



TOLLING. MOVING SMARTER.

IBTTA BOARD BOOK
VOLUME 1

January 8-10, 2020
Coral Gables, Florida USA

Revised December 21, 2019

IBTTA Board of Directors and Committee Meetings

January 8-10, 2020

Coral Gables, Florida USA

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SCHEDULE OF IBTTA BOARD AND COMMITTEE MEETINGS

January 8-10, 2020

WEDNESDAY, JANUARY 8, 2020

NOTE: The events on this day from 7:30am to 5:00pm (except separate COPS meeting) are for IBTTA Board Members Only. This is a closed session exclusively for the IBTTA Board.

7:30am to 9:00am

Breakfast for IBTTA Board members

9:00am to 5:00pm

Orientation for ALL IBTTA Board members

INTENDED OUTCOMES

- Board Orientation:
 - IBTTA's current governance practices and policies
 - Best practices in professional organization governance
 - Barriers and obstacles to achieving effective governance at IBTTA, as identified
 - Discuss areas for improvement for the Board
 - Discuss roles and responsibilities of Board members and staff
 - Other elements, based on discussion with IBTTA and input from the telephone interviews
- Strategic Thinking:
 - Key issues identified during interviews
 - Key issues raised in white papers completed by working groups
 - Identify topics to be included in survey to members

2:00pm to 6:00pm

- Parallel session: Council of Platinum Sponsors meet 2:00pm to 6:00pm.

5:00pm to 6:00pm

- IBTTA Executive Committee meet with Council of Platinum Sponsors.

6:00pm to 7:00pm

Reception for **ALL ATTENDEES** including IBTTA Board, Committees and IBTTA members.

THURSDAY, JANUARY 9, 2020

NOTE: The events on this day are OPEN TO ALL IBTTA MEMBERS.

7:00am – 8:30am

Breakfast for all attendees

8:30am – 9:10am

- Finance Standing Committee of the Board

9:10am – 9:50am

- Membership Committee
- IBTTA Foundation Board (concurrent session)

9:50am – 10:30am

- Government Affairs Committee

10:30am – 10:45am

BREAK

10:45am – 12:00pm

BOARD MEETING

Emerging Technologies Presentation and Discussion

12:00pm to 1:00pm

Lunch for All Attendees

- Past Presidents Advisory Council (Meet over lunch in separate room)

1:00pm – 1:45pm

BOARD MEETING: Council of Platinum Sponsors Presentation and Discussion

1:45pm – 2:45pm

BOARD MEETING:

Continue strategic planning discussion with IBTTA Board members and all attendees

- Table groups convene for discussions on information from Emerging Tech and COPS
- Table leaders conduct specific exercises to identify the most important issues for IBTTA to focus on that may answer these questions:
 - What can IBTTA as the association do?
 - What can members do?
 - What could partners and allies do?

2:45pm – 3:00pm

BREAK

3:00pm – 4:00pm

BOARD MEETING

Leaders of Board Committees, Working Groups, Foundation, and Discuss their visions and goals for 2020 and beyond.

- Finance & Investment
- Audit
- Membership
- Government Affairs
- International
- Young Professionals
- Foundation

4:00pm – 5:00pm

BOARD MEETING

Report out from Table Groups

Evening Free

FRIDAY, JANUARY 10, 2020

NOTE: The events on this day are OPEN TO ALL IBTTA MEMBERS.

7:30am – 9:00am

Breakfast for all attendees

9:00am – 11:30am

Board of Directors Meeting

9:00am – 9:30am

Tolling Immersion Program Update

9:30am – 11:00am

The Board will review its Strategic Planning discussions

- Continue strategic discussions from Days 1 and 2
- CEO recap and next steps
- Other topics

11:00am – 11:30am

The Board will conduct routine board business and approve resolutions on Foundation board election, 401k, membership, investment policy, and conduct other necessary business.

11:30am

Adjourn

IBTTA 2020 Board of Directors as of December 21, 2019

First Name	Last Name	Company Name	Title	Term Ends
Ferzan	Ahmed	Ohio Turnpike and Infrastructure Commission	DIRECTOR	12/31/2020
Jessica	Carson	E-470 Public Highway Authority	DIRECTOR	12/31/2023
Mark	Compton	Pennsylvania Turnpike Commission	FIRST VICE PRESIDENT	12/31/2020
Jeffrey	Dailey	Central Texas Regional Mobility Authority	DIRECTOR	12/31/2021
Joi	Dean	Richmond Metropolitan Transportation Authority	DIRECTOR	12/31/2020
James	Eden	North Carolina Department of Transportation, Turnpike Authority	DIRECTOR	12/31/2023
Andrew	Fremier	Bay Area Toll Authority, Metropolitan Transportation Commission	DIRECTOR	12/31/2023
Diane	Gutierrez-Scaccetti	State of New Jersey Department of Transportation	SECOND VICE PRESIDENT	12/31/2020
Bill	Halkias	HELLASTRON (Hellenic Association of Toll Roads Network)	DIRECTOR	12/31/2021
James	Hofmann	North Texas Tollway Authority	DIRECTOR	12/31/2022
Samuel	Johnson	Transportation Corridor Agencies	PRESIDENT	12/31/2020
Laura	Kelley	Central Florida Expressway Authority (CFX)	DIRECTOR	12/31/2022
Julia	Monsó	Cintra	DIRECTOR	12/31/2021
María	Moreno	SEOPAN	DIRECTOR	12/31/2022
René	Moser	ASFINAG	DIRECTOR	12/31/2023
Mark	Muriello	The Port Authority of New York & New Jersey	DIRECTOR	12/31/2021
Kathryn	O'Connor	Rhode Island Turnpike and Bridge Authority	DIRECTOR	12/31/2021
Patty	Rubstello	Washington State Department of Transportation	DIRECTOR	12/31/2022
Massimo	Schintu	AISCAT (Associazione Italiana Società Concessionarie Autostrade e Trafori)	DIRECTOR	12/31/2020
Malika	Seddi	ASFA (Association Professionnelle Autoroutes et Ouvrages à Péage)	INTERNATIONAL VICE PRESIDENT	12/31/2020
Timothy	Sturick	Thousand Islands Bridge Authority	DIRECTOR	12/31/2022
Benton	Tempas	Northwest Parkway LLC	DIRECTOR	12/31/2023
Juan	Toledo	Miami-Dade Expressway Authority	DIRECTOR	12/31/2020
Christopher	Tomlinson	State Road & Tollway Authority	IMMEDIATE PAST PRESIDENT	12/31/2020
Joseph	Waggoner	Tampa-Hillsborough Expressway Authority	DIRECTOR	12/31/2020

IBTTA Strategic Plan

Adopted by the Board August 29, 2015

(Editor's Note: This strategic plan builds upon the work conducted by the IBTTA board of directors and interested parties during the board meetings in January 2015 and April 2015 and in subsequent correspondence between members and staff. The IBTTA Board of Directors adopted the plan below on August 29, 2015 recognizing that it is a living document and subject to ongoing review.)

OVERVIEW

On April 24, 2015, a strategic planning group consisting of Board members, other key stakeholders, and senior staff of the International Bridge, Tunnel and Turnpike Association (IBTTA) met to update its long-range strategic direction. Carolyn Lugbill, CAE, a Senior Consultant of Tecker International, LLC and president of Going Global Matters led the group through the planning process.

This planning document defines IBTTA's clear strategic direction. It is the planning group's consensus on what will constitute the Association's future success. It answers the following two fundamental strategic questions:

1. Why will IBTTA exist in the future? *Its reason for being and core purpose.*
2. Where is IBTTA going? *Its future direction and goals.*

Planning Strategically:

The existence of this strategic direction and its successful implementation signals the leadership team's desire to lead IBTTA strategically. Developing a strategic direction is not a one-time event, but an ongoing commitment and process. The strategic direction represents a compass that will be used to guide and focus IBTTA's future strategic decision-making and ongoing operational work.

Strategic Focus:

Organizational strategic focus or intent is very important. One of the challenges that IBTTA faces is the fact that there is more it can do for members and key stakeholders than it has resources to accomplish. The temptation to do everything can often lead a not-for-profit organization to try to be all things to all people. Planning strategically is the counter to the all-things syndrome. It is about identifying a limited number of goals that IBTTA must undertake to move successfully into the future.

Strategic Approach/Philosophy:

The approach in defining the new strategic direction was not to identify what IBTTA wants to continue doing today (its current operational plan). Rather, the leadership team determined what the Association is not doing today, but must engage in to be successful in the future.

This strategic direction is not about business as usual — *it is about the change needed to*

stay relevant! This separates the strategic plan from the operational plan. Both are important. The strategic direction is a constant reminder, as the leadership team oversees the development of the annual operational plan, of what must be changed to stay relevant to what members are seeing in their real world.

Updating the Strategic Plan:

A strategic plan can only stay current and relevant if IBTTA insures that the plan is updated. It is the leadership team's *working document*. Therefore, the governing body has both the right and the responsibility to:

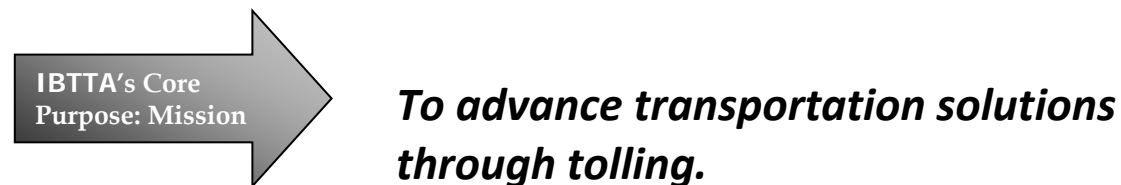
- 1) change the strategic plan any time it needs to be changed based on sound reasoning and assessment; and
- 2) Update the plan regularly on an ongoing basis.

Long-Range Strategic Planning Horizon (10 to 30 Year Envisioned Future)

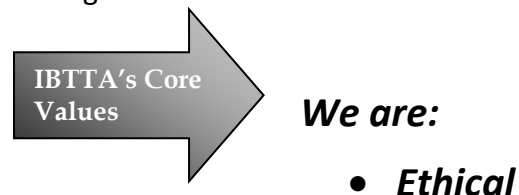
A 10 to 30 year planning horizon was developed, which consists of IBTTA's core ideology and 10 to 30 year envisioned future.

Core Ideology/Mission clarifies what must be preserved in an environment of increasingly rapid and unpredictable change. Core ideology consists of IBTTA's core values and core purpose.

The **core purpose** describes IBTTA's very reason for being or existing — *why the organization will or should exist into the future* (10 to 30 years). What would be lost if it ceased to exist? What sense of purpose will motivate members to dedicate their creative energies to IBTTA and its efforts over a long period of time?

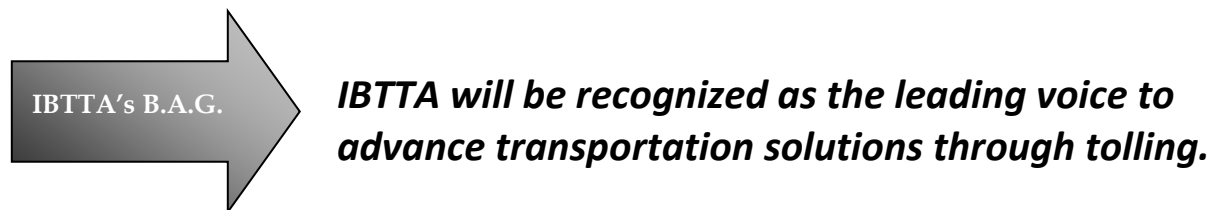


Core values are a small set of timeless, guiding principles that do not require external justification. They only have intrinsic value and importance to IBTTA and its members. Core values are so fundamental that they seldom change — *if at all*. They define the behavior required in order for the organization to achieve its core purpose. Core values are so deep-seated and valid that IBTTA would preserve the core values even if it were admonished for having these values.



- ***Collaborative***
- ***Collegial***
- ***Credible***
- ***Accountable***
- ***Innovative***
- ***Inclusive***
- ***A knowledgeable resource***

The ***10 to 15 year envisioned future*** consists of a single, ***big audacious goal (B.A.G.) or vision***. The B.A.G./vision is a goal (that is, IBTTA's vision statement) that stretches beyond IBTTA's current three to five year goals. Because it is "audacious" it represents a significant challenge and its achievement will require IBTTA to move outside of its comfort zone. It is clear and compelling to all members. It has a clear finish line which will take both time and hard work to accomplish. The goal should stimulate leadership activity, commitment and participation beyond IBTTA's present leadership. It helps to set the direction for the succession of future three to five year strategic plans. IBTTA can only manage one B.A.G. at a time.



A vivid description shows what IBTTA and user financed roads will look like when the association successfully achieves its Big Audacious Goal. The following description helps to clarify what is intended by the goal and provides measureable indicators of achievement.

In 2025:

Overall, the world has better, safer highways, bridges, and tunnels.

- There will be national and multinational interoperability.
- Congestion pricing will have been embraced by more urban areas, particularly in Tier 1 Regions, (i.e., New York, Chicago, etc.).
- Tolling has become a broadly accepted method of funding transportation solutions.
- States have the legal authority to toll interstate highways, if they so choose.
- Tolling should be considered for all new capacity.
- Road Usage Charging (RUC) or Vehicle Miles Traveled (VMT) fees will be in place in some

U.S. states.

- On board technology in connected vehicles will allow any jurisdiction to toll any road or implement RUC.
- Tolling will be a leading solution for congestion relief and for enhancing mobility through new capacity.
- Transportation pricing is in place in all metro regions.
- There will be more intelligent roads that interface with connected vehicles, creating more desirable options and resulting in fewer incidents.
- The user experience is much more personalized and specific, being able to meet users' expectations.

IBTTA has:

- Members from every entity that collects and/or supports the collection of tolls.
- An internationally recognized image and brand.
- A high level of collaboration with other associations.
- A \$1,000,000 foundation endowment.
- 3,000 delegates at its Annual Meeting.
- A current and accurate data clearinghouse of industry information.
- Every Department of Transportation (DOT) or Ministry of Transportation (MOT) as a member.
- Increased financial strength in support of the organization's goals.
- Developed a well articulated public education campaign.
- 20% of its membership from major regions in Asia (i.e., India, China, Japan, etc.) and South America and Europe.

Strategic Long-Range 3 to 5 Year Goals

The following represents IBTTA's goals that encompass its three to five-year direction. These goals are outcome-oriented statements that lead IBTTA towards its envisioned future. These goals are not in any order of priority. All of the goals will need to be accomplished, if IBTTA is to fully achieve its three to five-year quest.

In 2020:

Goal A: Transportation policies will facilitate tolling and other forms of user charging.

Goal B: Continental interoperability of electronic toll collection (ETC) is functionally possible.

Goal C: IBTTA members, stakeholders and nonmembers will find indispensable value in the association's programs, products, services, and meetings.

Goal D: IBTTA will be recognized for having a current and accurate clearinghouse of "key" industry data.

Goal E: IBTTA will be known for having an effective functioning "SWAT" team of tolling experts/champions/advocates/evangelists to effect positive outcomes in transportation.

LONG-RANGE GOALS & STRATEGIES

Strategies indicate how IBTTA will organize, focus and expend its resources and actions to maximize its effectiveness and efficiency in achieving its three to five year goals. The strategies must be reviewed and updated on an annual basis.

The strategies were rated in importance of when they should be undertaken (implementation timing). The three ratings include:

High: *Work on this strategy must be undertaken in the next program/fiscal year.*

Medium: *Work on this strategy should be undertaken in the next program/fiscal year if at all possible.*

Low: *Work on this strategy can wait until a subsequent program/fiscal year if necessary.*

Indicators of Achievement are used to determine the overall progress toward a goal. They indicate how close IBTTA is to achieving a goal as it executes the individual strategies for each goal. ***They measure goal achievement, not strategy achievement.***

Goal A: Transportation policies will facilitate tolling and other forms of user charging.

Strategies:

A1. (High) Encourage the removal of barriers to tolling.

A2. (High) Develop multi-state educational program pilots to increase the understanding and need for tolling and other forms of user charging to:

- better inform the general public, media, key stakeholders and policy makers.
- establish education programs that define appropriate uses of toll revenue.
- provide outreach to other bodies interested in sustainable and economic growth.
- identify worldwide best practices that encourage information exchange.
- clarify the message

A3. (Medium) Sustainability, economic growth, and environmental concerns – congestion tolling is a tool for these issues

Indicators of Achievement:

An increase in:

- ⇒ tolling on existing lanes of US Interstate highways
- ⇒ electronic tolling on-board units
- ⇒ awareness of real costs of transport infrastructure
- ⇒ membership and advocacy for tolling solutions
- ⇒ strategic partnerships that advance tolling solutions for members as well as non-members
- ⇒ partnerships for economic and mobility enhancements around the world

The existence of:

- ⇒ specific educational materials for political decision makers, stakeholders, media and the general public.
- ⇒ Information on user pays principle and cost transparency of transport infrastructure
- ⇒ Partnerships with tolled as well as non-tolled entities advancing transportation solutions through tolling
- ⇒ Restrictions lifted on the use of tolling at the federal, state and local levels to address transportation and economic development opportunities

Goal B: Continental interoperability of electronic toll collection (ETC) is functionally possible.

Strategies:

B1. (High) Develop a consensus definition of what interoperability would be from the customers' and operators' perspective, including:

- identifying all the constraints to be overcome.
- dealing with technical issues– standardization.
- Dealing with data exchange issues – availability of a harmonized/standardized data exchange hub as a solution.
- Addressing legal issues.
- working through contractual challenges.
- aligning and consolidating IOP initiatives.
- developing an operating plan for North America IOP solution.

Indicators of Achievement:

An increase in:

⇒ sufficient standards established, for example:

- DSRC communication protocols, and
- License plate standards.
- Data exchange hubs to minimize costs of transmission and data exchange
- Regional solutions that bridge to national interoperability
- Market demand and user support by entities and suppliers for interoperability

The existence of a:

⇒ consensus definition of what IOP should be from membership:

- Single tag for user
- License plate tolling
- Single invoice for the user
- Expansion of regional hubs that can be linked nationally

⇒ Plan for IOP – concept of operations for a uniform North American System and agreement and support from membership.

Goal C: IBTTA members, stakeholders, and nonmembers will find indispensable value in the association's programs, products, services, and meetings.

Strategies:

Meetings/Committees

- C1. **(High)** Review and update the meeting schedules (correct days and times) to dramatically reduce meeting schedule conflicts.
- C2. **(Medium)** Send marketing/meeting information to other agencies; include session summaries with measurable performance results that can be learned.

Leadership Development

- C3. **(Medium)** Develop meetings for all levels, and put in place new leadership development programs for young professionals
- C4. Review the Leadership Academy by developing:
- program targets;
 - ways to improve the experience;
 - ways to make the experience more consistent; and
 - A mid-level management academy.
 - Web-based learning opportunities from some of the material presented at the leadership academy

Products and Services

- C5. **(High)** Develop new products, programs and services that create new sources of net non-dues revenue.
- C6. **(High – 2011)** Improve the overall quality of data through standardization (data committee and staff).
- C7. **(Medium)** Develop publications that members want and need (survey members on their wants and needs).
- C8. **(Medium)** Create a Speakers Bureau.

Indicators of Achievement:

An increase in:

- ⇒ membership and membership retention.
- ⇒ non-dues revenue.
- ⇒ meeting participation.
- ⇒ paying non-members at meetings and programs.
- ⇒ attendance and participation of young professionals.
- ⇒ the level of engagement of governing bodies members (not just at Annual Meeting).
- ⇒ participation in and consistency of programs at the Leadership Academy.
- ⇒ hits on IBTTA's website resources.

A decrease in conflicts with competing meetings.

The existence of:

- ⇒ publications used by members (e.g., equal billing to “MUTCD”).
- ⇒ improved quality/definitions – “standardize” IBTTA data.
- ⇒ a Speaker Bureau available as a resource.
- ⇒ a high quality Leadership Academy experience.

Goal D: IBTTA will be recognized for having a current and accurate clearinghouse of “key” industry data.

Strategies:

- D1. (High) Identify “key” industry data to be compiled and tracked and what will not be tracked.
- D2. (Medium) Establish team of staff and member participants to develop strategy for compiling and updating data including frequency, response incentives, etc.
- D3. (Medium) Publish stories on how data has been used to positively impact the advancement of worldwide tolling and tolling organizations.

Indicators of Achievement:

An increase in:

- ⇒ public awareness and understanding of the toll industry business
- ⇒ knowledge of key industry data and interpretation of trends and actual developments
- ⇒ Consensus on “key” data is achieved and provided to member organizations
- ⇒ Responses by member organizations to “key” data requests
- ⇒ Use of data to positively impact tolling and tolling organizations
- ⇒ Non-member organizations and outlets are publishing and using “key” data
- ⇒ Hits on data by members and requests from non-members is tracked and increases shown
- ⇒

The existence of a:

- ⇒ Database properly filed and used
- ⇒ Ideal graphical means of presentation and comparison
- ⇒ Expanded use of “key” data by both member and non-member organizations
- ⇒ Increased participation by member organizations to provide and update “key” industry data

Goal E: IBTTA will be known for having an effective functioning “SWAT” team of champions/experts/advocates/evangelists to effect positive outcomes in transportation.

Strategies:

- E1. (High) Enlist “SWAT” team members
- E2. (High) Develop strategies for communication plan and information to be used by SWAT Team Champions. Keep information updated and available.
- E3. (Medium) Build succession planning for new SWAT Team Champions

Indicators of Achievement:

An increase in:

- ⇒ Calls for and opportunities to provide transportation/tolling advocacy
- ⇒ Identified SWAT Team Members
- ⇒ Positive impacts on transportation through SWAT Team efforts
- ⇒ Collaboration with other industry professionals (AASHTO, AMVA, etc.) on SWAT Team efforts

The existence of a:

- ⇒ Broad acceptance and use of the SWAT team
- ⇒ Positive contacts with stakeholders by the SWAT team
- ⇒ Defined number of contacts organized and in the responsibility of the SWAT team
- ⇒ Identified SWAT Team Champions
- ⇒ Information/talking points for use by SWAT Team Champions
- ⇒ Alliances with other industry professionals in combined SWAT Team initiatives
- ⇒ Collaborative calls, webinars, meetings of SWAT Team Members to discuss and refine outreach/evangelism efforts

ASSUMPTIONS ABOUT THE FUTURE

In order to make progress toward an envisioned future, an organization must constantly anticipate the strategic factors likely to affect its ability to succeed and to assess the implications of those factors. This process of building foresight about the future will help IBTTA to constantly recalibrate its view of the relevant future, a basis upon which to update the strategic plan.

These seven assumptions were gleaned from the work done in January and listed on the slides presented at the April 2015 Strategic Planning meeting:

- There will be an increase in IBTTA membership among cities and departments of transportation.
- There will be increased emphasis on transportation solutions that are multimodal.
- There will be an increase in the use and integration of mobile-based technology. Moreover, mobile based technology will lower cost and increase revenue.
- There will be an increase in the movement away from using fossil fuels for transportation.
- There will be an increase in the use of virtual offices and working remotely.
- There will be an increase in the use of tolling to support mobility needs, including HOT lanes, transit and other modes.
- There will be an increase in attention given to mileage based user fees to replace the gas tax.

