Appendix 4

Focus Group Results

1. New Jersey's Economy: Implications for People and Freight: Summary

Focus Group Abstract

After decades of development of suburban office parks, jobs are now growing fastest in urban centers in and adjacent to New Jersey. At the same time, the industrial economy is booming, and distribution and fulfillment centers, sometimes upwards of 1 million square feet, are being constructed, driven largely by New Jersey's proximity to major ports and its location between New York and Philadelphia. The result is an increase in longer-distance commute trips and growth in multi-modal freight traffic that produces unique and added burdens to the entire transportation system. How should NJDOT strategically invest in the transportation system in a manner that accommodates and continues to grow the statewide economy?

Organizations Represented by Attendees

- NJDOT Multimodal Services
- South Jersey Transportation Planning Organization (SJTPO)
- North Jersey Transportation Planning Authority

Summary of Research Needs Identified

- Methods of expediting truck/freight fluidity including by means of improving permitting processes and managing HOS regulations.
- Better coordination of municipal regulations and restrictions on trucks.
- Impacts of driverless trucks.
- Identifying accurate origin-destination and freight generators, including implications for data accuracy.
- Identification of up-to-date and future travel demand habits, including effects of TNCs and technological advances.
- Determination of effects of reduced reliance on conventional fuel.

Key Discussion Points

The moderator began the focus group by asking participants about the role of DOTs and MPOs in helping to support economic growth, including through the various approaches of capacity expansion and preservations, community partnership fostering, and related economy-land use connections.

A participant from NJDOT indicated that an important role for NJDOT is to approve truck parking and access to rest areas. Overall NJDOT must help to make the entire freight system, especially by means of truck traffic, more fluid and efficient. Trucks are inefficient in that as per federal hours of service (HOS) regulations, drivers often need to park and switch with one another. This issue is especially magnified given that auxiliary power units in trucks aren't well-ventilated. As such, exhaust can often trickle into the driver's cabin, including when the trucks are in motion and idle. As a result, NJDOT must play a role in facilitating driver changes, including by means of accommodating locations for these driver changes and corresponding transportation to and from these locations, all for the purposes of increasing freight fluidity. Currently this topic of freight fluidity in relation to truck driver changes has not been examined in-depth from an industry standpoint.

On the topic of trucks and drivers, the conversation shifted to the topic of driverless trucks. As such the moderator gauged the opinion of participants on driverless trucks and their implications on New Jersey's freight transportation system.

Regarding driverless trucks, the participants indicated that driverless vehicle technology will penetrate sooner on trucks than automobiles. Correspondingly, driverless vehicle technology will also occur sooner on limited access highway routes, especially in the form of vehicle platooning from one tandem area to the next. Despite these impending technological advances however, the participants also identified a number potential challenges associated with driverless vehicle technology including the following:

- General negative perceptions of driverless vehicle technology
- Interactions and incidents involving driverless vehicles and corresponding liability
- Vehicle sensor glitches and corresponding emergency mechanisms

Based on these and other potential issues related to driverless vehicle technology, the moderator asked the participants about what NJDOT, and the State of New Jersey as a whole should do, within the realm of various constraints, to respond accordingly in order to increase the vitality and fluidity of the entire freight system.

The participants provided a number of responses:

- First, there is a need for truck weight screening systems in order to create bypasses for weigh stations. It should be noted that NJDOT recently released a request for proposal (RFP) to develop electronic screening at 3 truck weight inspection sites. So far, they have received approximately 3 bids.
- NJDOT is in the process of updating their comprehensive plan to allow for additional funding for related projects.

- New Jersey's system of truck licensing and registration records keeping needs to be modernized. In particular, permitting should be moved from the Department of Motor Vehicles (DMV) to NJDOT in order to reduce a lot of the bureaucracy currently involved with permitting.

- A reliable, modernized, and up-to-date GPS needs to be developed exclusively for trucks, taking into account height, weight, geometric, regulatory, and other restrictions, as well as the incorporation of 511 trip planning.

The moderator then asked the participants to elaborate more on some of these truck restrictions.

In particular, the participants spoke about the need for better communication of local truck restrictions. Often times, municipalities will impose municipal-level truck restrictions, that don't create a cohesive truck route network. This is especially the case in Bergen County, and Rockland County to the north in New York, where primary truck corridors can quickly change into restricted local streets, and vice-versa. Overall NJDOT should play a larger role, and have a better understanding of all of such restrictions. Currently, NJDOT just oversees that such restrictions are enacted and filed properly, but not their actual content.

To this end, the moderator reiterated a key takeaway that there is a trade-off between the facilitation of economic growth, and municipalities putting in restrictions to maintain a high quality of life for residents. To follow, the moderator asked the participants about what supporting economic growth means, especially to the MPO participants.

The MPO participant responded that they consider the impacts to the local economy when prioritizing projects. Most approved projects are ones that local officials can administer by means of the Transportation Improvement Program (TIP). Currently, the MPO is developing their freight plan, and trying to determine which roads are most important local economy, including various locations such as warehouses, technology/industrial parks, and fisheries (including bridge deck clearances for vessels). Once these links are identified, they will then consider what the issues and needs of those links are before weighing the projects against the impact to the local economy.

On this topic of freight and economic development, another participant added that their main concern is availability of accurate data and information. During the development of the previous statewide transportation plan, the State didn't buy new data on freight generators, and already found it to be somewhat data. That data, 10+ years later is essentially obsolete. NJDOT needs new data to know about freight generators across the state. This information is especially important for regional and local planning in order to determine freight traffic from facilities to major highways and links. As such, the State needs to play a bigger role in providing such information, by acquiring licenses from groups providing data.

