.

**AK**: Even though the automated car did something totally unpredictable.

**R6:** It did something (background conversation). That’s a typical example… if it is something right now that there's an accident with a self-driving car, even if it's technically not legally the car company’s fault, it's almost likely the car companies unofficial and there should be some there that should take the burden off the poor person who happened to have been driving on the back of the car that slammed on the brakes too fast where most people would go through the yellow light. So, that's the kind of thing California has been doing - they get the information, but they haven’t figured out or [01:02:00] decided, or whatever the right word is, how to go back and protect that other person.

**MT:** I just want to, because I don't I know we don't have much more time, but I wanted to kind of go back to this idea of expertise. Like, we've mentioned wealthy at one point which we've been wanting to talk about wealthy as kind of a theme I think. But if you were to have somebody new getting into this field today, like on any of these regulatory sides, what we do think that they should know, like what kind of knowledge, skill sets, anything like what should they be reading, conferences they should be going to, to help have a smarter environment on some of this stuff.

**R6:** That’s hard, [01:03:00] that's really hard.

**MT**: I know! That sort of comes to the fundamental part of our study.

**AK:** Yeah, like how do people come to speed?

**MT**: How is this going to keep up? So, one thing, California maybe because it can’t keep up it does information disclosure. Or, government can't keep up, so NHTSA waits and just let's International process happen, then we follow the rest of the world. But like, you know, so there are different ways of managing the capacity, but if you try to actually be able to keep up with this exogenous technological change, you know, like we had something new that you can hire for or existing people that you could retrain to be more involved, do a better job.

**R6**: Well the first thing that would require is a conscious decision to seriously staff the areas that are undergoing technological [01:04:00] change. And almost uniformly at all levels of government that doesn't happen. Basically that says ‘take money away from existing things and put them on the new things.’ But the existing people protect their money pretty well. So…

**AK**: Is there any […] I guess for some at the federal level, I don't feel like there's much appetite congressionally to say, ‘hey, we're going to be throwing new money at agencies so they can keep up pace.’ I mean maybe states are more willing to do that.

**R6**: Not many.

**MT**: So, let’s say that there was this conscious decision to seriously staff some of these areas. Should it be in ICE and T fields, should be less civil engineers and more electrical engineers, should it be bringing more [01:05:00] interdisciplinary people that have like, you know, just make everybody through a lot of like regular reading of trade journals, or everybody goes to AVS every year, or there's more interagency working group which actually have teeth…

**R6:** You need combinations of those things. First, it’s very clear that no government agency practically is going to hire the best of the technologists. That's not going to happen.

**AK**: Right the private sector hires.

**R6:** They can’t pay the salaries.

**MT:** It’s not like the government doesn’t want to, it’s just that they can’t pay the salaries.

**R6**: Yeah, and it's not clear that the best technical people are the best public policy either. You're looking to get people to build the capabilities [01:06:00] to be able to get support and understanding of the technology as it's happening. And a lot of that, some of it’s having time, some of it is participating in some things where you get to know people, but the best people from our regulatory environment are going to be the ones who are able to be part of the network with the people, that's not formal: I am an expert in this area, but if something comes up, I know 10 people who are experts in this area and if actually eight out of ten tell me [01:07:00] the same thing, then I maybe can count on it

**AK:** I want I want to be thoughtful about your time and I thought I would see if we could ask just whether, I mean particularly on this point about people in these networks or sort of participating in either working groups or sort of these forums, I wonder if there are any people who are like that, that you can think of who might be willing to talk to us to tell us what their lives are like? How did they develop their network connections? What are they? How do they maintain them? Who's in them?

**MT**: expertise…

**R6:** One very good person is a guy by the name of [redacted] in the [redacted] [01:08:00]

**AK:** I don't think we’ve talked to anybody in SAE yet.

**R6**: Standard-setting, influencing, what have you…so [redacted] is in [redacted]. He does have some background in particularly working in these areas as an SAE person. He’s probably the best that I can think of.

**AK**: Would you say I mean, I don't know if you've interacted with anybody at FCC who would be, who is a person at FCC who says, ‘FCC should be paying more attention to this than it is,’ or that ‘we wish that we could.’ I don't know if there's anyone like that at FCC?

**MT**: Yeah, like the point guy for auto…

**AK:** Year like who is the DOT counterpart at FCC? I guess we could also ask some of the DOT folks that we have talked [01:09:00] to.

**R6:** Well, technically DOT can't talk to FCC. They have to go through NTIA. FCC is an independent agency. So, they’re very careful tracks of how things go through.