The items below are additional assumptions highlighted in table discussions at the Strategic Planning meeting in Portland.

- There will be a change in the demographics and needs of our customers.
- There will be increased emphasis on getting more throughput out of existing infrastructure capacity through active traffic management and other means.
- There will be an increase in transportation solutions that are “multi-party,” (e.g., DOT with a Metropolitan Planning Organization (MPO) that consists of a toll operator with a customer service center and commercial real estate).
- There will be an increase in the complexity and diversity of parties involved in financing infrastructure projects.
- There will be an increase in the public demanding greater transparency in the allocation of resources for infrastructure funding.
- Connected vehicles may change the way the tolling industry does business, and IBTTA will need to be a participant in this dialogue.
- Autonomous driving.

###

IBTTA THREE-YEAR PLAN | 2019-2021



FROM VISION TO REALITY

OCTOBER 1, 2018

IBTTA
TOLLING. MOVING SMARTER.

IBTTA Three-Year Plan | 2019-2021

October 1, 2018

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IBTTA THREE-YEAR PLAN IN BRIEF

What Is This Plan?

- It is a vision of what IBTTA wants to become in the next three years.
- It is a request for additional staff and funding to strengthen the programs and services we offer now and begin to achieve the new outcomes our members want.
- It is a proposed budget for 2019 and a rough outline of budgets for 2020 and 2021.
- It is an acknowledgment that we have “hit a wall,” that our current staff, consultant, and technology resources are fully engaged, and we cannot make new gains without additional resources.
- It is a description of the tremendous opportunities that lie ahead for IBTTA and its members.
- It is a description of the investments we need to make over the next three years to do what’s most important to serve our members in keeping with our strategic plan.

What Will the Members Get Out of This Plan?

- **OUTCOME 1: STRENGTHENING CURRENT PROGRAMS AND SERVICES.** These include meetings, advocacy, and communications.
- **OUTCOME 2: DATA AND ANALYSIS.** A fully mature **TollMiner™ data product** with key information on every toll facility and operator in the world.
- **OUTCOME 3: KNOWLEDGE TRANSFER.** Developing a more systematic way of capturing the knowledge that resides in the minds of individual experts and practitioners in the IBTTA community and making that knowledge more accessible to all members.
- **OUTCOME 4: INDUSTRY VISION.** Integrating our industry more appropriately into the fabric of the larger transportation community.

How Will We Pay for These New Investments?

This plan proposes a dues increase phased in over three years. See **APPENDIX 1-5** for a full description of the three-year financial forecast and dues increase.

BACKGROUND

This document outlines a plan for IBTTA for the next three years, 2019 – 2021. It connects our strategic plan with our vision of the future and the new programs we must advance to stay relevant as an association.

In July 2012, the IBTTA Board of Directors met in Atlanta to discuss the future of IBTTA, its major communications campaign, and how to pay for it. After months of discussion and deliberation, the Board realized that while IBTTA had a strategic plan, it didn't have the resources to implement it. Our major objective in 2012 was to launch an ongoing, proactive, and permanent communications campaign to position tolling in a positive light and give it a seat at the table for important policy discussions. We've been successful in doing that.

This moment in 2018 feels a lot like 2012 in terms of the opportunities and challenges we face. Back then, we rose to the challenge of creating and launching a communications campaign that everyone agrees we should have been doing for years but we simply didn't have the money to do. The results of our communications campaign over the last six years prove that when we commit to do something and dedicate appropriate resources to do it, we can be successful.

Now we're called again to advance with even greater vigor the major goals of our strategic plan, which are to:

- Enhance our clearinghouse of key industry data – TollMiner.
- Create indispensable value for members and stakeholders in our programs, products, services, and meetings.
- Advance policies that facilitate tolling and other forms of user charging.
- Effect positive outcomes in transportation.

We have a highly motivated, talented and energetic staff that is committed to the membership and mission of IBTTA and functions as a team. Nowhere is the dedication of staff more apparent than in the results it has delivered over the past five years. As dedicated and capable as our staff is, it is also now stretched to the limit of its abilities. We have hit the proverbial wall. We have grown the work of IBTTA significantly over the last five years while growing the staff size only marginally. Therefore, if we want to do more and offer more programs and services that are essential to members, we need more resources including people, technology and systems.

WHAT WILL THE MEMBERS GET OUT OF THIS PLAN?

OUTCOME 1: STRENGTHENING CURRENT PROGRAMS AND SERVICES.

Anyone who has spent any time with IBTTA knows what we're good at. We excel in putting on world class meetings that are known for excellent, relevant content, high production value, and valuable networking opportunities. We excel in advancing an industry-wide communications campaign that has helped foster more positive news coverage of our industry. We excel in advancing government affairs efforts which, combined with our communications campaign, have created a public policy environment more favorable to tolling. These programs are IBTTA strengths. Under this three-year plan, we intend to build on these strengths.

While our meetings, communications, and advocacy efforts are appreciated and well received, there is always room for improvement. To strengthen the content and execution of our meetings, we must:

- Develop a broader view of tolling and its future to attract a wider mix of delegates representing ITS, transit, state departments of transportation, metropolitan planning organizations, international and other audiences.
- Reach beyond traditional speakers to include new voices from academia, think tanks, local governments, environmentalists, and catalysts of the new economy.
- Reach deeper into member organizations to attract young professionals and encourage IBTTA stalwarts to engage the next generation of leaders who have a different perspective on the industry.
- Focus more attention on alternative ways to delivering educational content to serve those with limited ability to travel.
- Expand content delivery methods that encourage more interactivity and participant driven learning.
- Expand and support international membership outreach and the needs of non-US based members.

How Members Benefit. Members will come away from IBTTA education programs with a better chance to address challenges at home because of access to a wider spectrum of experts, more robust webinars and distance learning, new voices, and more timely and interactive content delivery.

OUTCOME 2: DATA AND ANALYSIS. A fully mature TollMiner data product with key information on every toll facility and operator in the world.

Good data helps us manage and grow every aspect of our work: communications, advocacy, business development, marketing, meetings, and the day to day operations of all our businesses.

Two years ago, we began to build TollMiner, IBTTA's data visualization tool. Our goal is to have it become the most important and effective repository of toll industry information for the benefit of our members and others who need it. Because of the information we've collected in TollMiner to date, we know that there are 129 distinct tolling entities in the US operating 332 separate toll facilities with 6,027 center line miles in 35 states. We also know there are 46 priced managed lane facilities in 11 states covering 644 center line miles operated by 25 distinct entities.

We didn't know these things two years ago and this is just the beginning. We know them today because we went out and meticulously collected the data from publicly available sources and from our members and put them into a robust data visualization tool. Now our members can know, on a daily basis, the extent of tolling in the US. We are increasing our knowledge about the industry every day, adding new data elements such as traffic and revenue figures for each toll operator.

This is a painstaking and laborious process. There are no shortcuts in collecting, cleaning, verifying, and displaying accurate data. How long does it take to plan and conduct the decennial US Census? Years. In a similar way and with limited resources, we have begun to collect the most important data on tolling. The members appreciate that we're making progress and that we have much more to do.

We can feel the opportunity but are stifled by the lack of resources. Wouldn't it be great if someday we have relevant data on every toll facility and operator (members and non-members) from around the world? It's a lofty goal, but eminently achievable with the right resources.

How Members Benefit. With our tolling data visualization tool TollMiner we have identified more than 60 "use cases" or questions that we can now answer about every toll agency and facility in the U.S. We have also identified nearly two dozen more use cases that we intend to answer in the next couple of years. We will continue to work on expanding not only our data set but also the use cases and analytical tools that will help toll agencies, consultants and vendors to see their own metrics in relation to others and make better business decisions. This, we believe, will be a major benefit to our members.

OUTCOME 3: KNOWLEDGE TRANSFER. Developing a more systematic way of capturing the knowledge that resides in the minds of individual experts and practitioners in the IBTTA community and making that knowledge more accessible to all members.

In the partnership between members and staff that defines IBTTA, we provide indispensable value to members and stakeholders in countless ways. From our 5-6 educational meetings each year, to our advocacy and government affairs efforts, to our communications campaign, TollMiner, daily newsletter and more, IBTTA is an ongoing collaboration that transforms member needs into solutions.

Addressing Current Issues

While emerging issues are often fun to explore, they often compete with efforts to resolve issues that are vital to current tolling operations.

For example, some experts have pointed out that critical back office, toll lane, call center, and related technology systems at many toll agencies are either reaching end of life or becoming obsolete. From this perspective, one can argue that while we must examine the new needs of the future (CAV, MaaS, RUC, etc.), we can't ignore the need to maintain and upgrade current systems that keep toll agencies in business.

To best serve our members, we need to be nimble and agile. We need to be poised to help them not only address current challenges (maintain and upgrade current systems, etc.) but also help them figure out how to address new developments. IBTTA is like a horseback rider standing on two different horses at the same time: one horse represents the present and the other represents the future. While we run the risk of falling off, we must continue to ride them both.

Deeper peer to peer networking beyond formal meetings

Late last year, we asked IBTTA board members to talk to us about key issues on their minds. One item that came up repeatedly was the idea of creating opportunities for peer networking and exchange outside of formal meetings. One board member said:

"Peer to peer interaction is key. We need to make sure we have other channels of communication open to our peers in the industry. We have subject matter experts in different disciplines in our organization, but a lot gets lost. How do we add to what we're currently doing to get higher levels of communication among other agency staff?"

A key role for IBTTA in the coming years is to help our members cope with current and future operational issues by developing the capability to bring experts together, curate and disseminate appropriate information about effective practices, and provide a forum for members to incubate new ideas. One example of how IBTTA is already fostering this type of

collaboration is through the active and robust CAV Working Group. Working Groups enable our members to build strong bonds and learn from one another, especially those who are not able to travel to in-person meetings. Also, under the leadership of First Vice President Chris Tomlinson, IBTTA is developing a peer to peer exchange pilot program that will launch in 2019.

Addressing Emerging Issues: Example – Connected and Automated Vehicles

On June 23, 2018, the IBTTA Board held a three-hour long discussion in Harrisburg, PA on the future of Connected, Automated, Shared and Electric (CASE) Vehicles. According to the post-board meeting survey, 17 of 17 Board members responding were satisfied or very satisfied with the CASE vehicle discussion. In response to the question “What was your favorite aspect of the Board meeting?” 8 of 10 Board members mentioned the CASE discussion, future vision, emerging issues, or “looking at new ways to improve transportation.” It appears that board members like to be engaged in these discussions and believe that focusing on the future is one of their main roles.

The discussion at the board meeting was a natural culmination of discussions about connected and automated vehicles that have been percolating in IBTTA and the industry for several years. IBTTA’s Platinum Sponsor Advisory Council has been looking at the issue for more than a year. And IBTTA’s CAV Working Group, which formed in June 2017 and has held monthly conference call since then, also set the stage for the board discussion. All of these discussions are natural outgrowths of the fact that several toll agencies are conducting CAV testing on their facilities including truck platooning and partial or fully autonomous vehicle testing.

We believe that CAV will have a significant effect on the operations and future financing of toll facilities. As one of the presenters on a CAV session said at the Portland Finance Summit in July, “Everyone is going to change their behavior, but they are not all going to change their behavior in the same way.” As an association, we need to have a much better understanding of those changes in behavior, how they will affect the tolling industry, and how we can positively affect federal and state policy discussions to recognize the needs of toll operators in this area.

How Members Benefit 3. Knowledge transfer is about developing a more robust and systematic way of capturing the knowledge that resides in the minds of individuals in the IBTTA community (experts, practitioners, etc.) and making that knowledge more accessible to all members. Acting independently, individual members could spend millions of dollars acquiring the knowledge and skills to effectively address the current and emerging issues they confront. As IBTTA board member Mark Compton put it, “If I do it myself, it costs more and won’t go anywhere.”

OUTCOME 4: INDUSTRY VISION. Integrating our industry more appropriately into the fabric of the larger transportation community.

Transportation is changing extremely rapidly. We have seen more rapid change in transportation in the last five years than we've seen in the previous 10 years. And that accelerating pace of change is likely to continue. **APPENDIX 6** contains a rollout of some of the biggest changes our members have observed since joining the industry.

In November 2016, IBTTA convened a "Transportation Visioning Summit" with leaders of 18 transportation-related associations and societies. The purpose of the summit was to develop a vision for a federal transportation program that addresses current and future challenges. While the summit did not conclude with a single vision, the event is considered an important step in advancing a common vision among major transportation groups.

That summit touched on a wide range of important issues including autonomous and connected vehicles, smart cities and smart design, the future of freight and goods movement, and making the case for infrastructure investment. As robust as the discussions were at the time, no one in that day-long meeting of transportation leaders used the expression "mobility as a service." And, yet, today it's hard to read an article about transportation without constantly coming across that phrase.

Indeed, two new associations have recently sprung up with "mobility as a service" in the name. One is called the Mobility as a Service Alliance, which Ertico formed as a public private partnership primarily serving Europe. The other is called the Mobility as a Service Association formed by tolling and ITS industry veterans Jack Opiola and Tim McGuckin.

Are these new associations our competitors? Who knows. The important thing to note is that change is happening very rapidly, and we should be asking ourselves some important questions:

- What is the significance of Mobility as a Service (MaaS) to the tolling industry?
- What effect will connected and automated vehicles have on transportation in general and tolling in particular?
- What is the future of Road Usage Charging and which institutions – states, telecom companies, toll operators – will take the lead in advancing RUC?
- How will global efforts to address climate change affect automobile design and production and what influence will these changes have on our industry?
- What effect will all of these changes have on our industry's appetite for credit and the decisions of rating agencies?

These are existential questions. Our members are rightfully concerned about the future (and their livelihood) because of rapid changes and uncertainty.

But these are also times of great promise. For individuals and institutions that position themselves to embrace change, the future can be bright. We at IBTTA want to help our members experience a bright future, whether road funding and finance continues in its present form or it takes on a completely different form.

Looking to the future, we need to prepare IBTTA to continue to be relevant to our members. One board member recently observed:

“Digitalization of information and introducing new means of payment are huge issues for us. If we don’t reflect on this, then other industries like telecom will do it for us. It will be a hurricane for the whole world of transportation. Are we prepared just to be in charge of the maintenance of assets?”

APPENDIX 7 contains a rollup of other key issues on the minds of Board members.

How Members Benefit. IBTTA members benefit when their association follows the advice of hockey great Wayne Gretzky to “Skate to where the puck is going, not where it has been.”

WHERE WE'VE BEEN AND WHERE WE'RE GOING

Like a well-run toll agency that understands the importance of maintaining existing assets, we need to invest in IBTTA to maintain the asset we've built over the years.

In the past several years, we've focused on growing the membership and committed ourselves to a steadily growing effort to directly respond to member requests for better data, which has culminated in TollMiner. At the same time, we have worked very hard to stringently manage expenses. There is a strong recognition among the Board and members that costs will increase even if we just "stay the course" on current operations. Chris Tomlinson expressed it well during the June Board meetings in Harrisburg when he said, "looking out over three years in all of our organizations the one thing you can count on is that costs escalate over time."

During that same Board meeting, we identified many IBTTA programs or activities that didn't exist as recently as five years ago. **APPENDIX 8** contains a rollup of major accomplishments from 2013-2017. We support all of those activities today without having had a dues increase since 2015.

Beyond maintaining the current asset we've built, we also need to upgrade and improve the asset to support the growing list of things our members are asking us to do to respond to future challenges like Data, CAV, MaaS, RUC, etc. In response to June Board Survey question, "What program or activity do you most believe IBTTA should STOP doing?" one board member responded simply, "There is no program/activity to stop." In other words, "keep doing what you're doing, and do all these new things, too!"

NEW DIRECTIONS IN 2019-2021

In this plan, we have described in four broad categories the outcomes that we believe IBTTA should focus on over the next three years:

- **Outcome 1: Strengthening current programs and services.** These include meetings, advocacy, and communications.
- **Outcome 2: Data and analysis.** A fully mature **TollMiner data product** with key information on every toll facility and operator in the world.
- **Outcome 3: Knowledge transfer.** Developing a more systematic way of capturing the knowledge that resides in the minds of individual experts and practitioners in the IBTTA community and making that knowledge more accessible to all members.
- **Outcome 4: Industry vision.** Integrating our industry more appropriately into the fabric of the larger transportation community.

How did we identify these specific outcomes? We asked for and listened to inputs from members who have completed post-meeting surveys over the last two years; the IBTTA board in one-on-one interviews and in group discussion at board meetings; member who have

participated in conference planning meetings or served on meeting planning groups; all of the committees serving IBTTA in any capacity, including board committees, functional committees, platinum sponsors, and the IBTTA Foundation Board; and IBTTA staff.

THREE-YEAR FINANCIAL FORECAST NARRATIVE

The three-year financial forecast in **Appendix 1** is intended to help IBTTA achieve the major outcomes that we've outlined in this document. Here we describe the basic assumptions and drivers of this forecast.

REVENUES

Membership Dues: Membership revenues will be driven by the dues structure described in **Appendix 3**. There are different percentage increases for different classes of members. If you think of 100% of the dues increase happening over three years, 50% of the increase takes effect in 2019; 30% of the increase takes effect in 2020; and the final 20% of the increase takes effect in 2021. This model assumes that the number of members stays **constant**. It also assumes that the toll revenues of Active members remain constant. In other words, we do **not** project that a toll operator will move from one dues category to another. Obviously, we expect the number of members to **increase**. However, to be conservative, we neither assume an increase in the number of members nor a movement of members from a lower dues class up to a higher dues class based on a toll revenue increase.

Meetings (Registration, Sponsor, Exhibit): This model assumes that meeting revenues increase 5% per year for the period 2018 through 2021.

EXPENSE

Personnel and Benefits: This model assumes an annual market adjustment in salaries of 3% per year for the period 2018 through 2021. In 2019 we add two staff: one administrative staff to support activities throughout the company; and one research associate to help with data analytics (TollMiner). In 2021 we add another staff to help with TollMiner consulting services, analysis, products, etc.

Communications: This model assumes a 5% increase in the cost of communications consulting costs in 2019 and a 2% increase each in 2020 and 2021.

Data Analytics: This model assumes we add a consultant subject matter expert and technology in 2019 that continues in 2020 and 2021. There is a 2% increase each in 2020 and 2021.

Public Affairs: This model assumes we add a consultant subject matter expert who works in 2020 and 2021 on research and writing in the run up to federal transportation reauthorization.

Member Services: This model assumes a 2% increase per year for the period 2018-2021.

Revenue Generating Meetings: This model assumes a 2% increase per year for the period 2018-2021.

Board and Administrative Meetings: This model assumes a 2% increase per year for the period 2018-2021.

Office Administration: This model assumes a 2% increase per year for the period 2018-2021.

APPENDIX 1: THREE-YEAR FINANCIAL FORECAST

Description of Items	2018 Budget	2019	Dif '19 - '18	2020	Dif '20 - '19	2021	Dif '21 - '20
Association Income							
Membership Dues	\$ 2,798,957	\$3,176,733	\$ 377,776	\$3,436,248	\$ 259,515	\$3,612,728	\$ 176,481
Meetings (Registration, Sponsor, Exhibit)	2,357,321	2,478,121	\$ 120,800	2,602,027	\$ 123,906	2,732,128	\$ 130,101
Total Income	\$ 5,156,278	\$5,654,854	\$ 498,576	\$6,038,275	\$ 383,421	\$6,344,857	\$ 306,582
Association Expense							
Personnel & Benefits	\$ 2,372,266	\$2,731,434	\$ 359,168	\$2,813,377	\$ 81,943	\$3,041,778	\$ 228,401
Program Related		-		-		-	
Communications	257,550	269,850	12,300	275,247	5,397	280,752	5,505
Data Analytics	175,000	325,000	150,000	331,500	6,500	338,130	6,630
Public Affairs	60,000	60,000	-	136,200	76,200	138,924	2,724
Member Services	287,350	293,097	5,747	298,959	5,862	304,938	5,979
Revenue Generating Meetings	1,322,700	1,349,154	26,454	1,376,137	26,983	1,403,660	27,523
Board and Administrative Meetings	91,450	93,279	1,829	95,145	1,866	97,047	1,903
Office Administration	507,103	517,245	10,142	527,590	10,345	538,142	10,552
	\$ 5,073,419	\$5,639,059	\$ 565,640	\$5,854,155	\$ 215,096	\$6,143,371	\$ 289,217
Association income over expense before investment income	\$ 82,859	\$ 15,795	\$ (67,064)	\$ 184,120	\$ 168,325	\$ 201,485	\$ 17,365

SUMMARY OF CHANGES IN REVENUE AND EXPENSE BY MAJOR FUNCTIONAL CATEGORY

	2019	2020	2021
REVENUE			
Membership (Rev)	See Appendix 3	See Appendix 3	See Appendix 3
Meetings (Rev)	5% increase	5% increase	5% increase
EXPENSE			
Personnel & Benefits	3% market adjustment + 2 FTE	3% market adjustment	3% market adjustment + 1 FTE
Communications	5% increase	2% increase	2% increase
Data Analytics	Add 1 Consultant SME	2% increase	2% increase
Public Affairs	No increase	Add 1 Consultant SME	2% increase
Member Services	2% increase	2% increase	2% increase
Revenue Meetings	2% increase	2% increase	2% increase
Administrative Meetings	2% increase	2% increase	2% increase
Office Administration	2% increase	2% increase	2% increase

APPENDIX 2 – DUES PHILOSOPHY

When the IBTTA Board approved a dues increase in 2012, they adopted a dues philosophy to ensure that the dues increase would be appropriate for each category of member. We propose the same dues philosophy for the proposed 2019-2021 dues increase.

Here are the principles of the dues philosophy:

1. All members experience some level of dues increase.
2. Preserve, more or less, the relative share of dues contributed by each of the major classes of members.
3. Obtain the largest portion of the dues increase from the largest agencies and companies that are capable of absorbing the dues increase (e.g. Large and Extra Large North American Active members and Sustaining members).
4. Improve the fairness of the dues structure between the smallest and the largest Active Members in terms of dues paid as a portion of toll revenues.