The moderator interjected citing Streetlight, an organization that collects and provides location-based service (LBS) data. The moderator then asked the participants if this could play a role in the context of freight and trucks.

The participants agreed that it could, but were cautious about how much it would cost. They were also concerned about the availability of capital and resources to properly work with and analyze such data. There is however a lot that these new data sources could dictate about overall freight demand and flow.

Next, the moderator asked about what the new industries and trends are in New Jersey are.

The participants identified that warehouses and distribution centers are increasingly being built further south in New Jersey where there is more land available. An example is Amazon which is constructing a massive distribution center in Burlington Township. These facilities are increasingly becoming more mechanized and 'vertical', but even so, there is still a need for manual labor, particularly in the assembling of diverse goods. Much of this is innovation is the result of the rise of 1-hour and expedited shipping. In addition, New Jersey maintains a heavy presence in the food packaging/manufacturing, seafood, drug, and chemical industries.

A participant did add however that NJDOT does not possess pipeline data, or even general data as to how much oil and diesel fuel is transported along roads. The same holds true with solid waste, stone, and gravel, which all have varying effects on the conditions of the local infrastructure system.

As an issue that New Jersey is grappling with, the moderator asked about the implications of old office parks and the recent rise of mixed-use development, especially for the state's overall economic climate.

A participant brought up the example of the revitalized Bell Works mixed-use complex in Holmdel. The massive corporate campus was revitalized and upgraded to include new amenities and is now considered a success.

The participants also brought up the topic of millennials who have expressed greater interest in urban living than earlier generations, and thus have contributed to the decline in office parks, and rise in mixed-use, urban-style developments. A significant question remains what trends will occur once millennials increasingly begin to have kids. Will they still want to be in urban areas, or increasingly migrate to the suburbs for the purposes of more physical spaces and better education opportunities?

The millennial generation is also driving the rise in telecommuting from people living both close and far from their physical employment locations. This particular trend will have big impacts on macro-scale transportation patterns, and could give rise to new trends such as tele-working centers, as an example cited by the participants.

The moderator followed up by asking about what this all means in terms of how New Jersey receives revenue from transportation.

The participants indicated that this will lead to both potential increases and decreases in transportation demand and the corresponding revenue.

However, in order to cope with other trends such as the rise of electric vehicles, New Jersey needs to institute some form of mileage-based tax, as opposed to (or in addition to) the traditional volume-based fuel tax. An example of a state that is responding to the gradual shift away from conventional fuel is Maine which is imposing higher registration fees for electric vehicles to make up for the reduced conventional fuel tax. In order to account for the increased ware on infrastructure from large trucks, NJDOT should consider a system of providing dedicated spaces for loading and unloading, in exchange for flat fees. UPS and FedEx often pay municipalities a flat fee in this format, and Philadelphia is already experimenting with a more formalized system.

At this point, the conversation shifted towards the overall topic of communication, including between other states, and with the private sector.

In particular, the participants responded that there needs to be more analysis of the impacts of tax incentives given to various companies by state economic development authorities.

In addition, there needs to be more coordination with other states. There is already a regional program in place with neighboring states to better coordinate truck rules and regulations, with the ultimate goal of developing a 'TSA Pre-Check'-style of program for trucks.

On this subject of communication, the moderator asked the participants if they often speak and coordinate with neighboring states.

The participants indicated that they mostly speak with New York via the Port Authority's G-MAP, a 4-state freight initiative, as well as Pennsylvania by means of DVRPC.

However, the participants also stated that in addition to the need for more communication, NJDOT needs to be able to participate more in relevant TRB committees so that it can be exposed to, and play a role in the development of effective best practices.

The moderator concluded by explaining the next steps in the strategic research process and by also thanking the participants for their input.

2. Improving Project Delivery to Achieve Better Outcomes: Summary

Focus Group Abstract

The project delivery process is a crucial component of NJDOT operations. This includes everything from project inception to final product delivery and every process in between and even including communication across different divisions. What is working well with the current process at NJDOT? What can be improved? How can NJDOT facilitate dialogue, communication, and collaboration across division boundaries?

Organizations Represented by Attendees

- NJDOT Program Management
- North Jersey Transportation Planning Authority (NJTPA)
- Delaware Valley Regional Planning Council (DVRPC)

Summary of Research Needs Identified

- Ability of NJDOT to cope with burdensome federal regulations, most notably ADA and Buy America requirements.
- Development and structure of full- as opposed to partial-scope projects, including dynamics/interactions between project managers, engineers, and planners.
- Incorporation of multi-modal components into relevant projects.
- Development of effective methods of project management, including software, and means of communication during early phases.

Key Discussion Points

The moderator began the meeting by asking the participants about what the main issues surrounding project delivery were, including how the Bureau of Research could potentially assist.

The participants highlighted a number of issues affecting project delivery, the first of which stem from burdensome regulations associated with two federal mandates. These include Buy America and ADA regulations.

ADA was sighted as a significant issue because of the effects it can have on a project's scope entirety. As part of these regulations, NJDOT is often forced to make extraneous,

expensive, or time-consuming ADA upgrades on what are originally meant to be smaller, limited scope projects. The participant cited how even time-sensitive infrastructure deterioration projects are sensitive to federally-required ADA upgrades that require significant amounts of additional resources.

Buy America regulations, requiring the use of American-made products, were recently strengthened. As a result, DOT projects are required to have larger proportions of American-manufactured materials. However, such products are often less cost effective. In some instances, as a participant noted, it's impossible to actually find a manufacturer for a specific part. To this point, the participant noted a previous example where NJDOT had to convince a foundry to manufacture a specific product. While the Federal Highway Administration (FHWA) was willing to provide extra funding for this burdensome process, given economies of scale on the part of the foundry owner, NJDOT was forced to buy more of the product than what was actually needed. Currently, that extra product is still unused given that there was no more need for it.