**MT:** So, you can't just have a simple interagency working group…

**R6**: Yep. But if you take all the people in the government on the vehicle communication, probably the best person is in the [redacted], his name is [redacted]. He's been working on this stuff for 20 years. They say he is the [redacted] [01:10:00], so he would be the guy on the communications side for automated driving - that would be the person in the government that could give you the best information.

**AK**: So valuable!

**MT**: What I love about this case is the intersectional – with all the ICT, all the other OEMS, and then all the infrastructure, right? And then you think about paint markings and how you see that through snow, and you deal with like cars talking to each other. It's just got so many technical efforts and regulatory things along all these different parts of it. I don't know enough about the infrastructure part.

**R6:** Yeah. So, parts of these things there is and will continue to [01:11:00] be from the large mainstream car companies trying to build their system so they work on whatever sloppy infrastructure there is. And the reality is for locale, maybe wants to encourage a robo taxi or short or slow speed shuttle…maybe they can do something. Doing a lot on the infrastructure for mainstream automated driving is hopeless because it's not going to get done uniformly across the entire country. So, the cars have to work with it. I’m sure the guys at 3M will try to sell [01:12:00] better paint to some state or what have you. (casual background chatter) And, certainly, the cars will pay attention to it, but you can't sell a Malibu and say will only work where there's good paint. So, that part – they should look at other things. If you’re on 880 when it's not congested, and you drive at the speed limit, you're a menace.

**AK**: Right, everybody drives 10 [01:13:00] miles per hour faster on the 880 if it’s not congested…So, do that in the slow lane maybe.

**R6:** Yeah, well that's the case where there really needs to be some legislative expanding to go change laws on how you will allow an automated car, once we ever get to a good automated car, that will be able to go at a reasonable highway speed.

**AK:** I heard somebody at AVS talking… I think that the representative from Waymo Malibu who was on the panel said that they had gotten, I'm trying to think if she had gotten permission from the state for their cars to match the speed of traffic on the freeway, because they were, initially they were like, ‘we will follow all the posted signs’ and then people started to argue that's really kind of a safety issue if everybody around you is going faster and you've got this little thing pudding along. But [01:14:00] I don't know if they did anything formal or informal. But apparently Waymo now is saying that their

**R6:** Yeah, it’s informal (interrupting). That’s the kind of thing where you do have to have things. And the delightful thing that technically came across all yellow lines, so the moving truck sitting there in front of you and you can't drive around. So, there's a bunch of those things where regulations have to updated to match what makes sense. Whether that gets done as an ASHTO model legislation or something like that, but those are the kind of things that states and localities can do, which is make sure again that they don't have things [01:15:00] that will prevent sensible implementations and there's time to do that, but they are issues, they are known, we’re not we're not that far yet, but we will get there and those kind of things will have to be taken care of. But for specific things that could be done to improve infrastructure, this is not going to happen.

**MT**: Right. And the response is the multiple sensors and stuff. I keep thinking about that GPS outage thing. And if your GPS is out, and you got these three other things…I mean it’s not just the cameras right because when the sun gets setting behind the traffic light…

**R6**: It’s the bug on the camera that’s harder than the sun!

**AK**: Oh, the bug is it? (laughs) [01:16:00] Interesting.

**R6:** Keeping things clean is a fundamental technology that doesn't exist. Because in all of those kinds of things we talked about, they’re unreliable, they’re unmechanical(?), it’s not going to work all the time. So those are all parts of the things about why this is going to take a lot longer, is these practical implementations that do affect things. We all know that the sun behind the traffic light and what have you, but those are known because really your neighbors running around here with their little test cars run into that. They don't get anywhere like, [01:17:00] ‘my bug on my lens’ they don’t think of those as issues, or as practical issues.

**AK:** Well, I feel like we've taken more time than we forecast and this has been so helpful for us, really delightful. I don't even know that, I mean we're thinking a little bit about the Netherlands as doing something in Germany, but I wasn't thinking about the working groups and how they have International processes taking place. So, it's been really valuable.

**R6:** All of this stuff is very complicated, I say. If you look at NHTSA as completely understaffed, most of the top NHTSA technical people have gone off to work for somebody in the last five years. [Redacted] is almost the guy left standing because the other guys are [01:18:00] working for Waymo or doing the Michigan test area, working in Virginia. So, that's an issue that goes with this, it’s the issue on how you get new people into things – it’s actually necessary. It requires large staffing, but how do you keep them?

**MT**: Right. Retention.

**AK:** Well, this has been terrific. Thanks so much for being willing to talk to us, and come on over here where we could have a quiet space, and talk to us for so long.