The chart on the next page shows the effect of the proposed dues increase on every category of member in this order:

- North American Active (toll operator) members
- Non-North American Active (toll operator) members
- Group Members
- Associate Members
- Sustaining Members
- DBE Members

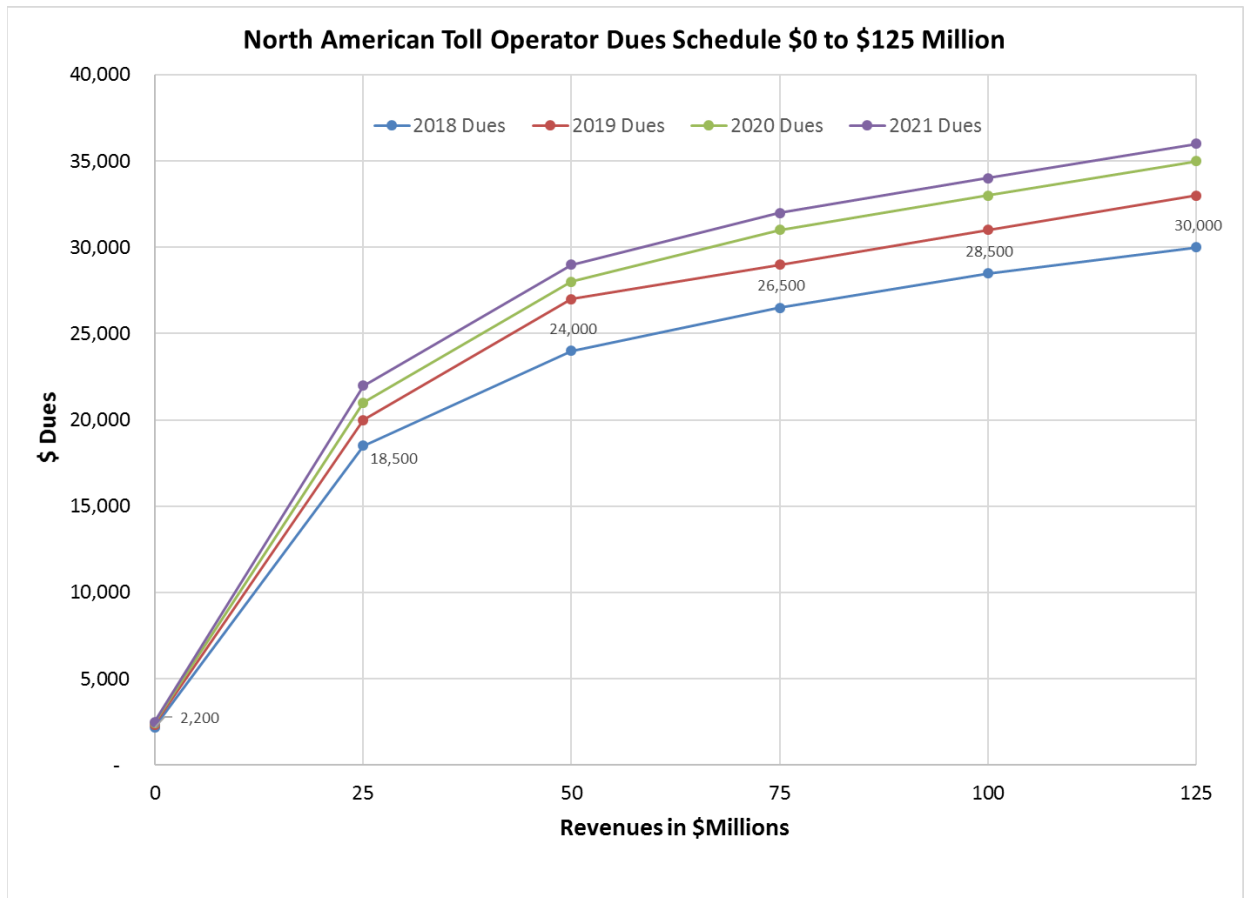
APPENDIX 3: PROPOSED 2019-2021 DUES STRUCTURE

Active North America Toll Revenues in \$Millions	# of members	TOTAL 2018 DUES REVENUE	Average 2018 Dues	2018 Dues	2019 Dues	2020 Dues	2021 Dues	18 to '19 increase	19 to '20 increase	20 to '21 increase
0 \$	10	\$ 22,000	\$ 2,200	\$ 2,200	\$ 2,350	\$ 2,440	\$ 2,500	7%	4%	2%
25 \$	21	\$ 233,548	\$ 11,121	\$ 18,500	\$ 20,300	\$ 21,300	\$ 22,000	10%	5%	3%
50 \$	5	\$ 112,712	\$ 22,542	\$ 24,000	\$ 26,500	\$ 28,000	\$ 29,000	10%	6%	4%
75 \$	4	\$ 97,801	\$ 24,450	\$ 26,500	\$ 29,300	\$ 30,900	\$ 32,000	11%	5%	4%
100 \$	4	\$ 108,489	\$ 27,122	\$ 28,500	\$ 31,300	\$ 32,900	\$ 34,000	10%	5%	3%
125 \$	3	\$ 87,672	\$ 29,224	\$ 30,000	\$ 33,000	\$ 34,800	\$ 36,000	10%	5%	3%
300 \$	11	\$ 346,715	\$ 31,520	\$ 35,000	\$ 40,500	\$ 43,800	\$ 46,000	16%	8%	5%
700 \$	7	\$ 245,000	\$ 35,000	\$ 35,000	\$ 42,000	\$ 46,200	\$ 49,000	20%	10%	6%
1500 \$	5	\$ 175,000	\$ 35,000	\$ 35,000	\$ 45,500	\$ 51,800	\$ 56,000	30%	14%	8%
2000 \$	3	\$ 105,000	\$ 35,000	\$ 35,000	\$ 47,500	\$ 55,000	\$ 60,000	36%	16%	9%
Active Non N.A. \$	11	\$ 155,655	\$ 14,150	\$ 17,500	\$ 19,300	\$ 20,300	\$ 21,000	10%	5%	3%
Group \$	4	\$ 100,000	\$ 25,000	\$ 25,000	\$ 27,500	\$ 29,000	\$ 30,000	10%	5%	3%
Small Assoc \$	65	\$ 155,000	\$ 2,385	\$ 2,500	\$ 2,800	\$ 2,900	\$ 3,000	12%	4%	3%
Med Assoc \$	30	\$ 240,000	\$ 8,000	\$ 8,000	\$ 9,200	\$ 9,920	\$ 10,400	15%	8%	5%
Sustaining \$	35	\$ 525,000	\$ 15,000	\$ 15,000	\$ 18,000	\$ 19,800	\$ 21,000	20%	10%	6%
DBE \$	23	\$ 22,388	\$ 973	\$ 995	\$ 995	\$ 995	\$ 995	0%	0%	0%
\$	241	\$ 2,731,980								
		Active N.A.		Total Dues Revenue 2018	Total Dues Revenue 2019	Total Dues Revenue 2020	Total Dues Revenue 2021			
		Active Non N.A.		\$ 1,533,937	\$ 1,793,145	\$ 1,947,060	\$ 2,050,341			
		Group		\$ 155,655	\$ 171,600	\$ 180,400	\$ 187,000			
		Small Assoc		\$ 100,000	\$ 110,000	\$ 116,000	\$ 120,000			
		Med Assoc		\$ 155,000	\$ 173,600	\$ 179,800	\$ 186,000			
		Sustaining		\$ 240,000	\$ 276,000	\$ 297,600	\$ 312,000			
		DBE		\$ 525,000	\$ 630,000	\$ 693,000	\$ 735,000			
				\$ 22,388	\$ 22,388	\$ 22,388	\$ 22,388			
				\$ 2,731,980	\$ 3,176,733	\$ 3,436,248	\$ 3,612,728			
					2019	2020	2021			
		Percent dues increase for smallest agency member			7%	4%	2%			
		Percent dues increase for median agency member			11%	5%	4%			
		Percent dues increase for 3 largest agency members			36%	16%	9%			

APPENDIX 4: Proposed Dues Structure, North American Toll Operators (\$0 to \$125 Million)

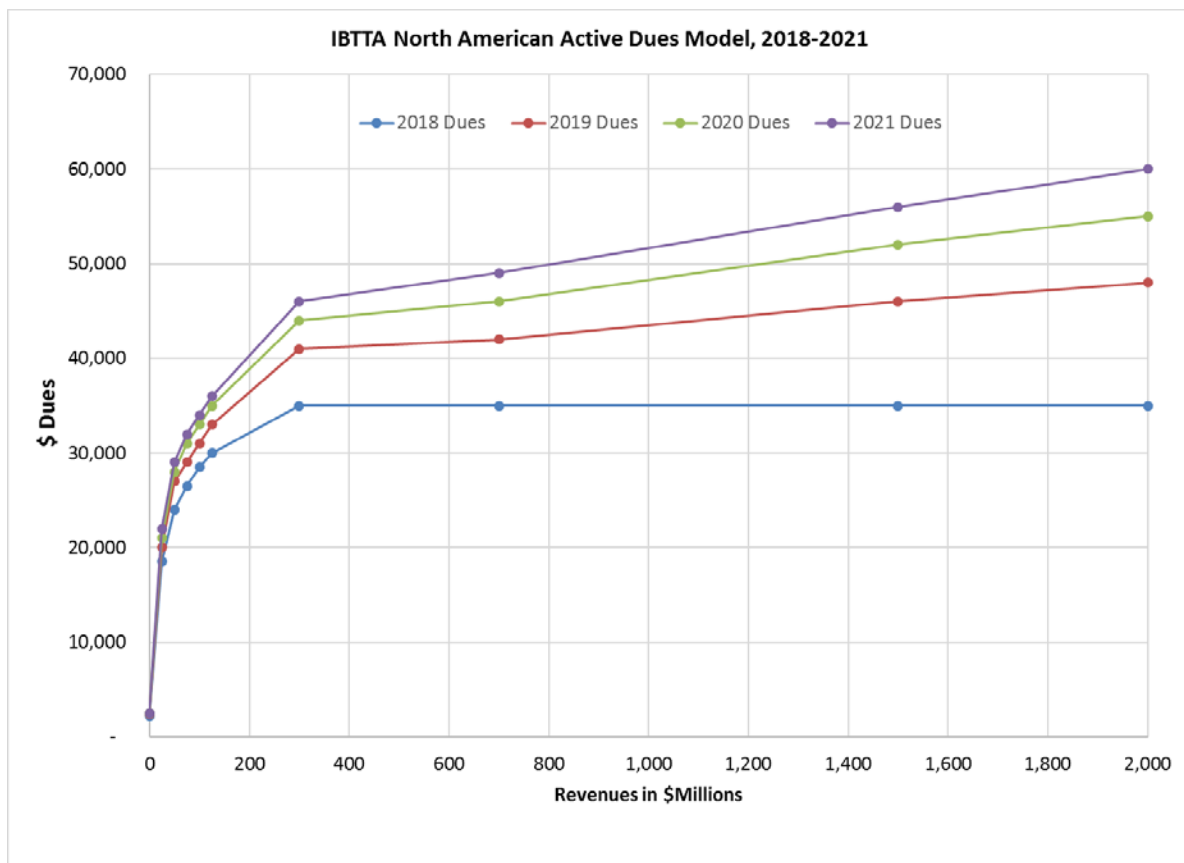
This chart illustrates the current and proposed future dues structure for North American Active (Toll Operator) Members. We show this level of detail here because the North American toll operator members account for nearly 60% of all IBTTA dues revenue.

The blue line towards the bottom of the chart is the current dues structure. The other lines show proposed dues levels for 2019-2021. To show more detail, this chart includes only members with toll revenues between zero and \$125 million. The next chart shows the dues structure continuing above \$125 million in toll revenues.



APPENDIX 5: Proposed Dues Structure, North American Toll Operators (\$125 Million to \$2 Billion)

This chart illustrates the current and proposed future dues structure for North American Toll Operator Members with revenues between 0 dollars and \$2 billion. The blue line towards the bottom of the chart is the current dues structure. Notice that the information from the previous chart – toll revenues between 0 dollars and \$125 million – is compressed into the left side of this chart. Also notice in the current dues structure – the blue line at the bottom – dues are capped above \$300 million in toll revenues. The proposed new dues structure would increase the dues for the 15 toll agencies that currently have more than \$300 million in toll revenues.



APPENDIX 6: BIGGEST CHANGES YOU'VE OBSERVED SINCE YOU JOINED THE INDUSTRY

Exercise conducted during the IBTTA Conference Planning Meeting, July 22, 2018

1. ETC
2. More women
3. Tolling in the news
4. Managed lanes
5. Shared vehicle services
6. AET / Coin toll booths
7. Toll is not a 4-letter word
8. Managed lanes
9. Use of data
10. From a focus on road infrastructure to a focus on mobility services
11. AET and human interaction with customers
12. Congestion management
13. How transportation is funded
14. From finance to mobility providers
15. Evolution of customer experience
16. P3 tolling to implementing projects quicker
17. Conversion to AET and use of managed lanes
18. Customer first operational attitude
19. Technology and materials in roads and bridges
20. Cash was interoperability; now ETC is interoperable
21. Move to AET in some areas; move backwards and away from AET in other places
22. Increasing collaboration in transportation and tolling
23. Manual tolling to AET
24. How we've used technology for tolling as a mobility service
25. More collaboration and fewer silos; toll operators are working with DOTs
26. Use of technology
27. Diversity in the workforce
28. People see the benefits of tolls including reliability
29. Tolling is a meaningful solution to transportation
30. From inward to outward

APPENDIX 7: KEY ISSUES ON THE MINDS OF IBTTA BOARD MEMBERS

In late November and early December 2017, we spoke by phone with most of our 2018 board members. The goal was simple: check in with each person to see how they were doing and learn about the issues that are top of mind with respect to their operations and IBTTA. Below is a summary of the major issues and themes covered in the calls. Quotation marks indicate a direct quote or a close paraphrase of what someone said.

Deeper peer to peer networking beyond formal meetings

- “Peer to peer interaction is key. We need to make sure we have other channels of communication open to our peers in the industry. We have subject matter experts in different disciplines in our organization, but a lot gets lost. How do we add to what we’re currently doing to get higher levels of communication among other agency staff?”
- “There is tremendous value in the network of people who are consistently there at meetings. How do you reach deeper into organizations to include more people at meetings?”
- “How do we better facilitate conversations among peer groups of people in agencies?”
- “How do we engage more people on a peer to peer level within IBTTA?”
- “How do we share best practices and failures; could we do a peer exchange as has been done in AASHTO?”

Public Private Partnerships

- “How do we make less feasible projects more feasible?”
- “There have been a number of valuable public private partnership projects in the works, but politicians have been struggling to jump over the hurdles to bring them to completion. From inception to revenue stream is a long time. State government officials are already backing up from projects that we thought long ago would be successful. I’d like to hear how other states have gotten across the line on newer projects.”

Revenue protection

- “What is the cycle for educating agency board members about the world of electronic toll collection.”
- “We need more effective reciprocity of violation enforcement across state lines.”
- “We don’t want to publicly expose the underbelly of revenue leakage.”

Let’s get practical!

- “We keep covering the same topics in the same way at these meetings. Someone talks about an emerging challenge that we need to prepare for without providing a practical, real world action or solution to address it. We need to hear more about the practical aspects of things that are being done.”
- “How do we present value to members who cannot make it to meetings?”

Connected and Autonomous Vehicles

- “What’s our role? Disseminating information, advancing a policy, or developing technologies? What are the consequences for tolling and managed lanes in 10 years?”
- “Road operators have not been fully invited into the discussion of CAVs.”

Digitalization of information.

- “This is a hot topic. Introducing new means of payment. If we don’t reflect on this, other industries like telecom will do it for us. It will be a hurricane for the whole world of transportation. Are we prepared just to be in charge of the maintenance of assets?”

Opponents and Supporters

- “Our legislature is anti-toll.”
- “The most helpful thing for me is public acceptance of tolling.”

APPENDIX 8: MAJOR ACCOMPLISHMENTS 2013-2017

Communications

- Launched and sustained a very successful communications campaign, “Moving America Forward.”
- Built ongoing relationships with national and international media.
- Created several data-rich reports, positioning IBTTA as a credible resource.
- Launched our daily e-newsletter, IBTTA SmartBrief
- Relaunched our Tolling Points blog.
- Build a vibrant and robust social media presence on Facebook, Twitter, LinkedIn, and Instagram.
- Created a standalone Communications Workshop.

Advocacy and Thought Leadership

- Strengthened public policies that support tolling through the FAST Act.
- Held a landmark Transportation Visioning Summit with the leaders of 18 key transportation associations and continued to nurture the relationships we built there.
- Reached consensus on how to achieve nationwide interoperability of electronic toll collection.
- Established the Platinum Sponsor Advisory Council as a future looking think tank for the association and industry.
- Launched a Connected and Automated Vehicle Working Group, a vital forum for sharing knowledge and ideas.

Meetings and Member Service

- Launched the Innovation TECH Talks, one of the most popular and creative features of our successful technology workshops.
- Established the Membership Committee and hired new staff, which resulted in a significant increase in membership, sponsorship, and exhibits.
- Created TollMiner, our powerhouse of toll industry data, which is still new and has great potential to serve our industry.
- Created a Scholarship Program to help support undergraduate students pursuing transportation-related degrees.

Deliverables as Part of IBTTA Three-Year Plan

Originally presented to the Board October 26, 2018

(Outcomes are written in **BLACK**. Text in **BLUE** signifies work to achieve the outcomes.)

During the October 13, 2018 Board meeting, the IBTTA Board adopted this resolution on the three-year plan:

Resolved that the IBTTA board adopt the three-year plan as presented and instruct staff and the finance committee to prepare a detailed 2019 budget and implementation plan based on the structure outlined in the three-year plan. Be it further resolved that budgets for 2020 and 2021 will be approved (not now but later) in the normal course of the board's action in 2019 and 2020.

In response to the Board's adoption of the 3-year plan, the IBTTA Executive Committee and staff developed the following deliverables, including a measure of success in parentheses at the end of each item. Some items lack a specific quantifiable measure of success either because it is self-evident or a good measure cannot be identified now. We recognize it's better to have a crude measure of the right thing than a specific measure of the wrong thing.

OUTCOME 1: STRENGTHENING CURRENT PROGRAMS AND SERVICES. These include meetings, advocacy, and communications.

Deliverables:

1. **Speakers with New Perspective.** Reach beyond traditional industry speakers to include new voices from academia, think tanks, local governments, the technology and mobility community, environmentalists, and others in 2019 meetings. (20% increase in this type of speaker vs 2018.
 - a. This was a priority for the Orlando Technology Summit (March 2019) planners and feedback from our post-Workshop survey reflected many comments about the number of outside speakers and new thinkers that they heard throughout the Summit. This is one of the overall objectives for all meeting planners.
 - b. IBTTA's Communication and Change Management Summit's Meeting Planning Group has planned a diverse set of speakers from inside and outside the tolling industry, entry level to executive level speakers, a mix of ethnic background and 55 percent of the speakers are women. IBTTA is partnering with the WTS Puget Sound Chapter for the Summit in Seattle.

2. **International Speakers.** Increase International participation in IBTTA meetings and in meeting planning groups to include non-US based speakers with relevance across the industry. (20% increase in this type of speaker vs. 2018).
 - a. The MaaS track during the Orlando Technology Summit was hoping to have more international expert speakers but unfortunately, most of them were unable to attend without significant funding and/or stipends. We did have many US-based speakers with knowledge of European MaaS.
 - b. The 2019 Annual Meeting should reflect a larger contingent of non-North American presenters; one of the General Sessions is a large panel of speakers from Around the World reflecting on specific experiences from their countries. Another general session is about Bridge Asset Management, also presented by bridge operators around the world who are part of ISCBOA, our Annual Meeting partner.
3. **Students.** Encourage members to “sponsor” student attendance at IBTTA technology workshop and annual meeting. (10 students in Orlando; 5 students in Halifax).
 - a. Eight students registered at the discounted rate for the Orlando Technology Summit. Those eight students and many others came to the Backyard Olympics which was a great way to introduce them to the IBTTA community.
 - b. We are working with a few students interested in attending the Annual Meeting in Halifax. The Young Professionals Council is also working to encourage student attendance as part of their initiative.
4. **Succession.** Encourage members to bring young professionals from their organizations to IBTTA meetings. (Hard to measure because we don’t have a baseline of “young” people now).
 - a. The Orlando Technology Summit brought approximately 25 people to the inaugural meeting of the Young Professionals Council. Tyler Milligan ran the meeting and did the outreach to encourage companies to send new staff. They worked on a Vision and Mission as well as identifying subcommittees and electing Council Leadership.
 - b. Marty Stone and Tom Knuckey ran a Tolling 101 session as part of the preliminary roundtables during the Orlando Technology Summit. It was very well attended and received great marks in the post-Summit survey. This is something that we’d like to continue since it appeals to both young professionals and newbies to the industry.

- c. The Young Professionals Council (YPC) will present a proposal to the IBTTA Board for institutionalizing the group's activities within the IBTTA framework.
 - d. The YPC is working with the Leadership Academy to create a mentoring program and the Leadership Academy alumni association (newly formed) is finding ways to work with the YPC moving forward.
- 5. **Collaboration.** Collaborate with other transportation related groups such as TRB, PIARC, AASHTO, ITSA, ASECAP, ITE, ASCE, ITS America and others in putting on meetings and delivering content.
 - a. Collaboration activities: Orlando Technology Summit: ATI, TeamFL, TRB, ITS International, PIARC; Finance Summit: TRB Finance Committees. 2019 Maintenance Workshop; no partners yet but working with AMOTIA (asset management association) and many member host agencies in Hampton Roads area. Communications: WTS. Annual Meeting partner is ISCBOA. International Summit of Portugal: ASECAP.
 - b. IBTTA worked closely with the organization "Infrastructure Week 2019," to promote Infrastructure Week, May 13-20, 2019, highlighting the benefits of tolling and transportation. One example was an audio podcast focusing on IBTTA Member, WSDOT's new SR-99 Tunnel.

OUTCOME 2: DATA AND ANALYSIS. A fully mature **TollMiner** data collection and visualization product with key information on every toll facility and operator in the world.

Deliverables:

- 1. **New Releases and Use Cases.** TollMiner will have 2 new releases per year focused on functionality prioritized by member use cases. Identify the use cases and the required data that will help toll operators solve real business problems that help them save money, make money, or increase value to their customers and stakeholders. (Identify three specific data points to be added by June and three more data points to be added by December.)
 - a. Releases: In June 2019, we released TollMiner 3.0. It added 2018 traffic and revenue (T&R) data and updated 2017 T&R numbers, along with a re-designed database. Also, as new facilities start tolling, they are continually added to the tool.
 - b. Agency Attributes to address use cases: We are working with the TollMiner Working Group to identify agency attributes that are the most relevant to collect

and display in TollMiner. These will allow a user to apply filters to identify agencies that have these attributes. Attributes span technology, operations, violation processing, and infrastructure, and will be included in a 2019 release of the tool.

2. **International Data.** Expand international representation by partnering with ASECAP to explore the commonalities between US data and ASECAP member data and adding ASECAP data where commonalities exist. (Add data from 6 non-US based toll operators or associations of toll operators).
 - a. TollMiner was discussed during the May 2019 International Committee meeting. Committee members understand the value of having their data in TollMiner and will be working with IBTTA to provide their information in a readable format. For now, TollMiner contains the facilities, operators, and centerline miles that are part of ASECAP, but does not have additional data including toll collection/pricing methods or T&R data. Maria Moreno from SEOPAN has provided more detailed information on roads operated by Roadis in India, Brazil, Portugal, Mexico, and Spain, so we are making some progress.
3. **Staff.** Hire, train, and leverage the skills of a research specialist (new staff member) who can explore alternate data sources and help with industry normalization of terminology.
 - a. In April 2019, we hired Lisa Jewell as a Research Specialist. Lisa has a MS degree in Library Sciences. She's jumped into working on TollMiner with interest and focus and is showing great promise as a new member of our team.
4. **Member Validation.** Members are confused about some data questions we pose because some terms (e.g. ORT, AET, priced managed lane) mean different things to different people. In 2019, we will work with members to adopt a process to normalize definitions of terms to reduce confusion and improve data validation efforts.
 - a. Data Validation. We have built a new Agency Validation interface that allows data to be edited in place and submitted to IBTTA. Once approved by IBTTA, the data is then pushed to the live TollMiner Tool. The new interface is easier to use and allows IBTTA to track the date that an agency approved their data. TollMiner will be adjusted this year to allow a user to visually identify which agencies have validated their data.