To the point of the Buy America restrictions, the moderator asked if there was a waiver process.

A participant replied that there was a waiver process that could be filled out. However, it is very difficult to successfully complete since it requires authorization by multiple entities at the federal level. The extraneous time and resources associated with completing this waiver process generally make it not worth pursuing, including by NJDOT.

To this point, a participant noted that on both the part of both ADA and Buy America, there is a need to balance cost sensitivity (taxpayer money) with FHWA mandates. Even though these regulations are theoretically implementable in isolation, their execution into project management has created significant issues. Part of the issue is that many of the associated decisions are not made by engineers or related personnel. On each of these points, a participant added that there needs to be more dialogue between the state and federal agencies.

At this point, the conversation shifted away from the topic of top-down regulations to internal departmental issues. It should be noted that of all the focus groups conducted, this particular one garnered the most spirited discussion.

A participant from the project management division indicated that another hindrance to project delivery is the tendency of the various divisions to take a 'while you're at it approach…' approach on projects. This approach has entailed requesting and tacking on additional work/tasks onto ongoing or planned projects, creating a 'Pandora's Box' of issues that delays project delivery time. According to the participant, this is especially common during the project conception phase, and that there is a need for project managers to remain more committed to original scoping goals.

While the moderator was originally curious to know about how internal dynamics play into this, another participant disagreed with the previous participant. In particular, this participant interjected that while limited scope projects are important for maintaining on-time

delivery, adequate project conception dialogue needs to happen so that any issues and important recommendations are ironed out/included in the project delivery.

On this point, another participant agreed. Historically, only approximately 70% of NJDOT's projects have been full as opposed to partial scope, meaning that 30% of the time, other potential project needs are not considered. This particular point was brought up by a member of NJDOT's bicycle/pedestrian division.

However, the participant from the project management division responded that at times, they felt that the bicycle/pedestrian division, as well as other divisions, try to 'tag along' in projects to which they don't have a full understanding of the intended limited scope, thus slowing down project delivery. In other words, tacking on additional project components may not be feasible/cost-effective in the long run, an important notion that planners don't necessarily understand, according to the participant.

To the point of dialogue in project planning, a participant from NJTPA indicated that they are currently working to roll out a mapping tool that will also allow users to provide input on what issues and improvements on projects. The output of this tool will be a scoping document. As a connection between policy needs, project expectations, and public input, the tool aims to better identify projects and project needs, while providing an organized means of identifying funding sources.

On the topic of NJTPA's platform, the moderator asked about what research was done to develop the tool.

The same participant replied that NJTPA did a desk scan on mapped-based project planning tools, but could not find many examples. As a result they decided to proceed on their own to develop one.

Returning to the topic of compliance with burdensome FHWA requirements (ADA & Buy America), the moderator asked the participants if they knew anything about how other agencies communicate to FHWAY.

A participant replied that they weren't aware of how other states or agencies go about with this communication, but that this was exactly the problem. FHWA has never provided NJDOT with best practice guidelines.

On the topic of project scoping, a participant indicated that planners and engineers need to collaborate and engage in more dialogue together, especially early on in the project conception phase. The participant also indicated that there needs to be a better means of targeting projects to specific grant management and funding sources.

At this point, the focus group concluded due to time constraints. The moderator concluded by explaining the next steps in the strategic research process and by also thanking the participants for their input.

3. Managing and Maintaining a 21st Century Transportation System: Summary

Focus Group Abstract

The turn of the 21st century has largely marked a transition from the aggregate construction of new transportation infrastructure, to the complex task of maintaining it for long-term use. This task is even more complex for NJDOT, given New Jersey's dense development and population density which puts added strain on the transportation system. Maintenance costs and demands are all growing, along with population, while revenues and funding sources remain stagnant at best. In this era of growing costs and limited funding, how can NJDOT best manage New Jersey's multi-modal transportation system in a safe and efficient manner?

Organizations Represented by Attendees

- NJDOT Statewide Planning
- NJDOT Local Aid

Summary of Research Needs Identified

- Allocation of funding between statewide and local projects, including with considerations for federal requirements.
- Allocation of funding for multi-modal projects, as opposed to surface transportation, and implications for increasing this.
- Improving methods of acquiring and training new staff/talent as a result of increased retirements.
- Methods of positioning NJDOT to respond to modern travel patterns and transportation needs.

Key Discussion Points

The moderator began the meeting by asking the participants how their divisions or organizations are planning ahead in terms of dynamic management.

A participant from NJDOT indicated that senior leadership at NJDOT is in the process of working on a strategic plan in order to develop a better understanding of what its workforce should look like at least 10 years from now.

Another participant indicated that while technology will be a crucial component of future operations, the primary focus of NJDOT should be on managing the physical 'bones' and keeping the multi-modal system in a state of good repair. If and when this can be achieved, NJDOT can then turn its attention to technology and sustainability applications. This would especially be the case since the private sector is largely taking the lead in developing CAVs. These CAVs will require

certain standards in order to operate safely and properly. The participant also noted that NJDOT is striving to have a 90% reduction in crashes in the future.

Another participant spoke about the travel demand patterns in urban portions of New Jersey. According to the participant, especially in northern New Jersey which is considered very urban, it will be important for NJDOT to consider these particular needs, given the growth of urban, mixed-use locations. On this topic, another participant added that one particular issue they see is that most local aid funding goes to surface transit, as opposed to multi-modal and bicycle/pedestrian.

At this point, the conversation shifted back to staffing. According to a participant, NJDOT used to have a program in place in which new engineers were rotated throughout certain NJDOT divisions so that they could get a good feel for the different departments. The participant went on to strongly recommend this, not only for engineers, but for all staff, for the purposes of stimulating planner-engineer knowledge transfer and interaction.