OUTCOME 3: KNOWLEDGE TRANSFER. Developing a more systematic way of capturing the knowledge that resides in the minds of individual experts and practitioners in the IBTTA community and making that knowledge more accessible to all members.

Deliverables:

1. **Agency Peer Exchange Pilot Program.** Track and report out on progress being made under the new agency Peer Exchange Pilot Program. Establish guidelines that will be used to support 2020 participants. Also look at ways this could be linked to a similar ASECAP initiative.
 - a. John Keller, New Jersey Turnpike, made a presentation on this topic during the spring Board meeting in Philadelphia in May 2019. Another presentation will be made to the Board at the September 2019 board meeting with recommendations on continuing the program in 2020.
2. **Group Briefings and “Webinars.”** Create one or more methods beyond in-person meetings in which executive directors (or people in other disciplines) can carry on a conversation about a specific topic without having to be in the same physical location. Deliver webinar-like programs to promote member sharing and information exchange with the specific intention of serving those with limited travel ability, including non-US members. Specifically, do a bi-monthly group briefing or conversation via skype or other technology platform. (Conduct 3-4 executive director briefing sessions and a combined total of 6 webinar-like programs and group conversations).
 - a. In April 2019, we opened a Gaggle email discussion group for executive directors and their equivalents at member agencies and concessionaires with some initial discussion on violation enforcement and related issues. Other recent topics have focused on toll leakage and cross state reciprocity, advancing roadway automation readiness, and commercial truck fleet loyalty and discount programs.
 - b. The International Committee held a Webinar on Managed Lanes on June 18, 2019. Three agency speakers presented their managed lanes models and messaging as examples to emulate at facilities operating in the US and outside of North America. 246 individuals registered for the webinar and 163 attended the live session.
 - c. We are planning a second International Committee webinar on drone usage in October 2019.
 - d. On July 17, 2019, the Council of Platinum Sponsors hosted a webinar to discuss the Department of Homeland Security Cybersecurity Framework for Transportation. The webinar was presented by Mark Cantelli, Vice President,

Conduent Transportation, and Frank Reid, Senior Cybersecurity Consultant at AECOM.

3. **Document Library.** Work with members to create a Document Library with identified categories that will be populated with a representative sample of materials in each category from across the membership. Establish a permanent curator and naming conventions for documents with indexing. Access will be granted within member organizations at the subject matter expert level. In 2019, sample RFPs and RFQs will reside in the Document Library. The Document Library will be housed on the website as a member-only benefit. The next category of document samples will include policy documents or org charts and job descriptions, based on 2018-2019 member survey results.
 - a. The Membership Committee launched the “IBTTA Exchange” also known as the Document Exchange. 197 Documents have been added by members. Categories include Job Descriptions, Organization Charts, Design Specs, Call Center Operations, and Policies. Instead of developing a proprietary software, we are using Box.com to launch this new product. The Committee will continue to gauge the success and work on improvements throughout the year.
 - b. Round two of the “Master Procurement Calendar” has been published to include procurements through 2021. The team is actively working to identify Procurement Contacts all at member agencies and add their procurement plans to the calendar.

OUTCOME 4: INDUSTRY VISION. Integrating our industry more appropriately into the fabric of the larger transportation community.

Deliverables:

1. **Fly In.** Hold Washington, DC fly-in to Congress and the Administration in 2019 to advance the tolling agenda.
 - a. Occurred February 27-28, 2019 with 20 participants (including staff). We attended a portion of the AASHTO Washington briefing and had sit-down briefings with staff of the Senate Environment & Public Works Committee and House Committee on Transportation & Infrastructure.
2. **IBTTA Policy Proposal on Reauthorization.** Working through the committee structure of IBTTA, develop a comprehensive and concise industry policy proposal in areas of funding, technology, etc. to advance our industry’s position on transportation reauthorization in Congress. Hire technical subject matter expert (outside consultant).

- a. This is a work in progress. The timetable of reauthorization is uncertain, but we are working on drafting policy position through the Government Affairs Committee.
3. **State Advocacy (SWAT – Take it to the States).** Establish tangible efforts in 3-4 states identified by the Government Affairs Committee to organize members involved in the state to communicate our coordinated message, to educate and build relationships with state and congressional officials and legislative committees focused on transportation in the state legislature, placing op-ed pieces, doing local television appearances, and building social media efforts in the targeted states. (Measurable efforts in 3 states).
- a. Government Affairs Committee has repeatedly discussed this effort and have been working with FHWA staff seeking opportunities to assist any states applying for the ISRRPP program. The sense of the GA Committee and staff is that other opportunities for advancing tolling may bear more fruit.
 - b. Officials from Connecticut reached out to IBTTA for assistance and Pat Jones testified to the state legislature in support of the Governor’s proposal to re-institute tolling. Other efforts have included meeting with Governor Lamont, writing and publishing op eds, and serving as a resource to supportive local organizations.
 - c. IBTTA staff have worked with MTA Bridges & Tunnels to convene an “industry day” in support of sharing ideas to advance cordon-based pricing.
 - d. IBTTA continues to educate and inform members of the media on the benefits of tolling, new efforts on congestion pricing and mobility.
4. **Preparation for disruptive technology.** Working through the committee structure of IBTTA, develop 1 year, 3 year and 5 year deliverables for the industry at large in the broader areas of MaaS, RUC, CAV, Hyperloop, Blockchain, artificial intelligence and how our industry fits in. We will also determine the roll of the toll agency in these efforts. The effort culminates in an Innovation Summit hosted by agency Chief Technology Officers within the agencies including non-US CTOs. (Innovation Summit to be held after 2019).
- a. Emerging Technologies Committee has been created and several new subgroups have been established: Big Data, Drones, Innovation & Strategy role within an agency, and Tolling and customer management. The groups have all held initial formation meetings and are working to develop white papers for Board consideration in early 2020. Existing Toll Miner and Connected & Automated Vehicles (CAV) Working Groups are also meeting and engaging on a regular basis.

5. **Joint Policy Resolution.** Develop a joint policy resolution focused on disruptive technology with other transportation associations and organizations such as TRB, ARTBA, ASCE, AASHTO, ITSA. (Multi-year activity).

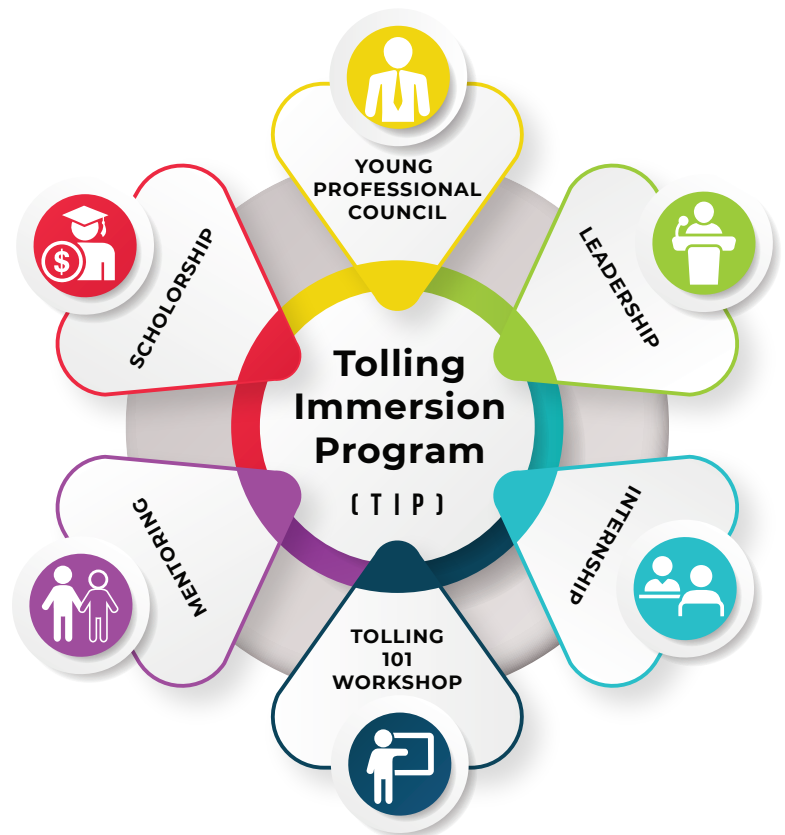


IBTTA 2020 Presidential Initiative Tolling Immersion Program – Internship and Mentoring

Overview

Strategic visioning to support the tolling industry and our members is a key function of IBTTA. Recent discussions with agency executive directors have resulted in the identification of the need for improved succession planning within the industry, and improved recruitment of the perspectives, ideas and talent needed for the accelerated evolution of transportation. Through the efforts of the IBTTA Foundation and the Council of Platinum Sponsors (COPS), IBTTA has made strides in supporting future members and industry leaders through our Leadership Academy, Scholarship Program, the recently launched Young Professionals Council (YPC) and the addition of the Tolling 101 workshop.

Leveraging these efforts to create a support platform for recruitment, retention and development is a key opportunity for IBTTA. Under the banner of a **“Tolling Immersion Program”** IBTTA is proposing to pilot two new components... an Internship Program and a Mentoring Program... to identify a suite of programs to foster future industry leaders. Each distinct in its function but synergistic in the desired outcome.



Internship Program

IBTTA's internship program would be distinct but complement our other efforts to **attract, retain and foster the development of future industry leaders**. The program would be somewhat unique in that it would be a two-part internship where selected candidates would spend part of a summer working for one of the Platinum Sponsors and part working for an Agency. It would also be possible to have a combination where they worked with a system or service provider and then a firm from the consultant/ engineering sector. The program would be flexible as its intent is to provide a purposeful, broad set of experiences within the Agency and private partner's organizations and could be somewhat tailored to the participant.

Although short-term (9 to 12-weeks), the experience gained in working in the multiple aspects in our industry **will provide the participants with career perspectives and increase their value in pursuing employment**. Participants may include IBTTA's scholarship awardees, the Agency and Platinum Sponsor(s) receive value in having a high-caliber intern with a broad perspective of the industry and the fostering future leaders for the industry.

Draft Concept Elements to be refined based on feedback from COPS, Foundation and Past Presidents (PPs)

- Work with the Foundation to **contact 2019 scholarship awardees or applicants** to make them aware of the internship opportunity and identify interested participants.
- Platinum Sponsors will identify participating firms to **provide paid internships** and assign them to identify partnering agencies who would also be willing to provide paid internships.
- Participating agencies will identify a program leader and **develop a work and/or a shadowing program**. The paired agencies would need to develop schedules and any rules associated to their particular programs.
- Develop a **feedback mechanism** for program evaluation and continuation.
- COPS, Past Presidents and Foundation will **identify what professional development opportunities should be included** and when. Key opportunities may include attending a summer IBTTA workshop, attending a YPC meeting/event, participating in Tolling 101 and being recognized officially by IBTTA. Connect the intern to a **YPC liaison** and **Leadership Academy Alumni**.
- Work with the Foundation to **include an option on the 2020 application for scholarship applicants to also apply for an internship**. We propose that applicants who volunteer/commit to participate in the internship program would receive bonus points towards the scholarship award evaluation.

Mentoring Program

The second component would be to identify volunteers from the Past President's Advisory Council, as well as alumni from the Leadership Academy, to develop mentorship programs and serve as mentors to the interns and YPC members.

While it would be beneficial to the Internship Mentees to have several status calls throughout the duration of their internships, this mentorship program would consist of mentors and mentees committing to a minimum of three contacts. These can comprise telephone calls, WebEx or Skype sessions, and even in person meetings when possible. The idea would be to communicate at each of the following:

- **Beginning of the internship**
- **During the transition from one agency/ company to the other**
- **Conclusion of the internship**

Depending on the number of Mentor volunteers, notably Leadership Academy alumni, and ratio to mentees, the YPC Mentoring program would be scaled. The mentor volunteers in collaboration with the YPC participants would develop the program.

IBTTA EXECUTIVE COMMITTEE

Agenda

Tuesday, January 7, 2020

8:00pm to 9:30pm

1. Call to Order
2. Catch up and reconnect
3. Board Retreat Overview
4. Enterprise Risk Assessment Action Plan
5. Unplanned Succession Plan (subject came up at previous ExCom call)
6. Adjourn

IBTTA FINANCE STANDING COMMITTEE OF THE BOARD

Agenda

Thursday, January 9, 2020

8:30am – 9:10am

1. Call to Order
2. President & Chairman's Remarks
3. Review of October 31st Financial Statements with year-end Projections
4. Investment Subcommittee Report
5. 2020 Finance Committee Goals
6. Progress Report on Action Plan to Mitigate Quadrant II Risks
7. 401 K Resolution
8. Approval of September 14 and September 25, 2019 Minutes
9. Adjourn

Mission of the IBTTA Finance Standing Committee of the Board
Approved by the IBTTA Board of Directors October 13, 2018

The Finance Standing Committee of the Board (the Committee) provides oversight of the finances of IBTTA on behalf of the Board of Directors. It also serves as a resource for the Association's management.

The specific tasks of the Committee are to:

- 1. Oversee financial planning.**
 - a. During the strategic planning process, participate in the analysis of the external and internal environment that determines the future course for the organization.
 - b. During the budgeting process, work closely with senior management to ensure that the process is efficient, includes key elements of the strategic plan, and includes Board decisions and directions.
 - c. Review and recommend the budget to the Board for approval.
- 2. Help the Board understand the organization's financial health.** Serve as a communication channel to the rest of the board, translating financial data into meaningful terms that can be understood by those less familiar with financial jargon.
- 3. Monitor liquidity and adherence to budget** by reviewing investment, reserve and budget reports on a regular basis.
- 4. Ensure protection of association assets** through an appropriate system of internal controls (if not addressed by the Audit Committee) and regular review of investments through the Investment Subcommittee
- 5. Draft organizational fiscal policies** to serve as guidelines for management and staff to follow when developing day-to-day procedures. Such policies include investment policies, establishment of reserves, calendar of reporting to the Committee and Board, and financial viability of major new initiatives.
- 6. Anticipate financial problems** by monitoring the external fiscal environment in which the organization operates.
- 7. Oversee financial record keeping** by reviewing and evaluating financial statements on a regular basis.
- 8. Ensure all legal reporting requirements are met.** These include timely filings with the IRS and any necessary state and local filings.

9. **Sustain the Committee itself.** This includes regular evaluations of the Committee's effectiveness, recruitment of new members, and training of all members in the overall fiscal operations of the Association.

The Finance Standing Committee shall perform such other duties as may be prescribed from time to time by the President and the Board of Directors.

International Bridge, Tunnel and Turnpike Association
Investment Policy
Adopted by the IBTTA Board of Directors on January 8, 2016
With revisions adopted September 9, 2017

Purpose:

The purpose of this statement is to set forth the policy and operational factors governing the investment management of the International Bridge Tunnel and Turnpike Association (IBTTA) Total Operating Reserve.

The Total Operating Reserve will be comprised of a short-term and long-term portfolio. This statement will serve to direct the management of investment assets within each portfolio by the designated investment advisor.

The determination of the amount in the short-term versus long-term portfolio will be determined annually by the Executive Director and submitted to the Board for approval as part of the annual budgeting process.

Operating Reserve – Guidelines and Restrictions

The primary objectives of this portfolio are:

- **Safety:** Investments of the Association shall be undertaken in a manner that seeks to ensure the preservation of capital in the overall portfolio. To attain this objective, diversification along credit and maturity lines is required in order that potential losses on individual securities do not exceed the income generated from the remainder of the portfolio.
- **Liquidity:** The investment portfolio will remain sufficiently liquid to enable the IBTTA to meet all operating requirements, which might be reasonably anticipated.
- **Return on Investments:** The investment portfolio shall be designed with the objective of attaining a market rate of return throughout budgetary and economic cycles, taking into account the investment risk constraints and the cash flow characteristics of the portfolio. The management of the portfolio should seek to optimize return while minimizing risk through diversification and asset allocation.

Cash Flow Expectations:

This portfolio provides a short term funding reserve for IBTTA that will be funded and reduced based on the amount of funds in the IBTTA checking account. It is expected that the reserve will receive a large initial contribution then be drawn down over the year. Funds can potentially be needed monthly.

Time Horizon:

This portfolio is considered short term in its investment time horizon. Investments should reflect a maturity target of approximately one year. The portfolio will reflect an allocation strictly to ultra short term investments in order to meet any monthly cash flow requirements.

Tax Status:

IBTTA is a nonprofit organization and is thus exempt from taxes. Investment decisions should reflect this tax status when purchasing or selling securities.

Risk Tolerance / Asset Allocation:

This portfolio is classified as conservative based on the stated objectives of preservation of capital and liquidity. The recommended target asset allocation is set to achieve these objectives while maximizing returns.

Asset Class	Target Allocation
Ultra Short Term Fixed Income	100%

The Ultra Short Term Fixed Income asset class will target a weighted average maturity of no greater than 14 months and a weighted average credit rating of AA, with an emphasis on US Treasuries and Agencies.

Eligible Investments and Restrictions:

The following are eligible investments for this investment portfolio:

- US Treasuries
- US Agencies
- Municipal and Corporate Bonds rated investment grade or higher by Moody's, S&P, or Fitch
- Mortgage Backed Securities issued by US Agencies
- Dollar denominated obligations of foreign issuers issued in the U.S.
- Foreign government and agency obligations
- Bonds with a maturity of 2 years or less at the time of purchase
- FDIC Insured Certificates of Deposit
- FDIC Insured Money Market Accounts
- Money Market funds that invest solely in eligible securities listed above, and whose credit quality is such that they must invest exclusively in high-quality securities (generally those that are in the top two tiers of credit quality)
- Mutual funds that invest solely in eligible securities listed above
- Exchange traded funds that invest solely in eligible investments listed above

Short-Term Portfolio Reserve – Guidelines and Restrictions

The primary objectives of this portfolio, in order of importance, are:

- **Safety:** Investments of the Association shall be undertaken in a manner that seeks to ensure the preservation of capital in the overall portfolio. To attain this objective, diversification along credit and maturity lines is required in order that potential losses on individual securities do not exceed the income generated from the remainder of the portfolio.
- **Liquidity:** The investment portfolio will remain sufficiently liquid to enable the IBTTA to meet all operating requirements, which might be reasonably anticipated.
- **Return on Investments:** The investment portfolio shall be designed with the objective of attaining a market rate of return throughout budgetary and economic cycles, taking into account the investment risk constraints and the cash flow characteristics of the portfolio. The management of the portfolio should seek to optimize return while minimizing risk through diversification and asset allocation.

Cash Flow Expectations:

This portfolio provides a short term funding reserve for IBTTA to cover expenses related to special projects/initiatives that are not covered by the annual budget, or to replenish the checking account. As such, there are no known cash flow expectations; however, funds may be needed periodically in order to meet these needs. Any change in IBTTA's need for cash flows from this account should be addressed through a change in this policy statement.

Time Horizon:

This portfolio is considered short term in its investment time horizon. The investment portfolio as a whole should reflect a maturity target of approximately five years or less.

Tax Status:

IBTTA is a non-profit organization and is thus exempt from taxes. Investment decisions should reflect this tax status when purchasing or selling securities.

Risk Tolerance / Asset Allocation:

This portfolio is classified as conservative based on the stated objectives of preservation of capital and liquidity. The recommended target asset allocation seeks to achieve these objectives while maximizing returns and minimizing volatility.

Asset Class	Target Allocation
Fixed Income	99.0
Cash	1.0

The fixed income asset class will target a weighted average maturity of no greater than five years and a weighted average credit rating of no lower than AA.

Eligible Investments and Restrictions:

The following are eligible investments for this investment portfolio:

- Cash Equivalents
 - Treasury Bills
 - Money Market Funds
 - FDIC Insured CDs
 - FDIC Insured Money Market Accounts
- Fixed Income Securities (rated investment grade by Moodys, S&P, or Fitch)
 - U.S. Government and Agency Securities
 - Fixed Income Securities of Foreign Governments and Corporations (up to 35% of the market value of the fixed income portion of the portfolio)
 - Corporate Notes and Bonds
 - Mortgage Backed Bonds
 - The fixed income portion of the portfolio shall have a weighted average maturity of 3 years or less.
 - The weighted average credit quality of the fixed income portion of the portfolio shall be not less than an 'AA' rating.
- Mutual Funds or Exchange Traded Funds (including similar pooled investments and separately managed accounts) shall be selected on the basis that they invest in those securities deemed to be allowable above.
- Diversification
 - No more than 10% of the portfolio combined may be in the securities of any one issuer with the exception of obligations of the US Government and its agencies, and federally insured instruments.
 - No more than 20% of the portfolio combined may be in the securities of a particular industry.

Benchmarking:

1. The portfolio will be compared to a benchmark comprised of the Barclays Capital Aggregate Bond Index, Barclays Capital Gov. 1-3 Year Bond Index, and the Merrill Lynch Three Month US Treasury Bill Index. Weights will be applied to each index based on the target allocation to each broad asset class.
2. The investment advisor will provide a benchmark for each fund and separately managed account held within the portfolio.

Long-Term Portfolio Reserve – Guidelines and Restrictions

Statement of Objectives:

The primary objectives of this portfolio, in order of importance, are:

- **Safety:** Investments of the Association shall be undertaken in a manner that seeks to ensure the preservation of capital in the overall portfolio. To attain this objective, diversification along credit and maturity lines is required in order that potential losses on individual securities do not exceed the income generated from the remainder of the portfolio.
- **Return on Investments:** The investment portfolio shall be designed with the objective of attaining a market rate of return throughout budgetary and economic cycles, taking into account the investment risk constraints and the cash flow characteristics of the portfolio. The management of the portfolio should seek to optimize return while minimizing risk through diversification and asset allocation.
- **Liquidity:** The investment portfolio will remain sufficiently liquid to enable the IBTTA to meet all operating requirements, which might be reasonably anticipated.

Cash Flow Expectations:

This portfolio is not expected to be a direct source of cash flow for IBTTA, however, withdrawals from this Reserve may be required in order to fund the Short Term Reserve. As such, an adequate amount of the fixed income portfolio will be held in short term securities. Any change in IBTTA's need for cash flows from this account should be addressed through a change in this policy statement.

Time Horizon:

This portfolio is considered long term in its investment time horizon. Investments seek long term growth as their primary objective. The funds in this account are not expected to be withdrawn in the next 5 years.

Tax Status:

IBTTA is a non-profit organization and is thus exempt from taxes. Investment decisions should reflect this tax status when purchasing or selling securities.

Risk Tolerance / Asset Allocation:

This portfolio is classified as moderate risk based on the stated objectives of long term growth of assets and preservation of capital. The recommended target asset allocation seeks to achieve these objectives while maximizing returns and minimizing volatility.

Asset Class	Minimum	Target Allocation	Maximum
Domestic Equity	26%	32.5%	36.5%
International Equity	14%	17.5%	18.5%
Fixed Income	39%	49%	59%
Cash	0%	1%	2%

The fixed income asset class will target a weighted average maturity of no greater than eight years and a weighted average credit rating of no lower than AA.

The domestic and international equity assets classes will reflect an allocation to all nine style boxes based on market capitalization (Large, Mid, Small) and style (Value, Blend, Growth.) The allocation to international equity will also include exposure to both developed and emerging markets.

Return Expectations:

Returns are expected to be commensurate with the risk tolerance and asset allocation of the investments and will reflect the portfolio's objectives of long term growth and stability. The portfolio performance will be gauged against a designated benchmark and is expected to track those benchmark returns over time.

Eligible Investments and Restrictions:

The following are eligible investments for this investment portfolio:

- Cash Equivalents
 - Treasury Bills
 - Money Market Funds
 - FDIC Insured CDs
 - FDIC Insured Money Market Accounts
- Fixed Income Securities (rated investment grade by Moodys, S&P, or Fitch)
 - U.S. Government and Agency Securities
 - Fixed Income Securities of Foreign Governments and Corporations (up to 35% of the market value of the fixed income portion of the portfolio)
 - Corporate Notes and Bonds
 - Mortgage Backed Bonds
 - The fixed income portion of the portfolio shall have a weighted average maturity of 10 years or less.
 - The weighted average credit quality of the fixed income portion of the portfolio shall be not less than an 'AA' rating.
- Equity Securities
 - Common Stocks
 - American Depositary Receipts (ADRs) and Ordinary Shares of Non-U.S. Companies
- Mutual Funds or Exchange Traded Funds (including similar pooled investments and separately managed accounts) shall be selected on the basis that they invest in those securities deemed to be allowable above.
- Diversification
 - No more than 5% of the portfolio combined may be in the securities of any one issuer with the exception of obligations of the US Government and its agencies, and federally insured instruments.
 - No more than 20% of the portfolio combined may be in the securities of a particular industry.

The following are not eligible investments for this investment portfolio:
Purchasing the following:

- Private placement;
- Letter stock;
- Futures;
- Currency forwards;
- Options;
- Commodities;
- Securities whose issuers have filed a petition for bankruptcy.

Making the following transactions:

- Short sales
- Margin transactions
- Any speculative investment activities

Benchmarking:

3. The portfolio will be compared to a benchmark comprised of the Russell 3000 Index, FTSE All World Ex-U.S. Index, Barclays Capital Aggregate Bond Index, Barclays Capital Gov. 1-5 Year Bond Index, and the Merrill Lynch Three Month US Treasury Bill Index. Weights will be applied to each index based on the target allocation to each broad asset class.
4. The investment advisor will provide a benchmark for each fund and separately managed account held within the portfolio.

Rebalancing Procedures:

This portfolio will be rebalanced periodically to assure that the overall asset allocation target of the portfolio is maintained. Events including large deposits or withdrawals and significant market movements may trigger the need to rebalance the portfolio. Regardless of activity the portfolio will be reviewed on a quarterly basis at a minimum to assure the balance is adequately maintained. In order to minimize transaction costs, the manager will evaluate the benefit of rebalancing relative to the transaction cost. The advisor will maintain a rebalancing threshold of +/- 20% of the target allocation percentage for each asset class, with the exception of cash, which will have a rebalancing threshold of +/- 50% of the target.

Total Operating Reserve Guidelines

Monitoring:

The advisor will provide the IBTTA Finance Committee with a detailed report of the portfolio at least quarterly. The quarterly report will outline the following in a simple and graphical way:

- What have we invested where?

- How has our portfolio performed relative to our investment policy and designated benchmarks?
- What is the change in value of our portfolio over time (a quarter, a year, etc.)?
- What, if anything, should we be concerned about with respect to the market, our portfolio, or any other relevant factors?

Policy Revisions:

This policy will be formally reviewed annually to determine if the objectives, constraints, and allocations are appropriate and consistent with IBTTA's objectives. Additional conditions under which the policy might be amended include:

- A change in IBTTA's risk tolerance, timeline, tax status, or cash flow expectations
- Introduction of new investment vehicles
- A change in the objective of the portfolio

The IBTTA Finance Committee will work with the designated investment advisor to review the policy for its appropriateness after such changes, and will amend the policy when necessary.

Duties and Responsibilities:

The following parties to this policy will be charged with certain duties and responsibilities as it relates to management of the portfolio:

International, Bridge, Tunnel and Turnpike Association: Will be required to review and approve this Investment Policy Statement in its entirety. IBTTA will be responsible for working with a Designated Investment Adviser no less than annually to review and amend this policy statement. IBTTA is responsible for selecting an investment advisor who will comply with this policy statement, and is responsible for periodically reviewing the advisor's compliance with this policy statement.

Designated Investment Advisor: Will be responsible for implementing the investment strategy outlined in this policy statement by selecting investments and external managers that meet the investment criteria within this policy statement. The Designated Investment Advisor will be charged with timely reporting of investment performance to IBTTA. The Designated Investment Advisor is also required to perform all normal due diligence in selecting external investment managers, including a review of their ability to operate within the investment guidelines and restrictions outlined in this policy. The Designated Investment Advisor is responsible for selecting other appropriate parties as needed to implement this policy, including attorneys, custodians, and broker/dealers.

Investment Manager: Investment managers will be any party the Designated Investment Advisor selects to invest funds on behalf of IBTTA. For purposes of this policy, Investment Managers include Mutual Fund Managers, Exchange Traded Fund Managers, Separate Account Managers, Money Market Fund Managers, and any other party that the Investment Manager contracts to invest funds on behalf of IBTTA. The Investment Advisor is responsible for assuring that any Investment Manager selected is investing funds in a manner consistent with the eligible investments and restrictions outlined in this policy.

Authority:

IBTTA Board approval is required to make changes to this Investment Policy Statement.

Authorized agents for IBTTA for this account may direct transfers in or transfers out of the account governed by this policy. The authorized agents are: Executive Director of IBTTA and Director of Government Affairs of IBTTA.

Approval

I acknowledge that this Investment Policy accurately represents the guidelines and restrictions to which the International, Bridge, Tunnel and Turnpike Association Total Operating Reserve is to be managed.

PRINT NAME

DATE

SIGNATURE

PRINT NAME (Dennis Gogarty)
President, Raffa Wealth Management, LLC

DATE

SIGNATURE

Revisions adopted on these dates:

April 4, 2014

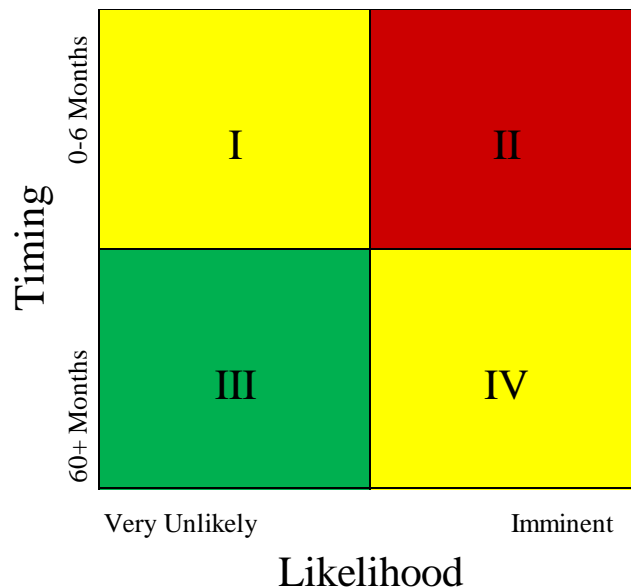
January 8, 2016

September 9, 2017

International Bridge, Tunnel and Turnpike Association
Enterprise Risk Assessment Action Plan – August 29, 2019

The International Bridge, Tunnel and Turnpike Association (IBTTA), engaged the services of CliftonLarsonAllen LLC (CLA) to conduct a strategic level Enterprise Risk Assessment (ERA). The ERA was issued on April 30, 2019 (attached in Appendix). Organizations face risks whether they are known or not. The ERA is a tool that allows the IBTTA to identify risks and group/prioritize the risks based on likelihood and velocity the risks could have on IBTTA’s operations and mission. It is important to note that CLA did not evaluate any risk in detail as applied to IBTTA and their findings do not represent any identified deficiency. Several items include the following phrase in the description: “Inherently this is a significant risk for associations the size of IBTTA.” Nor did CLA quantify the extent of any impact to the operation – minor disruption vs major catastrophe. Management views the ERA as an effective means to facilitate conversations regarding the organization’s risk tolerance and to make sound decisions going forward. CLA notes that there are four general responses to any of the risks: 1) accept and monitor the risk, 2) mitigate the risk, 3) transfer the risk (such as an insurance policy) or 4) avoid the risk. This Action Plan identifies strategies to mitigate the identified higher risks.

When conducting the ERA, CLA performed a quadrant-based analysis that categorized risks based on the likelihood and timing of the risk.



Likelihood was defined as the chance that a risk could have an adverse effect on IBTTA. A five-point scale was used with 5.0 representing imminent and 0.0 representing very unlikely. Timing was defined as how quickly the risk could have an adverse effect on IBTTA. The five-point scale was used with 3-5 representing zero to six months and 0 representing 60 or more months. For illustration purposes, the quadrants are color-shaded based on the severity of the risk. Quadrant II has the highest risk with the timing near-term and the greatest likelihood. Quadrants I and IV have a medium risk. Quadrant III is the

lowest risk with the timing long-term and the least likelihood. Greatest emphasis should be given to Quadrant II risks followed by quadrants I and IV. Minimal, if any, emphasis should be given to Quadrant III. This Action Plan identifies strategies to address Quadrant II risks.

When conducting the ERA, CLA examined the level of inherent risk in the organization across five (5) risk categories and 26 risk subcategories.

Risks: Sorted by Category

Risk Category	Risk Sub-Category	Risk Quadrant
Financial	Cost Containment	I
Financial	Expense Sustainability	I
Financial	Fraud	II
Financial	Investments/Endowment	I
Financial	Membership Dues	III
Financial	Revenue Diversity	III
Operational	Business Continuity / Disaster Recovery	II
Operational	Human Capital: Talent/ Turnover/ Vacancy	II
Operational	Insurance	III
Operational	Mission Critical System's Lifecycle	III
Operational	Process Efficiencies	I
Operational	Security Breach	II
Programmatic	Event Success	I
Programmatic	High Cost Low Demand Programs	IV
Programmatic	Market Relevance	II
Programmatic	Membership Experience	I
Programmatic	Research and Data Quality	III
Regulatory / Compliance	Grants and Contracts	III
Regulatory / Compliance	Non-Profit Eligibility	III
Regulatory / Compliance	Privacy of Data	II
Strategic	Competition	III
Strategic	Governance	III
Strategic	Legislative- Association	III
Strategic	Legislative- Membership	III
Strategic	Strategic Plan	I
Strategic	Succession Planning: Leadership	II

Risks: Sorted by Quadrant (Highest to Lowest Risk)

Risk Category	Risk Sub-Category	Risk Quadrant
Financial	Fraud	II
Operational	Business Continuity / Disaster Recovery	II
Operational	Human Capital: Talent/ Turnover/ Vacancy	II
Operational	Security Breach	II
Programmatic	Market Relevance	II
Regulatory / Compliance	Privacy of Data	II
Strategic	Succession Planning: Leadership	II
Programmatic	High Cost Low Demand Programs	IV
Programmatic	Membership Experience	I
Strategic	Strategic Plan	I
Financial	Cost Containment	I
Financial	Expense Sustainability	I
Financial	Investments/Endowment	I
Operational	Process Efficiencies	I
Programmatic	Event Success	I
Strategic	Legislative- Association	III
Strategic	Legislative- Membership	III
Programmatic	Research and Data Quality	III
Financial	Revenue Diversity	III
Operational	Insurance	III
Strategic	Governance	III
Strategic	Competition	III
Regulatory / Compliance	Grants and Contracts	III
Regulatory / Compliance	Non-Profit Eligibility	III
Operational	Mission Critical System's Lifecycle	III
Financial	Membership Dues	III

Quadrant II Risk: Higher Likelihood & Near-Term Effect

Risk Category/Sub-Category:	Financial/Fraud
Description of Risk:	The susceptibility of IBTTA for a fraud event due to a control failure, collusion, and/or inadequate prevention/detection processes. <i>Note: Inherently this is a significant risk for associations the size of the IBTTA.</i>
Mitigation Strategies: <ul style="list-style-type: none"> • Continue to require pre-employment and pre-engagement (with contractor) background checks. • Conduct independent auditor internal control assessments every 4 years or as needed as significant organizational changes occur and implement the recommendations as outlined in Management Response to the May 2019 Internal Control Assessment. • Implement online bill pay and research the potential benefits of implementing Positive Pay. • Ensure policies (ethics, conflict of interest, acceptance of gifts, etc.) are current and reviewed by employees annually. • Provide fraud prevention training to CEO and Deputy Executive Director and other staff as appropriate. 	
Risk Category/Sub-Category:	Operational/ Business Continuity/Disaster Recovery
Description of Risk:	Inability for IBTTA to efficiently respond and continue operations after an event that impairs business continuity or disaster.
Mitigation Strategies: <ul style="list-style-type: none"> • Develop a Continuity of Operations Plan (COOP) with annual reviews and practice. 	
Risk Category/Sub-Category:	Operational/Human Capital: Talent/Turnover/Vacancy
Description of Risk:	A loss of institutional knowledge, particularly when the knowledge spans 20+ years, and the inability to acquire the right personnel talent.
Mitigation Strategies: <ul style="list-style-type: none"> • Continue the effort to document Standard Operating Procedures. • Investigate the cost/benefit of establishing a Repository of Knowledge. • Continue to cross-train employees and support shadowing. 	

Risk Category/Sub-Category:	Operational/ Security Breach
Description of Risk:	Occurrence of an adverse security breach, primarily cyber security, in IBTTA data is compromised. <i>Note: Inherently this is a significant risk across all industries and sizes of organizations.</i>
Mitigation Strategies:	
<ul style="list-style-type: none"> Investigate the potential benefits and cost for a system vulnerability assessment which identifies and prioritizes weaknesses or security holes in a computer system or network and/or penetration test which simulates a cyber-attack against a computer system to check for exploitable vulnerabilities, understanding that the risks confronted by an association like IBTTA are very different from those confronted by toll operators with millions of accounts and transactions and sensitive data. 	

Risk Category/Sub-Category:	Programmatic/Program Relevance
Description of Risk:	IBTTA's ability to provide relevant products, services, programs to meet the demands of the membership. <i>Note: Inherently this is a significant risk for associations.</i>
Mitigation Strategies:	
<ul style="list-style-type: none"> Continue to collect feedback from members and conference attendees (e.g., surveys) and incorporate findings into operations plans and the Board's Strategic Plan. Continue to communicate and market to current and potential members the services provided by IBTTA. Periodically conduct focus groups with members and other stakeholders and associations to ensure a continued pulse on the industry and its needs. 	

Risk Category/Sub-Category:	Regulatory/Compliance/Privacy of Data
Description of Risk:	Lack of compliance with regulatory requirements regarding privacy of data. <i>Note: Inherently this is a significant risk for associations the size of the IBTTA.</i>
Mitigation Strategies:	
<ul style="list-style-type: none"> Document types of data maintained by IBTTA and any requirements. Draft policy and standard operating procedures. Provide relevant training. 	

Risk Category/Sub-Category:	Strategic/Succession Planning
Description of Risk:	Personnel vacancies in key positions may negatively impact IBTTA's ability to meet Strategic Goals without adequate succession planning.
Mitigation Strategies:	
<ul style="list-style-type: none"> Develop a succession plan Continue to employ both an Executive and Deputy Executive Director 	

**IBTTA FINANCE STANDING COMMITTEE OF THE BOARD
2020 GOALS**

GOAL #1 – MONITOR THE REASONABLENESS OF ESTIMATES IN THE UPDATED THREE-YEAR PLAN

Monitor the reasonableness of the financial estimates that support the framework of the revolving Three-Year Plan. The next update of the Three-Year Plan (2021-2023) will include a detailed budget for 2021 and high-level budget outlines for 2022 and 2023.

GOAL #2 – MONITOR PROGRESS ON THE ACTION PLAN DEVELOPED TO MITIGATE THE QUADRANT II RISKS IDENTIFIED IN THE ENTERPRISE RISK ASSESSMENT REPORT

Mitigating, monitoring and avoiding risks are prudent measures to protect the IBTTA from undue exposure to harm. The Enterprise Risk Assessment completed in 2019 identified a few risks which warrant attention. Staff developed an Action Plan to address these mostly operational risks. The Finance Committee working jointly with the Audit Committee will review staff's steps and results, assist as requested and make recommendations to the Board for any additional resources or actions.

GOAL #3 – INCREASE THE RESERVE RATIO TO 50%

In 2018, the staff developed and the Finance Committee approved a plan and procedure to achieve the 50% reserve ratio goal, which involves contributing a portion of excess net income to the long-term investment account. Staff and the Finance Committee will continue to follow this procedure and recommend Board action in early 2020 based on 2019 performance.

GOAL #4 – DEVELOP A POLICY TO ADDRESS THE INTERNAL CONTROL ASSESSMENT REPORT RECOMMENDATION RELATING TO MODIFICATIONS OF AN APPROVED BUDGET

The Internal Control Assessment Report prepared by the outside consultant and submitted in 2019 stated: "During analysis of the IBTTA Accounting Manual we noted that it did not address the approval process for significant budget modifications." It went on to recommend "the policy be updated to allow management the discretion to make budget modifications within set dollar thresholds and/or percentages and to require review and approval of budget modifications above these thresholds by governance." The Finance Committee will work with the Association Executive Director and CEO to develop a recommended policy for Audit Committee review and subsequent approval by the IBTTA Board.

CLOSING

The above is in addition to the Finance Committee's annual recommendation of the IBTTA Operating Budget, the monitoring of the financial and investment activities of the Association and other responsibilities as assigned.

Respectfully submitted:
December 2019

GEORGE P. ZILOCCHI
Chairman

SUSAN BUSE
Vice Chairman

MINUTES

IBTTA Finance Standing Committee of the Board

September 16, 2019

Halifax, Nova Scotia CANADA

Finance Committee Members Present: George Zilocchi, Chair; Susan Buse, Vice Chair; Fran O'Connor; Mary Jane O'Meara; Terri Slack; Steve Snider; Tim Sturick; Kary Witt; Tony Yacobucci. **Officers:** Chris Tomlinson, Samuel Johnson. **Staff:** Pat Jones, Cathy Pennington.

George Zilocchi, Chair, called the meeting to order at 10:00 am Atlantic Time.

Review of June 30 Financial Statements

Cathy Pennington made the report. She talked about the balance sheet and said the association has \$1.8 million in reserves. The budget projection for the year is positives. Dues are running ahead of budget, meeting revenues are higher than budgeted, and expenses are under budget. She explained that we changed the way we account for Platinum Sponsor registration fees.

George Zilocchi reported that the reserves ratio was 40% at the beginning of 2019 and today it is at 46%. The Finance Committee is working toward achieving the goal of 50% in reserves.

Investment Subcommittee Report

Susan Buse made the report. She said that at December 2018 there were \$1.69 million in long term investments and June 2019 there were \$1.778 million in long term investments. End of July 2019, after adding \$110,000, the total investments are at \$1.889 million. She said investments are split with 50% invested in stocks and 50% invested in fixed income investments. The investment committee holds quarterly meetings with professional investments advisors who manage our funds. There was a question about the performance of investments during a recession. Cathy Pennington said we have a diversified portfolio, we work closely with the professional investment advisors, and the best course is to stay the course and not panic. This plan of action has worked well for us in the past.

Proposed 2020 Budget

Pat Jones made the report. Pat provided a high-level expression of our vision, mission and three-year plan as it relates to the budget. He talked about his interviews with members of the Board of Directors. A summary of the conversations is in writing and given to all present. Pat mentioned that on Wednesday, September 25, 2019, the Finance Committee will vote on the 2020 Budget followed by a vote of the IBTTA Board of Directors via a telephone conference call. The proposed draft 2020 Budget for discussion is in alignment with the Strategic Plan and Three-year Plan – our goals, vision and mission.

Cathy Pennington gave a detailed analysis of the 2020 budget. She noted the comparison from the 2019 budget to the proposed draft 2020 budget. She explained that some line items for 2020 have been made with reasonable assumptions. An example, is the office lease. The office lease is up in 2020. The budget number included is a conservative estimate as we are not sure what the actual costs will be at this time. She pointed to two consultants being added in 2020. One is a human resources consultant and the other will work with IBTTA to draft a continuity of operations plan for the association, in accordance with one of the recommendations of the enterprise risk assessment.

Tim Stewart gave the report of the Compensation Policy Committee. He said total compensation budget for 2020 shows an increase of 6.9%. This is primarily due to the addition of a new position, a subject matter expert on data analysis, plus market increases in salary ranges and movement of staff within those ranges. PRM recommends a base increase of 3% for staff as consistent with movement in the Washington, DC association marketplace.

Budget Process

Pat Jones stated that the Board of Directors will review and discuss the proposed draft 2020 Budget today. On September 25, the Finance Standing Committee will vote, followed by a vote from the IBTTA Board of Directors. George Zilocchi complimented Pat Jones and Cathy Pennington on the work to create this proposed draft 2020 Budget. The budget covers what the membership expects of us. Pat Jones thanked the IBTTA staff, especially Wanda Klayman and Cathy Pennington.

Internal Controls Assessment

Deb Sharpless, Chair, Audit Committee, made this report. She said IBTTA issued an RFP in July 2018 for a company to conduct both the Internal Controls Assessment and Enterprise Risk Assessment. Clifton Larson Allen (CLA) was selected.

CLA made nine recommendations/observations. Members of IBTTA Audit Committee met with CLA representatives and walked through both detailed assessments. One recommendation was for the Finance Chair to review journal entries. IBTTA will not follow this recommendation. On two or three recommendations IBTTA had no policy in writing and will address these issues and create written policies.

There was a discussion about creating a policy that would define a specific threshold (either a percentage or dollar amount) in which management would need to seek board approval of a significant budget variance. It was decided that staff will develop a proposed policy to address this concern and seek approval of the Finance Committee and the Board.

Presentation on Enterprise Risk Assessment

Susan Buse made the report and gave a high-level overview of the observations from the assessment. Staff, in consultation with the Audit and Finance Committee leaders, developed an action plan to address the significant risks identified in the assessment. There was a brief discussion about the assessment and its observations. Pat Jones said the entire process of the assessments was a great exercise and IBTTA staff will implement the action plan.

Finance Committee Goals

George Zilocchi reported on the status of the 2019 Finance Committee goals and said they had met all three goals: monitoring the financial statement performance, conducting the Internal Controls Assessment and Enterprise Risk Assessments, and making a transfer of funds to the reserve account to get closer to the 50% ratio goal. He then challenged the Finance Standing Committee to be thinking of what the goals should be for 2020.

Minutes

There was a motion and a second to approve the minutes of the May 2019 meeting. The motion PASSED.

The meeting was adjourned at 11:55 am Atlantic Time.