Following this discussion, the moderator shifted the discussion to more general dialogue. In particular, the moderator wanted to know how each of the participant's divisions or organizations formulate projects, and what are the methods of developing the best solutions.

A participant noted that when responding to congestion mitigation needs, a safety connection is tied in and taken into strong consideration.

Another participant spoke from the perspective of NJDOT's planning division. In particular, the division focuses in part on incorporating ITS and bicycle/pedestrian improvements where feasible and needed, particular in the conceptual and early phases of projects. However, the participant noted the conflict faced by the planning division, as well as all of NJDOT. In particular, the entirety of a project's scope is often pitted against how long it will take to complete that project. In the past, there was a general concern that by adding too many components to limited-scope projects, no matter how innovative they were, project costs and timespans would increase too much. However, NJDOT is beginning to take into account innovation, as opposed to just churning out as many smaller projects as possible. A participant from NJDOT's Local Aid Division agreed with this statement.

The conversation briefly shifted back to staffing. After agreeing with the previously made statement, the participant from the Local Aid Division also brought up the issue of staff attrition and the corresponding loss of departmental knowledge. Additionally, in the current environment of NJDOT, new employees are trained rapidly, and without other considerations such as knowledge/awareness of other divisions.

On the topic of project scoping, a participant added that part of the reason many innovative components aren't considered in certain projects is because of the need to stay within existing right-of-ways (ROWs). As such, there has been a focus on developing quick, resurfacing projects for roads, as well as bridge rehabilitation and replacement projects. A participant added to this point however that the bicycle/pedestrian division has become increasingly frustrated

with this process given that their components likely won't make it into such projects. To this point, a participant added that NJDOT's process is relatively effective in terms of congestion management, but not when it comes to sustainable bicycle/pedestrian planning. Overall, a holistic view is missing. The participant also went on to identify PennDOT Connects, an initiative by PennDOT that considers public outreach in the project scoping process.

Similar to these issues, a participant brought up the issue of NJDOT's project management division's ranking system for considering projects. For example, if a project does not score highly on safety, and most notably congestion, it won't be considered. At times, this can be an issue with regards to management of local projects which may not score as highly as other projects. A participant did add that as of recently, MPO scoring is now considered in this ranking system.

To these points, the moderator asked if the ranking system is tied into NJDOT's overall strategic planning process.

A participant indicated that NJDOT's long range strategic plan is very much out of date. While a new long range strategic plan is currently being developed, in the current system of operations, there is a disconnect between the management system and how the entire NJDOT should function. There is a need for a more holistic way of thinking, including departmental priorities.

The conversation then shifted to the topic of federal compliance. As a participant noted, federal requirements are for NJDOT to maintain an asset management plan. With the requirements of these plans however, it is important to make sure that functionally obsolete components of the infrastructure system are being addressed (e.g., through capacity expansion or operational improvements), in addition to resurfacing and replacement projects.

To this point, the moderator asked if federal requirements for asset management can sometimes get in the way of pursuing the most effective and meaningful projects for New Jersey.

A participant responded that NJDOT's capital investment strategy allocates a high percentage (80-85%) of funds to infrastructure improvements. Currently, NJDOT is in the process of determining the best means of pursuing strategic investments and meeting federal requirements.

At this point another participant did note that one particular challenge has been the use of federal money in local projects, given a number of oversight regulations and requirements. In particular, the participant cited this as a major area where research is needed.

As a means of responding to infrastructure needs, a participant cited the need for more up-to-date travel pattern/demand data, as well as the perils of relying on old census data for guiding modeling efforts. A participant elaborated on this, particularly regarding the rise of TNCs. The participant also wondered about what effects this will have on transit usage, as well as what tools would be needed to shift people to bicycle and pedestrian modes from traditional surface vehicles. Additionally, the participant noted the need for qualitative factors in decision making.

Another participant brought up the strategy of tactical urbanism as a means of evaluating potential infrastructure investment strategies. Tactical urbanism involves short-term, low-cost, and scalable interventions as a means of responding to a variety of needs. The participant noted that this may have merit to NJDOT's transportation infrastructure management.

The moderator then brought up the idea of how NJDOT functions (or needs to function) as a state vs. city DOT. Cities tend to be a lot more focused on transit needs, as opposed to state DOTs. In particular, the moderator wanted to know how this applies within the context of New Jersey.

A participant agreed with this. The participant also added that certain parts of New Jersey are already thinking in the correct mindset, but there is still more that needs to be done. There is a continued need for focusing on complete streets, pedestrian safety, and public transits. The entire multi-modal transportation system, end-to-end, should consist of a network of walking, biking, and transit, supplemented by ride sharing, which is in turn supplemented by occasional automobile trips. A challenge to this notion however is that NJDOT has swung too far in the direction of simply maintaining infrastructure and not integrating meaningful and effective policies. In this sense, technology advances alone won't solve the problems, but rather, there is a need for stewardship-based thinking.

The moderator concluded by explaining the next steps in the strategic research process and by also thanking the participants for their input.

4. New Technologies: Opportunities and Challenges: Summary

Focus Group Abstract

TNCs, UAVs, LIDAR, PTC, and CAVs are more than just abbreviations. In many cases, they're also the future of transportation. These technologies are evolving rapidly. Whether it be through vehicles that communicate with other vehicles and infrastructure systems, or the ability to survey bridges for structural integrity using drones, NJDOT needs to be at the forefront of harnessing these technologies. How can NJDOT best integrate new technologies into its operations in a manner that produces tangible results and in a cost effective manner?