Respectfully submitted,
Bill Cramer, Director of Communications

MINUTES

IBTTA Finance Standing Committee of the Board

September 25, 2019

By Conference Call

Finance Committee Members Present: Lisa Lumbar, Donna Manuelli, Charles McManus, Fran O'Connor, Kent Olson, Terri Slack, Tim Sturick, Gary Trietsch. **Staff:** Ancilla Brady, Bill Cramer, Neil Gray, Pat Jones, Wanda Klayman, Cindy Norcross, Cathy Pennington.

IBTTA President Chris Tomlinson called the meeting to order at 11:05am EDT in the absence of Chair George Zilocchi and Vice Chair Susan Buse. Chris reviewed the major elements of the budget as outlined in the background materials. He said that the Finance Committee had had a robust discussion of the proposed 2020 budget in Halifax and that the in-person meeting there was specifically designed for the purpose of having a conversation without voting on the budget. Pat Jones gave a summary of the phone conversations he had with Board members about the three-year plan and proposed 2020 dues increase.

Chris asked if there were any more questions about the budget. There being none, **there was a MOTION and a SECOND to recommend to the Board approval of the 2020 Budget. The motion PASSED.**

The meeting was adjourned at 11:15am EDT.

Respectfully submitted,
Patrick D. Jones
Executive Director & CEO

**Package of Materials for the Budget Conference call of the
IBTTA Board and Finance Standing Committee of the Board
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Agenda

IBTTA Finance Standing Committee of the Board

September 25, 2019

11:00am EDT

1. Call to order
2. Chair's remarks
3. Presentation of 2020 Budget
4. Resolution to Recommend IBTTA Board Approval
5. Adjourn

Agenda

IBTTA Board of Directors

September 25, 2019

11:10am EDT

1. Call to order
2. President's remarks
3. Presentation of 2020 Budget
4. Resolution to Adopt and Approve the 2020 Budget
5. Adjourn

Summary of Discussion on IBTTA's Proposed 2020 Budget at the
Finance Standing Committee of the Board Meeting and
IBTTA Board of Directors Meeting
September 14, 2019

The Finance Standing Committee of the Board met on September 14, 2019 in Halifax, Nova Scotia, Canada to consider the proposed IBTTA budget for 2020. Pat Jones said the proposed 2020 budget is an expression of the outcomes that IBTTA intends to accomplish in 2020. He said the budget is consistent with IBTTA's strategic plan and the 3-year plan adopted by the Board in October 2019. Pat said that he had had phone conversations with all but three current and nominated Board members about our progress under the 3-year plan and their thoughts about a dues increase in 2020. The two main observations are:

- They like the 3-year plan and Deliverables Document and complimented the plan on how well thought out and structured it is.
- They have no problem supporting the 2020 dues increase and they commented on the value proposition.

Pat also talked about the things the board members say they are especially happy about and the issues they are concerned about or see as important on the horizon (see next page).

Cathy Pennington spoke in more detail about the major revenue and expense items in the budget, which are also described in the memo from Pat Jones on page 4 of this package.

Tim Stewart, Chair of the Compensation Policy Committee, said that the committee had met and endorsed the overall compensation budget for 2020 (which is included in the association's proposed budget) as consistent with IBTTA's compensation philosophy, policy, and marketplace definition and sources. The Committee further recommended that the Finance Committee and Board incorporate this compensation budget into the overall association budget for 2020.

In response to questions from members of the Finance Committee:

- It was clarified that the "Continuity of Operations Plan" (COOP) is also called a "Disaster Recovery Plan."
- It was clarified that we filled a new position in 2019 and plan to fill another new position in 2020.
- We don't budget for revenue from investments.
- We have not yet formalized a policy on how to handle major budget variances, but we are working on such a policy and will ask the Finance Committee and Board to adopt it during the January 2020 board meeting.

Pat Jones and Cathy Pennington gave a similar but shorter presentation to the Board of Directors in the afternoon and there were no questions about the 2020 budget.

**IBTTA's Three-Year Plan and the 2020 Budget
September 14, 2019**

Top Level Observations on Conversations with Board Members

- They like the 3-year plan and Deliverables Document. They complimented the plan on how well thought out and structured it is.
- No problem supporting 2020 dues increase. They commented on the value proposition.

Things they are especially happy about

- Efforts related to increasing diversity and attracting young professionals to the industry.
- Information resources such as SmartBrief, TollMiner and Webinars.
- “The quality of the people you’ve added in recent years is great.”
- Emerging Technologies Committee and its working groups.
- International Committee.
- Leadership Academy.

Issues they are concerned about or see as important on the horizon

- Toll violations enforcement and reciprocity among states.
- Electrification of the transportation system.
- How to help Director or almost Director level people to engage and get involved.
- Training for individuals involved in volunteer and leadership roles; TRB cited as a good standard for this kind of training.
- Continued efforts to educate public officials and policy makers about what tolling is and how important it is.
- More engineering topics at our meetings because engineers don’t see a role for them.
- A greater emphasis on training about safety issues.
- A greater emphasis engineering related issues at workshops.
- What happens with the shift to new technologies and systems that disrupt old ways of doing things? This could be a major rift in the industry, between agency and agency, between agency and consultant, between consultants, etc.
- Standardizing procurement documents.

Date: September 9, 2019
To: IBTTA Board of Directors and Finance Standing Committee of the Board
From: Pat Jones, Executive Director & CEO
Subject: **DRAFT 2020 Budget**

SUMMARY

Attached is the **proposed 2020 budget** for IBTTA.

- It supports the ongoing activities of IBTTA under our strategic plan.
- It supports the specific efforts for 2019 and 2020 that we envision under the **Three-Year Plan** approved by the Board on October 13, 2018. Those outcomes are further described in the **Deliverables as Part of IBTTA Three-Year Plan** beginning on **page 48** of the September 2019 Board Book Volume 1.

The 2020 budget incorporates the compensation budget. The Compensation Policy Committee will meet on September 13, 2019 and is expected to endorse the proposed overall compensation budget for 2020 as being consistent with IBTTA's compensation philosophy, policy, and marketplace definition and sources.

SPECIFIC ITEMS OF NOTE IN 2020 BUDGET

The 2020 budget is similar to the 2019 budget with some differences as follows:

Dues

We project membership dues revenue to grow to \$3,436,000, an increase of 11% over the 2019 budget of \$3,107,000 and an increase of 8% over the 2019 projected actual of \$3,171,000. We achieved this figure by:

- applying the 2020 dues schedule to all current members to yield gross dues of \$3,505,000
- factoring in membership attrition of \$180,000 based on the history of the last three years; and
- factoring in new member acquisition of \$111,000 based on recent history.

The 2020 dues projection reflects zero growth in toll revenues which would normally push dues higher. We expect toll revenues to grow, but we use this zero-growth assumption to be conservative for budgeting purposes.

The proposed dues increase for 2020 is illustrated in the Three-Year Plan on **page 41** of Board Book Volume 1 and needs to be approved by the Board. Dues increases range from a 4% for members with the lowest revenues to 16% for operators with the highest toll revenues.

Meeting Revenues

In 2020, we expect meeting revenues to be \$272,000 higher than the projection for 2019. This includes:

- \$156,000 more in registration revenues
- \$94,000 more in sponsorships and host contributions
- \$22,000 more in exhibit revenues.

The higher registration revenue is equivalent to about 195 more paid attendees in 2020 versus 2019. We expect most of the additional registrations to appear at the Finance Summit in Denver, the Technology Summit in San Diego, and the Annual Meeting in Austin. This is based on historical experience with performance at the 2020 venues and the fact that the Finance Summit is co-located and organized with TRB and four of its committees.

Personnel and Benefits

Personnel expense will increase about 7% over the 2019 projection. This includes a 3% market adjustment for salaries. It also accounts for two new employees hired mid-year in 2019 that translate to full year salaries in 2020. The 2020 budget also includes a new data analyst position to support TollMiner and other efforts. This position may be a consultant or an employee, but it's budgeted as an FTE.

Program Expenses

In 2020, we are increasing program expenses as follows:

- \$50,000 to develop a Continuity of Operations Plan (COOP) and pay for other process changes as a result of the internal controls assessment (ICA) and the enterprise risk assessment (ERA). (Note: there is a separate presentation on ICA and ERA that will be made to the Board by Deb Sharpless, Chair, Audit Committee and Susan Buse, Vice Chair, Finance Committee. The presentation and reports are on **pages 91-123** of Board Book Volume 1.)
- \$48,000 for a Human Resources consultant, also in response to the ICA and ERA.

Technology and Data expenses for TollMiner, web hosting, and our AMS are experiencing a slight increase over 2019.

To sum up, 2020 Expenses are roughly \$500,000 higher than 2019 in these areas:

Meeting venue and meals	\$53,000
Other direct meeting	\$83,000
Personnel and Benefits	\$174,000
Professional Services	\$104,000
Technology and Data	\$81,000
Total	\$495,000

International Bridge, Tunnel and Turnpike Association
Statement of Financial Position
June 30, 2019

ASSETS

CURRENT ASSETS

Cash and Cash Equivalents	\$ 529,782
Investments	2,031,989
Accounts Receivable	138,327
Meeting Expenses Paid in Advance	123,274
Prepaid Expenses and Other Assets	77,207
Due from Related Party	19,016
Total Current Assets	<u>2,919,595</u>

INVESTMENTS	1,779,178
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PROPERTY AND EQUIPMENT, NET	15,194
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INTANGIBLE ASSETS, NET	263,329
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DEPOSITS	<u>28,985</u>
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Total Assets	<u><u>\$ 5,006,281</u></u>
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LIABILITIES AND NET ASSETS

CURRENT LIABILITIES

Accounts Payable and Accrued Expenses	\$ 265,070
Deferred Revenue	686,673
Deferred Rent	30,618
Total Current Liabilities	<u>982,361</u>

DEFERRED RENT	<u>15,451</u>
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Total Liabilities	997,812
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NET ASSETS

Unrestricted:	
Undesignated	<u>4,008,469</u>

Total Liabilities and Net Assets	<u><u>\$ 5,006,281</u></u>
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2019 Budget vs. 2019 Full Year Projection as of June 30, 2019

	2019 Budget	2019 YE Projection	Variance 2019 Projection v 2019 Budget
Revenue			
75xx Member Dues	3,106,700	3,171,000	64,300
Total 76xx Meeting Revenues	2,485,631	2,562,600	76,969
Total 79xx Other Income	10,000	10,000	-
Total Revenue	5,602,331	5,743,600	141,269
Gross Profit	5,602,331	5,743,600	141,269
Expenditures			
Total Bank Fees	64,429	69,215	4,786
Total Design, Printing & Postage	132,200	131,509	(691)
Total Insurance	27,800	26,384	(1,416)
Total Meeting Venue & Meals	1,118,200	1,187,130	68,930
Total Miscellaneous	24,800	23,300	(1,500)
Total Occupancy	370,644	409,444	38,800
Total Office Expense	39,502	40,600	1,098
Total Other Direct Meeting Expenses	109,900	193,386	83,486
Total Personnel	2,551,342	2,502,992	(48,350)
Total Professional Services	475,365	504,134	28,769
Total Promotion & Advertising	25,500	31,500	6,000
Total Reference & Research	13,400	16,000	2,600
Total Technology & Data	482,000	418,000	(64,000)
Total Travel	77,400	78,871	1,471
Total Expenditures	5,512,482	5,632,465	119,983
Net Operating Income	89,849	111,135	21,286
77xx Investment Income - Total			
771x Investment Income - Portfolio			
7711 Dividends	40,000	40,000	-
7716 Investment Advisory Fees	(13,000)	(13,000)	-
Total 771x Investment Income - Portfolio	27,000	27,000	-
Total 77xx Investment Income - Total	27,000	27,000	-
Net Income	\$ 116,849	\$ 138,135	\$ 21,286

Proposed 2020 Budget with Comparison to 2019 Budget and 2019 Year End Projection

	Total Meetings	Total Programs	Total Supporting Services	TOTAL 2020 Budget	2019 Budget	Variance 2020 Budget v 2019 Budget	2019 YE Projection	Variance 2020 Budget v 2019 Projection
Revenue								
75xx Member Dues	-	-	3,436,000	3,436,000	3,106,700	329,300	3,171,000	265,000
Total 76xx Meeting Revenues	2,834,164	-	-	2,834,164	2,485,631	348,533	2,562,600	271,564
Total 79xx Other Income	-	-	20,000	20,000	10,000	10,000	10,000	10,000
Total Revenue	2,834,164	-	3,456,000	6,290,164	5,602,331	687,833	5,743,600	546,564
Expenditures								
Total Bank Fees	64,400	-	1,500	65,900	64,429	1,471	69,215	(3,315)
Total Design, Printing & Postage	102,950	19,800	29,500	152,250	132,200	20,050	131,509	20,741
Total Insurance	10,000	-	20,000	30,000	27,800	2,200	26,384	3,616
Total Meeting Venue & Meals	1,134,900	5,500	99,500	1,239,900	1,118,200	121,700	1,187,130	52,770
Total Miscellaneous	-	-	18,300	18,300	24,800	(6,500)	23,300	(5,000)
Total Occupancy	-	-	409,444	409,444	370,644	38,800	409,444	-
Total Office Expense	-	-	38,702	38,702	39,502	(800)	40,600	(1,898)
Total Other Direct Meeting Expenses	265,200	250	11,400	276,850	109,900	166,950	193,386	83,464
Total Personnel	-	2,100	2,674,666	2,676,766	2,551,342	125,424	2,502,992	173,774
Total Professional Services	82,500	253,900	272,200	608,600	475,365	133,235	504,134	104,466
Total Promotion & Advertising	22,500	-	5,000	27,500	25,500	2,000	31,500	(4,000)
Total Reference & Research	-	12,100	600	12,700	13,400	(700)	16,000	(3,300)
Total Technology & Data	-	499,000	-	499,000	482,000	17,000	418,000	81,000
Total Travel	58,600	4,850	24,750	88,200	77,400	10,800	78,871	9,329
Total Expenditures	1,741,050	797,500	3,605,562	6,144,112	5,512,482	631,630	5,632,465	511,647
Net Operating Income	1,093,114	(797,500)	(149,562)	146,052	89,849	56,203	111,135	34,917
Total 77xx Investment Income - Total	-	-	26,000	26,000	27,000	(1,000)	27,000	(1,000)
Net Income	\$ 1,093,114	\$ (797,500)	\$ (123,562)	\$ 172,052	\$ 116,849	\$ 55,203	\$ 138,135	\$ 33,917

IBTTA MEMBERSHIP COMMITTEE

Agenda

Thursday, January 9, 2020

9:10am to 9:50pm

Coral Gables, FL USA

1. Call to Order
2. Chair's Remarks
3. 2020 Dues Collection Recap
4. Review 2019 Goals
 - a. Membership
 - b. The Exchange Document Library
 - c. Strategic Partnerships
 - d. International Outreach
 - e. North American Efforts
 - f. Current Member Support
 - i. DBEs
 - ii. Young Professionals Council
 - iii. Women in Tolling
5. 2020 Goals
 - a. Taking 2019 initiatives to the next level
 - b. New Member onboarding support
6. Other Business
7. Adjourn

IBTTA FOUNDATION BOARD

Agenda

Thursday, January 9, 2020

9:10am to 9:50am

1. Call to Order
2. Catch up and reconnect
3. Welcome new directors (to be elected January 10)
4. Review and approve 2020 budget
5. Fundraising efforts for Scholarship Program and Service Project
6. Adjourn

Job Description for Members of the IBTTA Foundation Board November 4, 2019

Purpose

The purpose of this job description is to clearly describe the role of Foundation board members to ensure that the Foundation mission and board roles are aligned.

Foundation Objectives

IBTTA established the IBTTA Foundation in 2007 as the place to support the newly formed Leadership Academy which held its first Executive Development Program in 2008. Since then, the Foundation's work has grown to include the following objectives:

- To plan and conduct training, educational, and professional development activities such as the **IBTTA Leadership Academy**;
- To establish and implement a **scholarship program** to help deserving undergraduate students pursuing degrees in engineering, urban planning, and other relevant fields;
- To support charitable good works and **service projects** in cities where IBTTA holds conferences;
- To solicit funds to accomplish and support these purposes; and
- To engage in any other lawful activities in furtherance of the above purposes.

IBTTA Staff Roles

IBTTA staff have responsibility for planning and scheduling the Leadership Academy and Service Projects and overseeing the independent administrator that manages the scholarship program.

Board Member Roles

In the nonprofit sector, the three main elements of Board service are work, wisdom, and wealth. These are also important attributes for members of the IBTTA Foundation Board.

Work. Board members work as advocates and ambassadors for the Foundation to enhance its awareness, reputation, and capacity through social and professional events and activities. Work involves executing the programs/activities identified by the Foundation Board, being committed to the purposes and objectives of the Foundation, and holding oneself accountable for the success of the Foundation. The Foundation Chair may appoint committees to fulfill the Board's fiduciary responsibility including review, approval, and monitoring the annual budget.

Wisdom. Each Foundation board member brings a unique perspective and set of talents. As with any organization, board members are scanning the horizon to identify opportunities and activities that the Foundation can leverage to advance its mission.

Wealth. With a highly developed program of work that has real financial needs, wealth is one of the most important attributes of Foundation board service. Foundation board members should

actively participate in meeting the Foundation's financial needs. This includes personal giving, individual or corporate donations and all aspects of fundraising.

Importance of Fundraising

The IBTTA Foundation has an annual fundraising goal specifically for the scholarship program and the annual service project. The Leadership Academy is supported by the tuition charged to participants. To support these programs and the viability of the Foundation, we need board members who are committed to helping achieve the Foundation's fundraising goals.

Each year, the **Service Project** engages 40-100 volunteers to work on one major project for a day. In addition to the sweat equity that volunteers bring, the Foundation raises money to purchase supplies and make a contribution to the host charity.

The **Scholarship Program** strives to award no less than five \$5,000 scholarships each year. Foundation funds are also needed to pay for administration of the program by Scholarship America and the travel and lodging costs of award recipients to attend the Annual Meeting.

Now, more than ever, we need Foundation Board members who will focus on fundraising to advance the Foundation's vital work. Secondly, we need board members willing to handle any work or initiatives that are different from or go beyond the work that is already handled by IBTTA staff.

Summary: Facing the Community and the Future

The IBTTA Foundation is the face of IBTTA that looks both outward to the community (service projects and scholarships) and outward to the future to develop our industry's future leaders (Leadership Academy). To succeed at this great work of helping to make the world a better place by showing the caring and giving side of our industry, we need Foundation board members who are willing and able to raise the funds needed to support the Foundation's vital programs.

IBTTA GOVERNMENT AFFAIRS COMMITTEE

Agenda

Thursday, January 9, 2020

9:50am to 10:30am

1. Call to Order
2. Update on Congressional Activities
 - Staff visits with House staffers in November/December
 - Senate – Aug 1: <https://www.congress.gov/bill/116th-congress/senate-bill/2302/text>
 - House – Sept 11 hearing [https://transportation.house.gov/committee-activity/hearings/the-subcommittee-on-highways-and-transit-hearing-on --pricing-and-technology-strategies-to-address-congestion-on-and-financing-of-americas-roads](https://transportation.house.gov/committee-activity/hearings/the-subcommittee-on-highways-and-transit-hearing-on--pricing-and-technology-strategies-to-address-congestion-on-and-financing-of-americas-roads)
3. FCC NPRM on reallocation of 5.9 GHz
4. 2020 Fly-in
5. Adjourn

IBTTA PAST PRESIDENTS ADVISORY COUNCIL

Agenda

Thursday, January 9, 2020

12:00pm to 1:00pm

1. Call to Order
2. Catch up and reconnect
3. Honorary Member Candidates
4. Potential Board Candidates
5. Book for Future Presidents
6. Adjourn

IBTTA BOARD OF DIRECTORS

Agenda

January 9-10, 2020

THURSDAY, JANUARY 9, 2020

NOTE: The events on this day are OPEN TO ALL IBTTA MEMBERS.

10:45am – 12:00pm

Call to order and Discuss Emerging Technologies Committee White Papers

1:00pm – 1:45pm

Council of Platinum Sponsors Presentation and Discussion

1:45pm – 2:45pm

Continue strategic planning discussion with IBTTA Board members and all attendees

- Table groups convene for discussions on information from Emerging Tech and COPS
- Table leaders conduct specific exercises to identify the most important issues for IBTTA to focus on that may answer these questions:
 - What can IBTTA as the association do?
 - What can members do?
 - What could partners and allies do?

2:45pm – 3:00pm

BREAK

3:00pm – 4:00pm

Leaders of Board Committees, Working Groups, Foundation, and Discuss their visions and goals for 2020 and beyond.

- Finance & Investment
- Audit
- Membership
- Government Affairs
- International
- Young Professionals
- Foundation

4:00pm – 5:00pm

Report out from Table Groups

- Table leaders report out the highlights of their discussions

FRIDAY, JANUARY 10, 2020

NOTE: The events on this day are OPEN TO ALL IBTTA MEMBERS.

7:30am – 9:00am

Breakfast for all attendees

9:00am – 11:30am

Board of Directors Meeting

9:00am – 9:30am

Tolling Immersion Program Update

9:30am – 11:00am

The Board will review its Strategic Planning discussions

- Continue strategic discussions from Days 1 and 2
- CEO recap and next steps
- Other topics

11:00am – 11:30am

The Board will conduct routine board business and approve resolutions on Foundation board election, 401k, membership, investment policy, and conduct other necessary business.

11:30am

Adjourn

IBTTA Board Information – Letter #1 – A Quick Look Back

Dear IBTTA Board Members:

Joining the board of IBTTA can be a challenge because there's so much to know and learn. What's the mission of IBTTA? What does IBTTA stand for? Do we have a strategic plan? If so, where did it come from? Who drafted it? How often do we revisit it? What is the appropriate role of board members? What is my fiduciary responsibility? Do I have to attend all board meetings? How do I learn all this stuff?

Yep. That's a lot of questions. The most important thing to think about right now is that you are part of the IBTTA board, and we will do everything we can to help you perform as an effective board. IBTTA is a great organization. My predecessor as executive director of IBTTA, Neil Schuster, used to say this is what IBTTA stands for: **I Belong To a Terrific Association**. True enough.

As a new board member – and perhaps a returning one – you have questions about your role and responsibilities. Some people, when they take on a responsibility like this, feel like they're drinking from a fire hose. We're going to try to make your initiation less stressful than that. We'll try to manage the flow of information so it comes to you in a steady stream and won't knock you over. At least, that's our intention.

The next board meeting starts on January 8, 2020. That's 56 days away. Between then and now, I plan to write a letter to you every couple of days with some new and, I hope, useful information about IBTTA, the board, and your role in it. I have an idea of some important things I think you should know. But, as I unspool these letters, don't hesitate to ask questions. You can "reply all," email me privately, or call me on cell at +1 703 587 5683. Over the course of the next 56 days, I'll try to answer as many questions as I can and convey other pertinent information that perhaps you haven't thought about.

First, I suggest you take a quick look back. Most of you know that IBTTA was founded in 1932. But do you know what has happened in the 87 years since then? As luck would have it, ITS International published a commemorative magazine on the 75th anniversary of IBTTA at our annual meeting in Vienna, Austria in 2007. Here's a [link to that 42-page publication](#) that will give you a glimpse of the first 75 years of IBTTA.

There's more to learn and experience about IBTTA and your role on the board. Stay tuned for more information in my next letter. And, don't hesitate to ask questions.