Organizations Represented by Attendees

- NJDOT Statewide Planning
- NJ TRANSIT

Summary of Research Needs Identified

- Methods of connecting various data/project management software, along with analysis of best practices from other DOTs.
- Methods of leveraging technology to better integrate real-time data.
- Determination of how unmanned aerial vehicles (UAVs) can best be integrated into DOT operations.
- Determination of how to keep track of different travel patterns and respond accordingly, including different ways of reporting and updating such patterns.
- Scenario planning of connected and automated vehicle (CAV) market penetration.
- Analysis of declining public transit ridership and potential mitigations.

Key Discussion Points

The moderator began the meeting by asking the participants about what particular challenges they face related to the adoption of new technologies.

A participant indicated a number of challenges, the first of which is related to the ability to capture and analyze all necessary data on a day-to-day basis. This is especially the case given the widespread availability of real-time data. However, there is equally a growing need to actually present data in a meaningful manner. Given that the costs of acquiring and analyzing data are not cheap, this is an important challenge. From the New Jersey Transit perspective, added by another participant, lots of data is collected on paper. As such, there is a growing need to utilize

new technologies such as GPS integration, as well as to 'clean' raw data and to connect different datasets.

Another participant also indicated that one particular challenge NJDOT faces is getting people to use technologies. At times there is resistance from staff, given what may be considered outside the realm of existing duties and job requirements.

To these previous points, a participant summed up NJDOT's challenges with regards to technology as data processing in the short-term, and acquiring/making best use of the most applicable technologies in the long-term. Overall staff need to be able to analyze data to best support decision making, in both the short- and long-term.

Next, the moderator asked, in terms of specifics, what is affecting the participant's ability to perform their daily job.

A participant reiterated on the topic of manual/paper data collection. In particular, there is a need to move in the direction of electronic and automatic data collection. Another participant also reiterated the importance of actually getting people to use the technology, including the right equipment/software at the right times. Lots of times different systems or software aren't meant to be 'end-to-end' project enablers. Rather, there is an important need for proper and effective technical training. In a sense, this is also tied in with those issues related to staffing and retirement, in which technical knowledge can also sometimes disappear.

From here, the moderator asked about whether the participants have reached out to other NJDOT peers about their systems.

A participant responded that they have. From this process, NJDOT is now in the process of implementing e-Builder, a construction management software. e-Builder aims to consolidate grant management onto one platform. However, questions still remain. How does NDOT get buy-in from staff, including through the proper resources and training? How can e-Builder integrate with other systems?

Next, the moderator asked about the idea of an 'end-to-end' system. In particular, what are these ends?

A participant provided the example of the local grants process. The start (first end) of the grants process is at the local/municipal level, particularly with the ability to send in a request to NJDOT for project funding. Eventually, on the part of NJDOT, this turns into a funded project. At the 'end' of this system, the project is completed and eventually gets closed out. To this end the entire grant system consists of the following:

1. Initiation from applicants

2. Analysis of problem statement by NJDOT

3. Determination and selection of alternatives to solve the problem

4. Realization of actual project

5. Project delivery

Another participant agreed with this example, and also added that an end-to-end system requires knowledge of all projects, as well an ability to prioritize them. Continuing on this topic, another participant indicated that different divisions and departments are responsible for each of these 5 steps in the process. While there are committees that oversee multiple areas, overall knowledge is only as good as what comes out of each of the divisions.

To this point, the moderator asked if there was a way to share information in order to enable visibility.

A participant indicated the possibility of grouping and harmonizing projects based on common needs and features. However, another participant again brought up the threat of knowledge drain, through these and other processes, even with collaboration and enabling technologies in place.

Another participant added more information about the project prioritization process. NJDOT does have a process in place to rank different criteria (including congestion, drainage, and pedestrian safety were some of those criteria that were named) in order to prioritize projects. This process also provides the ability to combine projects, and also takes into consideration MPO scoring/ranking. According to the participant, this process is currently working well. This project prioritization process is discussed during periodic meetings held between New Jersey Transit, local MPOs, FHWA, and NJDOT, which have been occurring for 5-6 years now.

To add to this, a participant indicated that during the prioritization process, it is important to have a strong knowledge and understanding of the business and technological components. Bridging these two components is crucial. As such, during the data collection process, NJDOT needs to determine where they can leverage technology and where they can combine in-person data collection with passive technologies such as through apps.

The moderator then asked the respondents about what general technology questions they have, including in relation to whether other states are using certain models, processes or technologies.

A participant indicated that origin-destination data is always difficult and costly to collect. Since much of this information is now provided through third-party mobile data collectors, there is also a question of how much confidence there is in the data, especially since it is biased towards smart phone users. On this point, another participant added that there is a need to capture the full multi-modal components of origin-destination patterns, both individually and as linked trips.

Next, the moderator turned to the topic of new technologies being provided in both the public and private sectors, especially with regards to CAVs. In particular, what are the challenges that these are presenting to decision making.

A participant indicated that one particular challenge is that since CAVs are being developed largely within the private sector, for competitive issues, each firm develops their CAV technology in a unique way. Furthermore, such firms are often reluctant to release related specifications, including to the public sector/DOTs.

On the topic of other new technologies, the moderator asked what breakthroughs were realistic within the approximate 1-10 year time frame.

A participant responded that from the consumer perspective, use of smartphones in relation to transportation would continue to grow. Another participant also indicated that the use of drones for inspecting bridges and other infrastructure would also be a major breakthrough.

When asked about when CAVs would become more prevalent, the participants indicated that this would be more in the long run, at least 20 years from now. In addition, a participant also indicated that one particular challenge regarding CAVs will be with regards to communication with local/smaller roads. DOTs are currently moving in the direction/in the early phases of developing means of communication between roads, particularly highways, and the vehicles. Eventually such communication will need to be examined on local, smaller roads, as well as those roads with less than optimal driving conditions.

As an additional challenge that DOTs will likely face, a participant indicated interest in the potential changes to travel demand patterns as a result of additional CAVs. Given that they may lead to increased VMT, the participant wondered what the effects will be on preferences for commute times. The participant also indicated interest in the potential mobility benefits, given the possibility of developing on-demand personal transit systems.

Next, the moderator asked about what elements of advanced ITS will likely present challenges for DOT.

A participant indicated concerns about how well the current multi-modal infrastructure system will be able to accommodate advanced technologies. Similar to the topic of accommodating CAVs on local roads, the participant was concerned about how well vehicles will be able to interact with poorly maintained roads, or poor weather conditions. In other words, will there need to be new, upgraded, or minimum standards? Adding to this point, another participant indicated that locational technology accuracy will need to improve significantly.

Nearing the end of the focus group, the moderator asked about what NJDOT's overall role is, with regards to new technologies.

On the previously discussed subject of the private sector developing CAV technology, a participant indicated that NJDOT will need to begin dialogue with these various firms in order to make them more open to sharing what is often considered proprietary data.

The participants stated other roles for NJDOT including the following:

- Identifying and managing the equity, mobility, and environmental aspects of new technologies.
- Identifying and managing data and privacy considerations.
- Understanding the overall limitations of new technologies.
- Understanding the impacts to overall travel patterns, including effects on telecommuting, and public transit ridership.

The moderator concluded by explaining the next steps in the strategic research process and by also thanking the participants for their input.

5. Organizing, Staffing, and Sustaining the NJDOT of the Future: Summary

Focus Group Abstract

Like many other public agencies, NJDOT is at a crossroads. Highly skilled and seasoned veteran employees are retiring at a rapid rate, and not being replaced quickly enough by new hires due to a number of factors, putting NJDOT at risk for knowledge drain. What steps can NJDOT take to best position the agency, market itself to new hires, all while facilitating effective knowledge transfer?

Organizations Represented by Attendees

- NJDOT Human Resources
- NJDOT Right of Way and Access Management
- NJDOT Budget Office
- NJDOT Statewide Planning
- Rutgers University

Summary of Research Needs Identified

- Methods of expediting knowledge transfer in preparation for oncoming waves of experienced staff retirements.
- Increased training and collaboration so that staff have a strong understanding of their roles with respect to the broader mission of NJDOT
- Knowledge sharing and summaries of best practices to help staff gain practical understanding of the application of their jobs to the real world.
- Methods of coordinating staffing with general needs, including data collection and modeling and consistency in carrying out business processes.
- Identification and understanding of the consequences of reduced staffing availability.

Key Discussion Points

The moderator began the meeting by asking the participants about what trends they are seeing with regards to staffing at NJDOT.

A participant replied that approximately 2/3rds of the total DOT staff is eligible to retire in the next 10 years, with benefits. At this point, NJDOT is in the process of hiring additional full-time staff. However, the gap in terms of employment needs is growing as people continue to retire. One particular means of a hiring strategy that NJDOT is looking at is staff augmentation. This means that when a person retires or leaves NJDOT, an evaluation would be performed with regards to that person's skillsets, compared to what additional skills would be needed by future staff. According to the participant, augmentation is applied as a means of temporarily fixing middle-level staffing needs. Originally, some employees were scared that this was simply a fancy term for preparing to outsource work to consultants, but these nerves have since subsided.

On this subject, the moderator asked if it has generally been a 1:1 ratio in terms of skills replaced to skills needed for new hires, or are there different, evolving needs.

A participant from NJDOT's Right of Way Division (ROW) indicated that there is a trend towards requiring more tech-savvy hires. This is in part driven by an overall reduction in staff over the recent years. Examples of desired technical proficiency include Google Mapping, and application permit database management, as a result of the need to minimize human efforts. However, the participant also brought up the issue of funding which can get in the way of hiring adequate and high-quality staff.

The moderator followed up by asking about what the overall outlook of staffing is from the management perspective.

A participant indicated that there used to be a mentorship program in place that matched supervisors and directors with new staff, but it was discontinued under the previous administration. The participants agreed that this was a very effective program that should eventually be reinstated. Lots of times when veteran staff retire, their knowledge does not effectively transfer to new hires and the remaining staff. The participants also recommended that there should be a knowledge management guide posted on the NJDOT website, as well as knowledge/technology transfer events held every so often.

Next, the moderator asked given the issues of knowledge management and information sharing, how can NJDOT cut across the various silos and organizational constraints.

A participant from ROW replied that not all information is in the general NJDOT operations manual. Instead each retiree should provide a self-written 'how-to-do' list summarizing useful information from the manual, but with a more practical, real-world, and operations-specific touch. This should also be combined with training of newer staff and a mentoring program.

Another participant indicated that NJDOT is a very silo-oriented organization. Within the Human Resources Department, while there has been cross, developmental, and leadership training, including training provided by STEP of Mercer County, participating employees often return to NJDOT with limited ability to use recently gained insight.

The moderator then asked if NJDOT has actually had an opposite issue to what they face now, in which there were people with too many job responsibilities, rather than being in a silo environment.

A participant responded that a primary problem at NJDOT is that some managers want to refill staff as quickly as possible without looking at the potential or need for changing positions to match present and future needs. There has never been an issue of putting people into too many positions, but rather that too many people are in silo environments. According to the participant, this stems in part from civil service restrictions. For example, these restrictions state that for every primary level supervisor, there needs to be 3 subordinates, something with which NJDOT struggles to adhere to. In fact, these restrictions led to some people being promoted due to personal relationships rather than functional excellence. Other staff have gotten promoted too quickly, and not to positions that they are most qualified for.