Best regards,

Pat

IBTTA Board Information – Letter #2 – What about strategy?

Dear IBTTA Board Members:

We work on strategy a lot at IBTTA. A short, simple passage on our website says, “The IBTTA Board of Directors sets the strategic direction of the association, approves the association outcomes to be accomplished, and assures that the resources necessary for the achievement of desired outcomes are available and used efficiently.” I see the main function of the board as developing the vision, direction and strategy of the association. Strategy helps us answer the questions: Where are we? Where are we going? How are we going to get there?

The strategic direction of IBTTA is not about business as usual — it is about the change needed to stay relevant! This separates the strategic plan from the operational plan. Both are important. The strategic direction is a constant reminder, as the leadership team oversees the development of the annual operational plan, of what must be changed to stay relevant to what members are seeing in their real world.

A strategic plan can only stay current and relevant if IBTTA ensures that the plan is updated. It is the leadership team’s working document. Therefore, the board has both the right and the responsibility to change the strategic plan any time it needs to be changed based on sound reasoning and assessment; and update the plan regularly on an ongoing basis.

Mary Jane O’Meara, IBTTA’s President in 1999, is often credited with leading IBTTA to develop its first strategic plan. She was the second woman ever to serve on the IBTTA Board. According to Mary Jane, board meetings back then were short and superficial. There was no expectation that the Board would discuss policy, big ideas, or develop long-term strategy to advance tolling. So in 1999, she set out to create a strategic plan for IBTTA.

Our board has developed and adopted several strategic plans since then. In each of those efforts, the board has reevaluated the association’s mission, vision, values, and long-range goals. A key feature of all our strategic plans over the years is the belief that IBTTA should be:

- THE advocate for tolling
- THE central clearinghouse of knowledge and information about tolling
- THE leader in offering high quality meetings and educational experiences for the industry

The IBTTA Board adopted the [current strategic plan](#) in 2015. Under that plan, IBTTA’s mission is “To advance transportation solutions through tolling.” In addition to a mission, we adopted a big audacious goal (B.A.G.) or vision. According to the plan, our B.A.G. “is a goal that stretches beyond IBTTA’s current three to five-year goals. Because it is ‘audacious’ it represents a significant challenge and its achievement will require IBTTA to move outside of its comfort zone. The goal should stimulate leadership activity, commitment and participation beyond

IBTTA's present leadership. It helps to set the direction for the succession of future three to five-year strategic plans."

Our current Big Audacious Goal is this: "IBTTA will be recognized as the leading voice to advance transportation solutions through tolling."

In 2018, the Board began a process to update the 2015 strategic plan. Rather than replace that plan, we adopted a rolling [Three-Year Plan](#) which focuses on achieving specific outcomes deemed important to the members and the future of the association. The four major outcomes focus on (1) strengthening IBTTA's current programs and services; (2) enhancing our data and analysis capabilities through a fully mature TollMiner data product; (3) enhancing knowledge transfer within the industry; and (4) developing an industry vision that integrates our industry more appropriately into the fabric of the larger transportation community.

As a board member of IBTTA, you'll spend quite a bit of time talking about and working on strategy. Our strategic plan helps define the core of IBTTA.

Best regards,

Pat

IBTTA Board Information – Letter #3 – The Advocate

Dear IBTTA Board Members:

Most transportation associations in Washington, DC devote a lot of resources to communications and advocacy – to cultivate a positive industry image and create a favorable political and business environment for its members. IBTTA is no exception.

In 2013, we took a big step forward to shape the public conversation about tolling. We launched the [Moving America Forward public awareness campaign](#). Through the campaign we are engaging the mainstream media, policy makers, and the public in a thoughtful dialogue about the importance of tolling as one of the tools in the toolbox that can help rebuild America's transportation infrastructure. Through this campaign we are working to achieve the Big Audacious Goal that "IBTTA will be recognized as the leading voice to advance transportation solutions through tolling."

The campaign combines tolling facts with important transportation stories to bring attention to the many benefits of tolling. We also focus aggressively on responding to inaccurate and misleading information about tolling. Since the campaign's launch, we've seen a dramatic increase in mentions of IBTTA and industry priorities in the news media, including high profile stories on NBC Nightly News, CBS News, and ABC News; in the pages of *The New York Times*, *The Washington Post*, and the *Wall Street Journal*; and in countless other media outlets.

IBTTA also created the [Grassroots Toll Kit](#), an online repository of resources to educate people about the benefits of tolling. Together we are making a difference in shaping the dialogue about transportation funding and reaching influential stakeholders in America and around the world. Through the campaign, IBTTA has established itself as a leader in transportation and positioned tolling as a proven and viable infrastructure funding option. The campaign is led by IBTTA Communications Director [Bill Cramer](#).

Being "[The Advocate](#)" also means advancing the concept of tolling before government officials. This work is carried out by our Government Affairs Director, [Neil Gray](#); our outside lobbyist, Kathy Ruffalo; and by members of the Government Affairs Committee and others who participate in our annual Washington, DC "Fly-In." Last week our staff held meetings in the offices of 15 members of the House Transportation and Infrastructure Committee to brief them on the role that tolling plays in road funding, finance, and mobility around the world. We also laid the foundation for more intensive discussions leading up to reauthorization of the FAST Act. In addition, we respond to requests for information about tolling from states, and this year have testified at public hearings in [Connecticut](#) and [Maine](#).

IBTTA has a positive story to tell. We want people to know that transportation policies that embrace tolling are an important way to enhance mobility and the quality of life for all road users. It's our job—as an industry and an association—to tell that story.

Best regards,

Pat

IBTTA Board Information – Letter #4 – TollMiner

Dear IBTTA Board Members:

I had a colleague at another association who liked to say, “She who has data is better than she who doesn’t have data; and she who has more data is better than she who has less.” Truth!

Our member surveys consistently show that members want access to accurate industry reports, data, and market intelligence. An opportunity analysis in our 2015 Member and Nonmember Study showed that developing industry studies and reports is a great opportunity for IBTTA to deliver value to members across all categories.

IBTTA’s [TollMiner™ Data Visualization Tool](#) is one response to your appetite for data. Since 2016, we have been gradually and painstakingly building a comprehensive database of information about toll operators around the world. Right now TollMiner data comes from IBTTA staff researching and cleansing industry data **from publicly available resources**. This is a big effort but necessary because collecting data from agencies historically has been a challenge. The current release of TollMiner, available to IBTTA members only, is known as 3.0. In future releases we will engage with and collect data directly from operators because some important data points are often not published.

What kind of data do we have? How about traffic and revenue. We’ve collected revenue and vehicle volume data on almost all 127 U.S. toll operators. For example, the Golden Gate Bridge Highway and Transportation District collected \$147 million in toll revenue on more than 20 million trips in 2018. All U.S. operators collected more than \$20.6 billion in toll revenue on more than 7.9 billion trips in 2018. We also collect data on facility type (road, bridge, tunnel), centerline miles, and collection method (Cash, ETC, AET). We have a special section on priced managed lanes. We know there are 26 entities operating 51 priced managed lane facilities with 718 centerline miles in 11 states – as of today. We can drill down and tell you the precise characteristics of each one of those facilities, including maps using data from Open Street Maps (OSM).

You want data and we’re trying to deliver it. We’re adding new data and new functionality almost daily. We’ve begun to collect data on operators outside the U.S. and are working to make it even better. If you’ve never looked at TollMiner before, you should. You can even get a private tour from [Cindy Norcross](#), our Research and Technology Director. She is assisted by Lisa Jewell, our Research Specialist.

How do our members use this data? One operator contacted us to investigate the feasibility of implementing AET on bridges. They wanted to find agencies that were like them in size that had already done it. We provided a list, traffic and revenue data, and the names and locations of all AET bridges in the U.S. TollMiner data helped this member build the case for their senior leadership and board.

What are some other uses for this data? The news media are constantly asking us for tolling data and insights when writing stories, and we can provide the right data at the push of a button. We ask them to credit IBTTA TollMiner as the source, which helps advance our Big Audacious Goal: "IBTTA will be recognized as the leading voice to advance transportation solutions through tolling."

What problem are you trying to solve? Chances are we have the data you need in TollMiner. And if we don't have it, we're probably working on developing it. Still not sure? Contact Cindy. She has a lot of data!

Best regards,

Pat

IBTTA Board Information – Letter #5 – We have meetings!

Dear IBTTA Board Members:

One of my favorite moments in IBTTA meetings history was the closing session of the 2005 annual meeting in Cleveland in which we staged a short dramatic play called **“Your Toll Road: Sell It or Keep It”** featuring several of our members as the main characters. The actors all deserve Academy award nominations for their outstanding performances. Ed DeLozier (E-470 Public Highway Authority) played the role of “Governor,” a stereotypical big shot politician whose main interest is raising money and getting re-elected. Michael Huerta (ACS State & Local Solutions) was exquisite in his portrayal of “Mr. O’Money,” a devilishly unscrupulous and fantastically rich private toll road investor. Ken Daley (Transurban City Link Limited) portrayed the role of the harried toll agency “Executive Director” grappling with huge forces beyond his control. Kelly Wick (Tamer Partners Corporation) portrayed three different versions of “Everyman” (depending on where you come from), poking and prodding the other actors on stage with his dizzying array of challenging and difficult questions. And Steve Snider (Halifax Harbour Bridges) was poignantly confused in his portrayal of a state “Senator” trying desperately to weigh all the evidence and make the right decision – whether to sell or keep the toll road.

The “Oscar,” however, goes to the audience. In the first few moments after the on-stage actors completed their scripted dialogue and took seats on stage, the audience remained quiet for what seemed like an eternity. Then one by one, audience members approached the microphones and began to ask questions. I knew something magical had happened when, after only a few questions, the audience members began to pose very sophisticated and challenging questions *in character*. One audience member appeared as the destitute mother of six children wondering how much the tolls would increase after the sale and whether she would be able to afford to ride the toll road again. Another audience member introducing himself as “Mr. More Money from Switzerland” offered to buy the toll road with a bid one and a half times the size of that offered by Mr. O’Money on stage. It went on like this for an hour. When it was over, I realized that this is the kind of interaction, dialogue, and learning that we want to happen at every IBTTA meeting.

Later that day, a representative from a private toll road investor approached me and said that he had learned more about public perceptions of potential asset sales in the U.S. by listening to the “actors” in the audience than by any other experience in his career. He said that the “general public” represented by audience members spoke with great fervor and emotion because they didn’t have to worry about offending any “real” people. This truly was an amazing result of this little drama.

Not all IBTTA meetings have the same level of energy and artistic creativity as that session in Cleveland. But many of them do. Creating an IBTTA meeting is an exciting and painstaking process that involves dozens of member volunteers and most of our staff working together for months or years. We hold 5-6 major meetings each year ranging in size from 150 delegates to

more than 1,000. In 2019, our meetings accounted for more than \$2.5 million in association revenues, roughly 45% of the IBTTA budget. We've held meetings in North America, South America, Europe, Africa and Australia. Each year our workshops are organized around major themes such as Technology, Finance, Maintenance & Roadway Operations, the Global Tolling Summit, and Communications (every other year). If you meet someone on the street who is familiar with IBTTA, it's most likely because they attended one of our meetings.

According to the 2015 Member and Nonmember Research Study, IBTTA is widely perceived as a market leader for meetings and business development opportunities. Over 70% of respondents rated IBTTA as being their first choice for meetings and tradeshows and associate members cited IBTTA as providing the best business development opportunities.

It takes a village to make an IBTTA meeting. Hundreds of volunteers each year plus our entire staff. While [everyone on staff](#) has a hand in our meetings, the folks who work on them every day include **Wanda Klayman**, Deputy Executive Director; **Cheryle Arnold**, Web Services and Conference Production Manager; **Kristin Bromberg**, Marketing Manager; **Anna Sohriakoff**, Meetings and Special Projects Coordinator; **Harry Smith**, Office Manager and Meetings Registrar; **Ancilla Brady**, Membership and Business Development Director; and **Terri Lankford**, Membership and Business Development Manager.

If you've attended and enjoyed an IBTTA meeting recently, thank these members of our team. And check out our [calendar of events](#) for 2020!

Best regards,

Pat

IBTTA Board Information – Letter #6 – Duty of Care, Loyalty and Obedience

Dear IBTTA Board Members:

Up until now, these letters have focused on aspects of IBTTA that are informational and nice to know. This letter explores a more serious, **need to know** topic: the fiduciary duties of board members.

A nonprofit board and its members individually have three fundamental fiduciary duties: a duty of care, a duty of loyalty, and a duty of obedience.

The duty of care describes the level of competence that is expected of a board member and is commonly expressed as the duty of "care that an ordinarily prudent person would exercise in a like position and under similar circumstances." This means that a board member owes the duty to exercise reasonable care when making a decision as a steward of the organization. To fulfill the duty of care, board members must:

- Be interested in and understand the organization's mission, goals and plans;
- Prepare for and actively participate in board and committee meetings;
- Review all board materials and agendas in advance;
- Be alert to potential problems and concerns; and
- Investigate violations or irregularities in the governance of the organization.

The duty of loyalty is a standard of faithfulness; a board member must give undivided allegiance when making decisions affecting the organization. This means that a board member can never use information obtained as a member for personal gain but must act in the best interests of the organization.

The duty of obedience requires board members to be faithful to the organization's mission. They are not permitted to act in a way that is inconsistent with the central goals of the organization. The governing board must comply with local, state and federal law and conform to the organization's tax-exempt standing, articles of incorporation, bylaws and policies. This duty forbids acts outside the scope of corporate powers. A basis for this rule lies in the public's trust that the organization will manage donated funds to fulfill the organization's mission.

The board duties of care, loyalty and obedience are of more than academic interest. Observing these duties is serious business. Every day we see articles in newspapers and stories on TV alleging that the President of the United States has placed his own personal interests ahead of the interests of the country he is sworn to serve. Whether the allegations are true or not, the appearance of impropriety can bring damage to the country. This is territory that the IBTTA board must avoid. The appearance of impropriety by the board as a whole or by even one board member can harm the reputation of IBTTA and result in the loss of members, sponsors, meeting attendance and more.

We will continue our conversation about the fiduciary duties of board members during the January 8-10, 2020 board meeting. I wish to give credit to [BoardSource](#), [The Guidestar Blog](#) and [Tecker International](#) for important information used in writing this letter.

Best regards,

Pat

IBTTA Board Information – Letter #7 – Bylaws, Ethics and Antitrust

Dear IBTTA Board Members:

In Letter #6, we talked about the fiduciary duties of the board: the duties of care, loyalty and obedience. Those are big duties and you might be wondering what resources are available to help you fulfill those duties. The **duty of obedience**, in particular, requires board members to be faithful to the organization's mission; act in ways that are consistent with the central goals of the organization; comply with local, state and federal law; and conform to the organization's tax-exempt standing, articles of incorporation, bylaws and policies.

We have resources to help you understand these duties. In this letter, we'll focus on three resources: the bylaws, policy of ethical behavior, and antitrust policy.

The IBTTA [bylaws](#) describe such things as the classes of membership, qualifications of directors and officers, committees, and other information about governance. Did you know that all IBTTA members are elected by the board? That's right. According to Article II, Section 2, "Active Members, Associate Members, Sustaining Members and Honorary Members shall be elected to the Association by resolution of the Board of Directors." That's why we include a resolution to elect new members in almost every board briefing book.

Another part of the duty of obedience is complying with the [Policy of Ethical Behavior](#) approved by the board in 2008. As described in the preamble, "The Policy of Ethical Behavior (the 'Policy') serves as a code of conduct for all who are performing official duties on behalf of IBTTA in their various capacities, as Officers, Board members, as members of Task Forces or Committees, as Volunteers, as Paid Consultants and as Staff (hereafter referred to as 'IBTTA Representatives')." The Policy of Ethical Behavior includes a Code of Ethics, a Conflict of Interest Policy, and a Whistleblower Policy. These policies apply to all "IBTTA Representatives" including board members and staff.

The board adopted an [Antitrust Policy](#) in 2015. The introduction says, "It is the policy of IBTTA to comply with all applicable federal and State antitrust laws. The fundamental objective of the antitrust laws is to protect and promote free and fair competition. IBTTA understands and supports the public policies embodied in these laws. Through the adoption and issuance of the IBTTA Antitrust Policy, IBTTA affirms its commitment to abide by the spirit and the letter of all antitrust laws, and all members of IBTTA are required to do so as well in connection with their participation in IBTTA activities."

In addition to these policies, IBTTA has a relationship with the law firm Webster, Chamberlain & Bean, to help us with any matters on which we need legal guidance. WC&B is one of the leading firms in the United States specializing in providing a full range of legal services to

nonprofit and tax-exempt organizations. Since 1970, WC&B has provided comprehensive legal services to a broad range of trade associations, professional societies, foundations and other organizations. One of the firm's partners, Hugh K. Webster, serves as IBTTA's General Counsel. Hugh is a nationally recognized lawyer who has served as an advisor to associations and other non-profit organizations and association management companies for almost 20 years. With special expertise in governance, strategic, and operational issues, Hugh also works in such diverse areas as employment, taxation, antitrust, contracts, standards and certification, code of ethics, publishing, and fiduciary obligations of directors and officers. Hugh Webster helped us draft both the Policy of Ethical Behavior and Antitrust Policy.

These are a few of the most important resources to help board members comply with the duties of care, loyalty and obedience. We'll talk about these duties during the January 2020 board retreat.

Best regards,

Pat

IBTTA Board Information – Letter # 8 – Internal Control Assessment and Enterprise Risk Assessment

Dear IBTTA Board Members:

In 2018, IBTTA's Audit Committee and Finance Standing Committee of the Board recommended to the Board that IBTTA conduct both an **internal control assessment** (ICA) and an **enterprise risk assessment** (ERA). The two committees sought these services to advance the Board's fulfillment of its fiduciary responsibility to ensure that IBTTA is taking appropriate and manageable risks and that IBTTA's internal controls are sufficiently robust to protect it against fraud or other financial malfeasance. With the board's concurrence, staff issued an RFP to engage a firm to provide these services. In late 2018, the leadership of the Audit and Finance Committees selected the firm Clifton Larson Allen (CLA) to conduct the assessments.

The objectives of the internal control assessment were to evaluate the design and operation of the current internal control state; identify improvement opportunities; and propose recommendations that improve internal control and/or future mitigate risks. CLA examined key process and subprocesses in six categories: revenue and receipts; non-payroll disbursements and accounts payable; compensation and benefits; investments and cash management; journal entries and financial reporting; and budgeting.

The assessment resulted in nine observations and recommendations, outlined in the Detailed Observation Listing section. Overall these observations are reflective of a stable internal control environment and offer opportunities to strengthen the current state. The observations followed the following key themes:

- Implement policies and procedures for the documentation of review and approvals.
- Enhance internal controls with increased segregation of duties and additional "preventative" mitigating controls within the payroll processing and journal entry review.
- Establish an organizational chart outlining approved reviewers, including alternative reviewers.

According to CLA's report, "the results of the assessment are primarily reflective of opportunities for IBTTA to enhance the current internal control environment. The results of the assessment align with what we would expect to see for an organization with the size, maturity, and structure of IBTTA. IBTTA has a stable internal control environment, supported by this assessment and the results of the financial statement audit."

The second study performed by CLA was the enterprise risk assessment. The objectives of this assessment were to:

- Conduct a strategic level assessment of IBTTA's exposure to risk such as financial loss, inefficient operations, legal violations, reputation damage, long-term viability or similar endangerments;
- Identify the most likely or imminent risks; and
- Start a dialogue between management and governance regarding proper actions to reduce the likelihood and minimize the impact of the prioritized risks.

CLA classified risks in quadrants of likelihood (unlikely to imminent) and timing (0-60 months). They noted four general responses to any risk: accept and monitor, mitigate, transfer or avoid. They recommended monitoring the middle tier risks in Quadrants I and IV and accepting the very unlikely Quadrant III risks. They identified 7 risks with higher likelihood and potential for near-term effect (Quadrant II).

In response to the risk assessment, staff developed an action plan to mitigate the Quadrant II risks. One response of the action plan was to continue best practices such as internal controls, standard operating procedures, review and enforcement of policies, employee cross-training, member communication, industry focus groups and periodic evaluation of the Board's Strategic Plan.

As part of the action plan, staff committed to:

- Conduct an internal control assessment every four years.
- Provide risk training for senior staff.
- Develop a Continuity of Operations/Disaster Recovery Plan.
- Document types of data maintained by IBTTA, the relevant privacy requirements, and investigate the cost/benefit of a cybersecurity assessment.
- Develop a formal succession plan.

Much work has gone into these reports over many months, especially the ERA action plan and the management responses to the ICA. The team that oversaw this process included Audit Committee Chair Deb Sharpless; Finance Committee Chair George Zilocchi and Vice Chair Susan Buse; Deputy Executive Director Wanda Klayman; CFO Cathy Pennington; and me.

One major response is that IBTTA management will develop a Continuity of Operations Plan (COOP) with annual reviews and practice. This is to ensure that we can appropriately respond to a disaster or other event that impairs business continuity. We included \$50,000 in the 2020 budget to develop the COOP.

You can read the ICA, ERA, and IBTTA's ERA action plan on [pages 91-123 of the September 2019 board briefing book](#).

Best regards,

Pat

White Paper

Big Data Workgroup

How Toll Agencies Can Make Best Use of Big Data

Abstract

The future of tolling depends on the data and analytics capabilities we build and scale. Big data can produce a lot of value for tolling agencies, but only if we know how to claim it. But big data's value doesn't come from the collection of information—that's just the starting point. The real value comes from our ability to combine tolling data with other data repositories and use that stored and/or real-time information to uncover new insights with big data analytics, and then present those ideas to promote better business decisions. The intent of this white paper is to assist tolling agencies make more informed business investment decisions and collect better business insight and intelligence by using big data appropriately.

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Introduction

With increased connectivity and communications among vehicles, organizations, systems, and people, unprecedented amounts of data are being generated. However, despite its abundance, access to this data and the ability of transportation agencies across the United States to translate it into relevant and valuable information remains limited, particularly as it relates to mobility, programming and planning, and investment decisions, as well as performance evaluation.

Tolling has evolved from an all cash ticket system, to all electronic tolling due to advancements in technology. However, the system integrators have built the systems on a “piece meal” basis in response to the technology changes. All electronic tolling has made tolling more transaction-based starting with pre-paid customer accounts using vehicle transponders to post pay utilizing billing systems where drivers are billed and sent an invoice for payment. Reporting needs have also drastically changed from providing a simple report of expected revenue based upon vehicles paying cash tolls and cash received to inventory management, road side transactions, back office received and processed and finally, a billing/accounting system. Reports often are the last thing system integrators provide, and if provided, it is long after system go-live. Toll agencies are often operating in an informational vacuum working with limited reports.