To the point of civil service restrictions, another participant cited the opposite instance. About 5 years ago, their division lost a lot of staff, and was largely rebuilding from scratch. As a result, they were hiring mostly entry-level staff. While the hiring process was successful, there wasn't much opportunity for promotion given those restrictions. At this point, another participant noted that higher level openings are more often harder to fill given a lack of qualified staff.

A participant also indicated that Human Resources Department recently instigated an overfill strategy, taking into account attrition and retirement rates. The strategy, consisting of hiring staff in advance of when they would actually be needed worked out well in that certain departments actually came out with the same number of staff, but with more interaction between incoming and outgoing employees.

At this point, the conversation shifted towards the topic of consultants as a means of performing operations. A participant indicated that other state DOTs have larger proportions of consultants. Given the associated transient characteristics, knowledge transfer happens in a more smooth manner. However, not every function can be transferred to a consultant which is very important to keep in mind at NJDOT.

As a broader topic, the moderator asked where NJDOT is headed organizationally. The moderator also asked what the participants considered to be the 'ideal' staffed NJDOT.

A participant indicated that trends such as cost-per mile, e-builder, and advanced cost tracking are all factors that will shape NJDOT in the future. While such innovations will positively affect NJDOT, there is also a need for careful and successful integration. Otherwise the full potential associated with these technologies won't be fully maximized. Another participant indicated that the use of technology will be able to further streamline the Human Resources hiring process in future years.

At this point, the moderator asked if NJDOT communicates with other state DOTs on these topics.

A participant replied that communication does occur, primarily via AASHTO. However, the conversation quickly shifted back to internal issues in acquiring and securing talent. A participant indicated that NJDOT's biggest issues are associated with how much they can offer in terms of salary. Given budget restraints, it's hard for NJDOT (as well as other DOTs) to compete with the private sector which can offer better compensation. To combat this, the Human Resources Department aimed to develop lower-cost entry-level apprenticeship that could eventually evolve into full-time positions. However, this program is stuck in the development phase given a hiring freeze.

A participant additionally added that the biggest attrition rates within NJDOT are for bridge operators, at over 15%, as opposed to just 3% for engineers. In particular, NJDOT is attempting to recruit students from low-tech schools to begin working part-time.

Next the moderator asked about how NJDOT thinks about recruitment in regards to future generations beyond millennials.

A participant indicated that while younger generations prefer a more unstructured work-life, this isn't necessarily the case at NJDOT. In fact, based on experience, those hires that come to NJDOT do so for the more structured work environment, regardless of age.

Another participant did indicate that one particular challenge with new hires is that they have expectations of being promoted more quickly. Instead of this mindset, NJDOT and these new hires need to focus on organizational sustainability and core responsibilities.

The moderator concluded by explaining the next steps in the strategic research process and by also thanking the participants for their input.

6. Resilience to Climate Change and Other Threats: Summary

Focus Group Abstract

A coastal setting, high population, and dense concentration of multi-modal infrastructure all combine to make New Jersey one of the most vulnerable states to climate change, extreme weather, and human-made threats. Only 6 years ago, Superstorm Sandy came ashore here, completely washing away a portion of the Barnegat Peninsula in Mantoloking, and causing severe damage to multiple components of the statewide multi-modal transportation system. With almost all indicators pointing to increased risk from natural and human-made disasters, how should NJDOT move forward in protecting vulnerable assets and developing a more adaptive and sustainable transportation system?

Organizations Represented by Attendees

- NJDOT Environmental Resources
- NJDOT Statewide Strategies/Asset Management
- Delaware Valley Regional Planning Council (DVRPC)
- South Jersey Transportation Planning Organization (SJTPO)

Summary of Research Needs Identified

- Effective scientific data for climate change-based decision making. Specifically, attendees mentioned updating flood plain maps to take into account intensity-duration-frequency curves (for precipitation events) and sea level rise projections for periods within the useful life of transportation assets (5-50 years) and within long-range transportation plan horizons (25 years).
- Identification of cost-effective solutions that can be used to adapt transportation assets and networks to the impacts of climate change and other threats.
- Understand tradeoffs between repair, rehabilitation, and reconstruction strategies suggested by a life-cycle planning approach (corridor, network and system-scale) informed by climate change, and investments to support other strategic goals (such as safety, economic development, and environmental conservation).
- Modeling asset and system-level vulnerability to various climate stressors.
- Additional communication between various state agencies on issues of climate impacts to transportation, water, communications, housing, schools, social services, and other infrastructure and services.

- Staff capabilities to support climate vulnerability and risk assessment, asset management, and design decisions, including data modeling and centralized database practices.

- Integrating climate risk (damage and disruption costs) into cost-benefit analysis of capital investment strategies, life-cycle cost analysis for specific assets, and life cycle planning for corridors, networks, and systems.

Key Discussion Points

The moderator began the meeting by asking the participants, including those members of MPOs, about their overall perspectives on the relationships between climate change and transportation infrastructure resiliency.

A participant from SJTPO spoke on this. Atlantic and Cape May Counties in southern coastal New Jersey are conducting a sustainability and resilience. These counties are currently receiving money directed by the MPO to identify how vulnerable key assets are including roads and tunnels, as well as what technologies can be used in response. Some potential means of mitigation include permeable pavement, burns, sea walls, and sand dunes. According to the MPO participant, it is a matter of identifying assets and analyzing threats.

The moderator then elaborated on the concept of climate change vulnerability by asking the participants about how they respond to and balance the need for climate change adaptation, as well as general transportation needs such as resurfacing, reconstruction, and other demands.

A participant indicated that this decision-making is the role of each county. In particular, each county must create a fine balance between immediate and long-term issues. However, the participants weren't aware of the details as to how the different counties prioritize. A participant did highlight the topic of recovery also in regards to decision-making, particularly related to the need for good data and knowledge of how long newly implemented infrastructure will last for, as well as the relation to emergency management and evacuations.

Further elaborating on the topic of good data, the participants brought up the issue that there is currently no definitive map of the 2050 Flood Plain since this is largely dependent on data modeling and predictions. This, as part of the 2040-2060 time range, is probably the most important time range since most infrastructure built now wouldn't be designed to last longer.

Afterwards, the moderator asked the participants if the issue of policy decision making in regards to risk tolerance has been tackled, especially in relation to sea level rise. In other words, which questions are being asked? What are the next steps? What information is needed immediately?

The participants agreed that risk tolerance is the primary topic of consideration with regards to decision-making given that there is well-documented information on what the physical threats to the region are. As previously indicated, every county and organization approaches risk differently. While corresponding rules and regulations exist, there is no single standard. For example, some counties where flooding occurs are in acceptance of this and take the

corresponding approach of planning for traffic diversions. Other counties plan to increase maintenance spending to reduce delays, issues and closures.

At this point, a participant brought up the topics of nuisance and 'sunny day' flooding, noting that they are becoming more common. The participants indicated that this is attributed to roadways being previously built to lower standards, over-development, and previous disregard for environmental degradation effects.

As for implications for the research bureau, the participants brought up the need for cost-benefit analysis in the decision making process. For example, how much damage is avoided during the next major storm as a result of upgraded designs? In addition, there needs to be identification of low-cost solutions such as better maintenance and the associated best practices. This is especially with regards to the tradeoff between approaches suggested by life-cycle planning under a "business as usual" scenario (where more frequent maintenance activities might be prioritized) and proactive rehabilitation and replacement investments to reduce the frequency of damage and disruption under more severe climate change scenarios? What is the optimal solution? Additionally, the participants were interested in knowing how other states deal with resiliency and coordinating needed investments.

Still related to this decision making process, the moderator asked about how power supply and communications infrastructure play into managing the transportation network.

A participant replied that a lot of communications infrastructure issues have been addressed directly by the utility companies. They have been aided in large part by increased funding from the Department of Homeland Security. Another participant added that these assets are not run by the DOT or MPOs, and while they know they play a strong role, there hasn't been much communication between the different entities. The exception to this would be with the need to raise and protect critical infrastructure. At NJDOT yards, major infrastructure components, including those communication-related components, are raised to increase resiliency and to avoid future flooding.

Next, the moderator asked if there were best practices with regards to risk management and analysis with for general infrastructure, or other undertakings by other peer agencies, that NJDOT should know more about.

The participants indicated that there were a number of such undertakings. In Arizona, GIS is used to track and predict mudslides as a result of high temperature and rain, based on a comprehensive history of mudslides. Minneapolis has put together a detailed method for enlarging culverts, based on a number of factors. Kentucky also recently conducted a vulnerability assessment for the entire state. Locally, NJDOT is involved with a peer exchange in assessing severe weather impacts, which could serve as a best practice.

The conversation again returned to the topic of resiliency. New federal legislation is about to be adopted which requires checking of all public roads. Once those roads are affected twice by a natural disaster, those roads must be specially tracked, with repairs and maintenance

promptly made after emergencies. Eventually these requirements need to be built into how business in conducted.

A participant also indicated that NJDOT needs to take on the challenge of modeling asset vulnerability. At the state (and federal levels) all agencies should work off of the same maps and standards. The State needs to take more of an initiative on this, in collaboration with the Department of Environmental Protection, and Army Corps of Engineers, and local/regional stakeholders. The participant did indicate that certain branches of NJDOT have been working in collaboration with Rutgers University to develop a single set of such standards.

From here, a participant brought up the need for a statewide planning office. Even with up-to-date data and a single, coordinated set of maps, NJDOT does not have control of land use, which can have a significant effect on the corresponding infrastructure and land in which development occurs on. On the topic of green and sustainable infrastructure planning, a participant indicated that NJTPA is working with Passaic County to develop green infrastructure strategies in response to flooding. NJTPA is also working with NJ Water Works, as well as Hoboken and Newark to develop a set of complete street standards. It was also noted that while NJDOT looked at green design standards for highways, given projected water and flooding, it wasn't considered viable, although such standards should be pursued at the local level. The participants noted that green design of road infrastructure isn't designed to mitigate catastrophic flooding. Rather, it is mostly designed to capture the kind of events occurring many times a year, such as minor floods, for the purposes of not carrying pollutants into bodies of water. In terms of flood mitigation, such designs would not be sufficient.

Next, the moderator asked if there was any information at the statewide or national level, including data/information developed by NOAA to assist in mitigations and responses to flooding, that could be researched by NJDOT.

The participants indicated that data for predicted increases in precipitation would be needed by means of better models. One participant indicated that NYSDOT and Cornell University are working with USGS to improve 'fine grain' analysis on how a particular location will flood. Within New Jersey, a similar analysis needs to be undertaken. This is also in addition to the need to incorporate asset management planning.

In response, the moderator asked if NJDOT has the right staff to respond to these needs.

A participant indicated that NJDOT has the right people, but overall not enough staff who are able to code, visualize, and make information usable. NJDOT needs to develop visuals, not just more reports. Similar to how the financial sector is increasingly hiring more computer scientists, the transportation sector, and in particular NJDOT, need to do so as well, especially with regards to environmental engineers. At NJDOT, there is staff devoted to drainage, an important analysis area, but they are mostly focused on the overall permitting process, not data and engineering/resiliency analysis.

The moderator concluded by explaining the next steps in the strategic research process and by also thanking the participants for their input.