Scope of White Paper

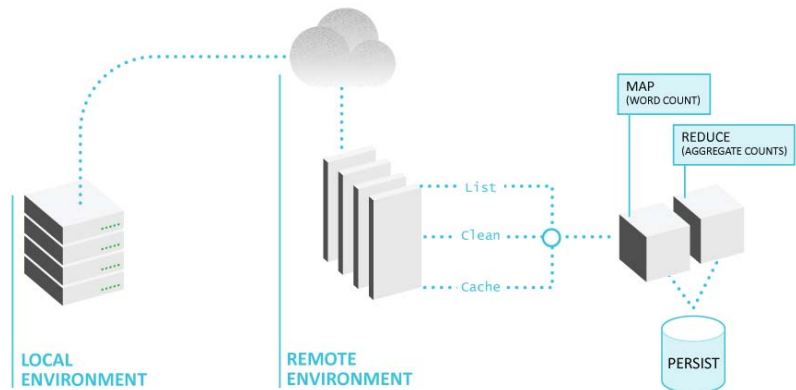
The future of tolling depends on the data and analytics capabilities we build and scale. Big data is defined as extremely large data sets from varied sources that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions. Big Data can produce a lot of value for tolling agencies, but only if we know how to claim it. But Big Data’s value doesn’t come from the collection of information; that’s just the starting point. The real value comes from our ability to combine tolling data with other data repositories and use that stored and/or real-time information to uncover new insights with Big Data analytics, and then present those ideas to promote better business decisions.

The intent of this white paper is to assist tolling agencies make more informed business investment decisions and collect better business insight and intelligence by using Big Data appropriately.

Toll agencies invest in volumes of data. It is time to turn this business investment into value. This paper explores the Big Data infrastructure that supports new opportunities, cost savings, transformation, and return on investment (ROI) in your data by addressing the questions raised in the remainder of this white paper.

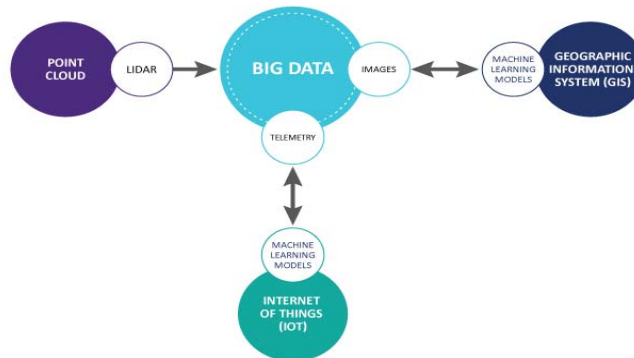
Section 1. What is Big Data?

Big Data is defined more by how it is processed than by raw numbers – but today, data sets of 500 GB and above would be considered Big Data. If datasets exceed the capacity of conventional computing platforms, then *distributed cluster processing* is the ‘go to’ technology and that essentially defines the problem as a Big Data problem. Big Data programs start with migrating locally produced data to cloud-based storage where it is loaded onto a distributed cluster of machines. The data is prepared for usage and then a process – MapReduce – is used to map a transformation over all elements of the distributed data and reduce those transformations to results or a summarization.



What Interactions Does Big Data Have with Other Technologies?

Beyond the obvious and original connection of Big Data to the web, there are new connections being formed with emerging data sets including GIS, IoT, and Point Cloud (remote sensing) technologies.



Where Is Big Data Headed?

The surprising increase in scale for Infrastructure as a Service (IaaS), cloud vendors are the most obvious indication that a landslide of new data is on the horizon. The more subtle change is that how the data is used is going to change in equally dramatic fashion. There are a few noteworthy changes suggested below.

Machine Learning Takes MapReduce to New Levels

Just as MapReduce provided a distributed solution to very large datasets, Machine Learning (ML) models will become the functions that perform both a map and reduce step to produce fully transformed and summarized data. These models will be managed, and as their

performance degrades, they will be replaced by a pipeline of new models. The complexity of the transformations that ML models bring on-line should not be underestimated as input vectors to Deep Neural Networks (DNN's) climb beyond 100,000 elements feeding more than 1,000 hidden layers to produce results.

Use Case: Geospatial Data. 3D GIS leads the pack for applications of Big Data particularly as point cloud generation continues to make inroads into highly realistic digital renderings of environments. Look for Big Data processing to solve the computational burden of object detection, classification, and for computing interacting geometries.

Nowcasting Rather than Forecasting

With the advent of extremely large data sets in streaming form, e.g. motion video from a car-mounted video camera, it is likely that “in stream” processing will become the norm. This will fuel a predictive analytics cycle that provides immediate estimates of future states based on huge quantities of current data.

Use Case: Video Stream Processing. Remote sensing by our connected machines like connected autonomous vehicles will require real-time processing before storage to present detected objects to the control systems. This places the burden on the stream to perform the processing for everything from inbound streaming video to vehicle-to-vehicle communications.

Streaming Data and ML will Fuel the Semantic Web

While people perform searches, IoT generates data, and remote sensing systems digitize the world, they are building relationships between digitized objects. These relationships are multi-dimensional including spatial orientation, compositional makeup, ownership, and preference just to name a few. The digital ecosystem will not only receive and store raw data but will also produce more data by making inferences about these relationships. This presents a new frontier of data to be mined, understood, and utilized.

Section 2. Who Should Care About Big Data

Changes in roadside and in-vehicle technologies, as well as changing vehicle ownership are all opportunities for the toll industry to look at how, when, and where we participate. The opportunity to put these changes and evolutions in buckets and analyze their effects on our industry is a good first start.

The immediate bucket that will affect users is the method used to pay for these. While vehicles are evolving, the need to pay for tolls remains unaffected. No matter what you are driving, or who is driving, or even if no one is present in the vehicle, the need to pay for tolls is still required. Who gets charged and how is a question we should look to solve—now. Connected, automated, and/or electric vehicles will not change this aspect of toll road usage.

Internal --- Tolling Industry

In general, there are several major strategic drivers of the tolling industry that could be supported by accurate and thorough use of available Big Data. They are:

- Safety – to provide the safest possible environment
- Customer – to meet and exceed customer expectations
- Financial – to maintain a sound financial position
- Infrastructure – to make sound investments in new assets and maintain existing assets
- Mobility – to maintain an accessible, reliable, and available travel system

Managers, analysts, operators, enforcement officials, customer support and maintenance personnel, training staff, and developers should all be aware of and knowledgeable about various aspects of Big Data – its availability and how to leverage it. Managers should use Big Data to make better decisions faster, enabling all the strategic drivers above. *For example, adding weather data into trip data could show differences in rain vs. travel by time of day. This would allow for the staging of safety vehicles and assist in provisioning dynamic messaging to customers.*

External --- Customers

The major drivers for customers are accuracy, speed, safety, and relevance.

External --- Government/Regional Transit and Local Partners

Major drivers for governmental agencies, regional transit and local partners are:

- Accuracy, flexibility, and scale of analytics
- Accurate application of regulatory compliance
- Optimization of capital expenditures

Predictive analytics allow agencies to investigate uses of their systems and identify areas of fraud, waste, and abuse simply by investigating outlying or emergent data. With Big Data analytics, agencies are past the point of trying to use static reporting to understand complex data patterns.

Section 3. Data Management

Introduction

There is data being generated and recorded all around us in nearly every industry. Utility industries use the data being generated from the various metering to record peaks and valleys in usage. This allows the particular company to ensure that sufficient capacity is available during the hours, and days for their customers. This meter data from the sensors, on the sides of buildings, may not tell the complete story. There may be other data sources to consult. The weather report could affect the usage for a particular time period. The number, and type of

construction permits in an area would give string indicators of usage increasing, or not given a geographical area. All of these data points can be leveraged, with the idea in mind of trying to give the customers the best experience, while making the best decisions for the business. What is your line of business? What are the factors that influence it? Are there auxiliary activities that depend on it? What auxiliary activities do you depend on? Is there a single governing body? Is there a committee that votes? Are there parallel activities that are similar to yours? Once you have identified one, or more of these areas, now how do you find data from these processes. This may take a sustained effort of patience, and following a process, rather than a single action. Not every action or activity will have publicly exposed, freely available data. The more data you gather, the more possibilities exist from its possible combinations. This can be a good thing, and it can be an impediment. When the amount of data overwhelms the person's, or people's ability to sift through it, Big Data just becomes big confusion.

Approach

The goal is to choose the right data to be analyzed for the best results every time. This is much easier said than done. One of the best ways to ensure failure in Big Data and Analytics, is to attempt a project beyond the scope of understanding of the team that will be working with it. It is far more effective to choose a smaller, simpler dataset that more people understand. Complexity, and larger datasets, can always be added at a future time when people have a mastery of the simpler ones. Individuals and teams who work closely to the source of the data are very valuable sources of knowledge. They may have no idea what is going to be done with the data they produce, but they can explain the data is being produced. This information should be recorded and placed with the data as it is stored for future use.

As the demand grows for greater amounts of data, and as the number of data sources increases, the responsibility for the collection and distribution becomes increasingly important. As we become more dependent on data to make decisions, we must either take responsibility for getting the data we need, and then depositing it in a local storage location. Or we must get another team involved, who specializes in the care and feeding of the data, in another location. That location can vary based on the technology choices that each group makes. Their involvement in the data management can be very useful, as standards and policies need to be enforced.

Many policies and standards for how to treat data will likely exist in your direct organization, or extended organizations. This does not mean that you should shy away from trying to use data to get insights on how to improve aspects of your business. It does mean, however, that you will need to familiarize yourself and teams of any risks that each data set has. Some data will have no restrictions on it. Some data will be highly restricted due to its sensitive nature. You will be responsible for identifying the sensitivity level of the data and using it properly within the bounds of your permissions. The central organization that handles the data operations will have to grant you access, that is appropriate for your job. Do not assume that just because you have permissions to view it, that the data is fit for public release. There will be times that you are not sure of the sensitivity of data you are working with. Reach out to the subject matter

expert or technical lead on the project and inquire. If that person is not available, reach out the organization closest to the source of the data that you have access to.

Securing data for internal and external usage can be very detail oriented, but can also help protect your organization, and others from unintended consequences. The details of implementing an all-encompassing security policy are too numerous to list in this document, but we will attempt give some guidelines to help start the conversations around the topic for your organization and others. The security options will be different based on access to each resource as well. When we give access to outside individuals, we need to have agreements in place to protect both sides. This will likely have to come from the legal department where you are. A few questions the organization will need to answer are: Is this data ok for the public to see? How long can the data be available? Is there an access control mechanism? Who owns each piece of the data? Is there a certification process defined for adding new data?

Standards, and interoperability can be divided into three areas of concern, storage, format, and transport/availability. These three areas are related and can affect one another.

The first area to address is storage. Where and how you store your data can greatly affect the other two areas. A common question to ask is whether you should store the data on premises or in one of the major cloud providers. If you have a team of IT professionals to take care of the data and the hardware it resides on, then you may want to leverage that investment and in-house expertise. If you do not have such a team or your team is too busy, one of the major cloud providers would likely be better for the time being. The cost is usually very attractive, and do not hesitate to ask the provider of your choice about their pricing, and what they are willing to do to win your business. This cost will be an on-going operational expense so that will need to be considered in the current budget and the following budget planning sessions.

The second area to address is the format with which to store your data. Three popular file formats which are universally accepted are CSV (comma separated values), XML (extensible markup language), and JSON (JavaScript object notation). Nearly every data processing technology will have the ability to ingest these file formats. There are a few others that have been designed especially for Big Data analysis, such as Avro or Parquet. If your organization already has these Big Data formats being used for information processing, then you can build from the current examples being used. If not, it is recommended to start with more general file formats, and further specialize when situations demand it. Another advantage to storing your data in a generally understood and consumable format, is for future projects. Technology moves at a very rapid pace, but the need for data is going to increase as time goes on. We cannot predict the future, but we can do our best to remain as flexible as possible. It will typically be a built-in feature of the platform to take a general data format and transform it to a future specialized format. It will likely be more effort to go from current specialized format to future specialized format.

More than likely, organizations will have some form of database, relational, or non-relational where some of their data resides. If this is the case, this organization should inquire with the team in charge of the data that resides on the database server. The group in charge of the databases can usually back up the data to a file, after which it can be catalogued and stored.

There may be extreme circumstances where data should not be exported. One of these cases might be when Personally Identifiable Information is present, always check your organizations data privacy policies before storing any data. Once the data is in file format, it can be compressed and stored in the location selected. If the amount of data is going to be cost-prohibitive to store for some reason, you can reduce the historical length of time, or which fields to export, until you have achieved the right balance of cost versus data.

The third area of concern to address is the transport/availability of the data. Once the data is obtained and stored, it needs to be used to justify the effort and cost. Some data will be fit for general public consumption, some will not. For data that is cleared for public use, it is recommended to provide an online portal where users inside and outside of your organization can discover it via search engine and download their own copy to work with. Even though it is a public download it is best practice to meet with your legal representation and ensure that a user license agreement is included where appropriate. When data is meant for a bigger audience, but not everyone, you can put a login in front of the data to ensure that those looking at the data have traceable login credentials. Once again, check with the legal team to ensure everything is above board before asking people to give any of their information. Once the overall logins are established, more sensitive data can be restricted to those with logins for the appropriate scope of usage. If one does not exist, a user management portal with the ability for users to create or request accounts will need to be deployed or created.

Section 4. Big Data Strategies

From Data to Business Intelligence/Information

Business Intelligence should not be confused with Big Data Analytics. We can make some abstractions and talk of business intelligence as the function of applying some analytic tools to enterprise data with the purpose of gaining business insights. Both Business Intelligence and Big Data Analytics do that. That's where the similarity stops. When we talk about Business Intelligence as an application, we can find many differences comparing Business Intelligence and Big Data Analytics; mainly, (a) the type of data that Business Intelligence can handle is a subset of what Big Data Analytics can handle, (b) Business Intelligence and Big Data Analytics have different implementation architectures, and (3) the technology stack used in Business Intelligence cannot handle Big Data.

Once interesting facets of Big Data are found, how that transition to an actual contribution to an agency's future decisions is key. That's where Business Intelligence comes in.

Business intelligence is used by many people to mean many things, but for this section, we will keep the definition relatively simple. It will mean the effort of taking acquired data, spelunking through it, and finding actionable items to present and discuss with your organization. To apply business intelligence, it requires knowledge of the domain from a particular business domain and a willingness to learn about others. There are many opportunities for business intelligence in each role of an organization, because each role has a different perspective. The data itself will not change but public interpretation will. One example of using data sources, to aid in the health of a company would be pricing of a particular good or service. The sales team may be

looking at data to figure out how sales are doing at the moment. The customer service team may be looking for a price point with which more people end the call and give great survey answers. The finance team may be looking at the price point that will allow them to keep the company in good shape financially. All of these questions can be handled with as complex of data analysis as you would like to do. You could start with yesterday's totals versus the day before totals. Then look at the hours during the day. Was there a high or a low point? Was the slope drastic or gradual? Did both days have a similar shape of points? If so, you might add another day. Did it have the same shape? What is going on during those high and low points? You can take several next steps. There is likely more data that can be gathered. You may or may not have it though, as each one of these business intelligence quests has the possibility of finding something that no one had thought of. More research may be needed. This is why the business domain knowledge is very important. That knowledge, combined with the technologies, methodologies, and tools can have drastic effects on your overall business. Once you know what to look for and how to measure it. These known data points then become part of the research for other business intelligence challenges. Data analysis, business intelligence, and investigation are not perfect—you will not always find something very useful. Once interesting points of the data are found, though, future decisions can be greatly influenced due to the effectiveness of other data analysis and business intelligence.

Section 5. Big Data Capability

Agency leaders and managers need to build Big Data Capability within their organization to be able to make smart decisions using Big Data Analytics and drive business transformation. Instead of relying on their intuition, their experience, anecdotal evidence, or their “gut”, they can base important decisions on data and facts. The decision to embrace Big Data Analytics does come with one big challenge—establishing the required capabilities.

In this section, we provide a four-layer capability model to help leaders and managers chart a strategic path forward toward building that capability.

Before we introduce the capability model, we first take a closer look at the analytics lifecycle to provide some guidance for the required organizational collaboration and the roles and responsibilities with the associated skills and interests of the various stakeholders.

The Analytics Lifecycle



Figure 1. *The Analytics Lifecycle*

Discovery

Discovery focuses on the following activities:

- Gaining a good understanding of the business domain and the business processes.
- Capturing the most important business questions that the business users are trying to answer.
- Assessing the available resources and framing the business problem as an analytic hypothesis.

Data Preparation

Data preparation focuses on the following activities:

- Provisioning an experimental analytic workspace, where the data scientist can work without the constraints of a production data warehouse.
- Acquiring, cleansing, and analyzing the data using techniques such as data visualization to gain an understanding of the data.
- Transforming the data using techniques such as logarithmic and wavelet transformations to address potential skewing in the data. Other tools used to transform data consist of extract, transform, load (ETL) tools, and SQL and Java.

Model Planning

Model planning focuses on the following activities:

- Exploring and testing a few analytical models to determine which one will yield the best predictive results.
- Determining correlation between variables to select key variables in model building. Since correlation does not necessarily mean causation, care must be taken to select and quantify cause-and-effect variables.

Model Building

Model building focuses on the following activities:

- Preparing the data sets for testing, training, and production.
- Assessing the quality and reliability of the data to use in the analytic models. Different transformation techniques could be used to see if the quality of the data can be improved.
- Developing, testing, and tuning the analytic models. Testing helps to determine which variables and analytic models yield the most predictive and actionable insights.

Communicate Results

The communicate results step focuses on the following activities:

- Ascertaining the quality and reliability of the analytic model and the statistical significance and actionability of the resulting insights.

- Developing charts and graphics to communicate the analytic model insights and recommendations. Business stakeholders should be able to understand and buy into the resulting analytic insights.

Operationalize

The operationalize step focuses on the following activities:

- Delivering the recommendations, reports, code, and technical documentation.
- Implementing the analytic models in the operational environment. Working with the application and production teams to determine how to set up the analytic models to run on a regular basis.
- Integrating analytic scores (KPIs) into executive and operational dashboards and reporting systems.
- Optionally, running a pilot to verify the business case and the financial return on investment.

Big Data Capability Model

The Big Data Capability Model provides a basis to systematically develop the necessary capabilities for the adoption and strategic usage of Big Data Analytics. The capability development and adoption encompass the acquisition of sufficient knowledge of how to extract business value from Big Data Analytics and the application and management of the underlying technologies. The capabilities are organized in four groups or layers.

Business Layer

The business layer addresses the innovative usage of Big Data Analytics in line with the business strategy and considering the changing trends. This affects the ability to develop new Big Data innovations that provide new value to the organization. At the same time, trends must be detected early and monitored.

Organizations find use cases by discovering new patterns in previously unassociated datasets and developing predictive models that yield key operational advantages.

Building a complete view of data, internal and external customers, and technology enables agency leaders and managers to address this large opportunity. This approach allows an organization to predict likely outcomes based on various what-if scenarios, and possibly influence the outcome.

Because of its disruptive nature, Big Data Analytics requires organizations to transform current ways of work and possibly their business models. Essential to that transformation is the inherent value of data, where data is not viewed as a by-product of the value creation process, but a source of value for the organization, and therefore, for its customers. The competence to transform and adapt to environmental dynamics is critical to the successful implementation of Big Data Analytics. This transformation depends on a unified vision and integrated strategy that originates from the leadership of the organization.

Analytical Layer

The analytical layer addresses the data pipeline: Data collection, storage, processing, and analysis. These data pipeline steps enable speed and access to quality data and analytics.

Data Collection

How an organization collects data is a primary indicator of its Big Data Analytics capability. Typically, organizations invest a major effort in collecting primarily structured data to use in evaluating business performance. It is critical to include unstructured data that is usually ignored or discarded because its size or format does not fit traditional data models.

Data Storage

Traditional enterprise data warehouse infrastructures come with limited storage capacity. This results in what's called "dark data"—data that remains unused because of lack of visibility or access until it is discarded. A successful Big Data Analytics implementation takes advantage of the potential future value of storing data even if its value cannot be determined initially.

Data Processing

A fully operational Big Data Analytics engine uses multiple data types and sources, including real-time streaming data. Establishing an enterprise Data Lake (a system or repository of data stored in its natural/raw format) based on a unified enterprise data architecture is necessary for creating a shared data service that is open to users across the organization.

Data Analysis

The data analysis that consists of using data to report on basic business key performance indicators (KPIs) for the purpose of performance management can be greatly enhanced. New kinds of data and sources enable deeper analytic exploration based on what-if scenarios. This analytic practice evolves with the implementation of Big Data Analytics to extend to predictive modeling and real-time analysis. The result is consistently high quality, availability, and value across multiple areas of the organization.

Capabilities Layer

A McKinsey study found that some organizations have an easier time implementing Big Data Analytics initiatives than others, depending on four critical factors: (1) talent, (2) IT intensity, (3) data-driven mindset, and (4) data availability. Talent being the main barrier.

The ability to achieve transformational results relies on having a sound approach to identifying the right organizational structure and staffing model.

Table 1 depicts the skillsets and roles needed to enable new analytics-based processes in the organization.

Table 1. Big Data Analytics Skillsets and Roles

		ROLES						
		Data Scientist	Business Stakeholder	Software Engineer	Database Admin	Systems Admin	Business Analyst	Graphic Designer
	Advanced Analytics	✓						
	Application Development			✓				
	Collaboration						✓	
	Creativity	✓	✓				✓	✓
SKILLS	Data Analysis	✓			✓			
	Database Management	✓			✓			
	Domain Expertise		✓					
	Programming			✓				
	System Integration					✓		
	Data Visualization	✓			✓			✓

Technology Layer

The technology layer focuses on the adoption of a hosting strategy, analytic tools, and level of integration to enable shared access to key analytics capabilities.

Hosting Strategy

Hybrid hosting scenarios (on-premises and cloud) maximize data access across the organization. Security concerns prevent many organizations from exploring cloud hosting solutions. Ultimately, as demand grows, organizations will have to design hosting environments that optimize availability and speed. Hybrid hosting solutions deliver high availability, reliability, and security across cohesive public/private cloud and on-premises implementations.

Analytics Tools

Initially, analytic tools support department specific requirements for reporting on business performance. As analytic tooling matures, multiple technologies will enable convergence in an enterprise Big Data Analytics platform. The organization-wide presence of analytics is what will allow transforming the way to do business by creating a culture where analytics resources are connected to every business decision.

Integration

Integration is a key factor in unifying deployed technologies around a common architecture. When implemented successfully, integration enables the creation of a single view of key

business functions and entities and delivers a centralized Big Data Analytics capability to the whole organization.

Section 6. New Business Models for Big Data

Introduction

What needs to be in place to implement Big Data and how do you build a data driven culture? Organizations need to plan how they use data so that it's handled consistently throughout the business to support business outcomes.

Data-driven decision management (DDDM) is an approach to business governance that values decisions that can be backed up with verifiable data. The success of the data-driven approach is reliant upon the quality of the data gathered and the effectiveness of its analysis and interpretation.

One of the most potent choices a company can make is to focus on data and develop a strategy of data-driven decision making. Experience and inference are powerful leadership tools, but data can guide CEOs and other executives to the best decisions possible.

Organizations who successfully do this consider the who – what – how – when – where and why of Big Data to not only ensure security and compliance but to improve business performance by extracting value from all the information collected and stored across the business.

Governance

The who – what – how – when – where and why of Big Data can be defined as Data Governance, a set of principles and practices that focus the implementation and ensure high quality through the complete lifecycle of your data as shown in Figure 2 below.

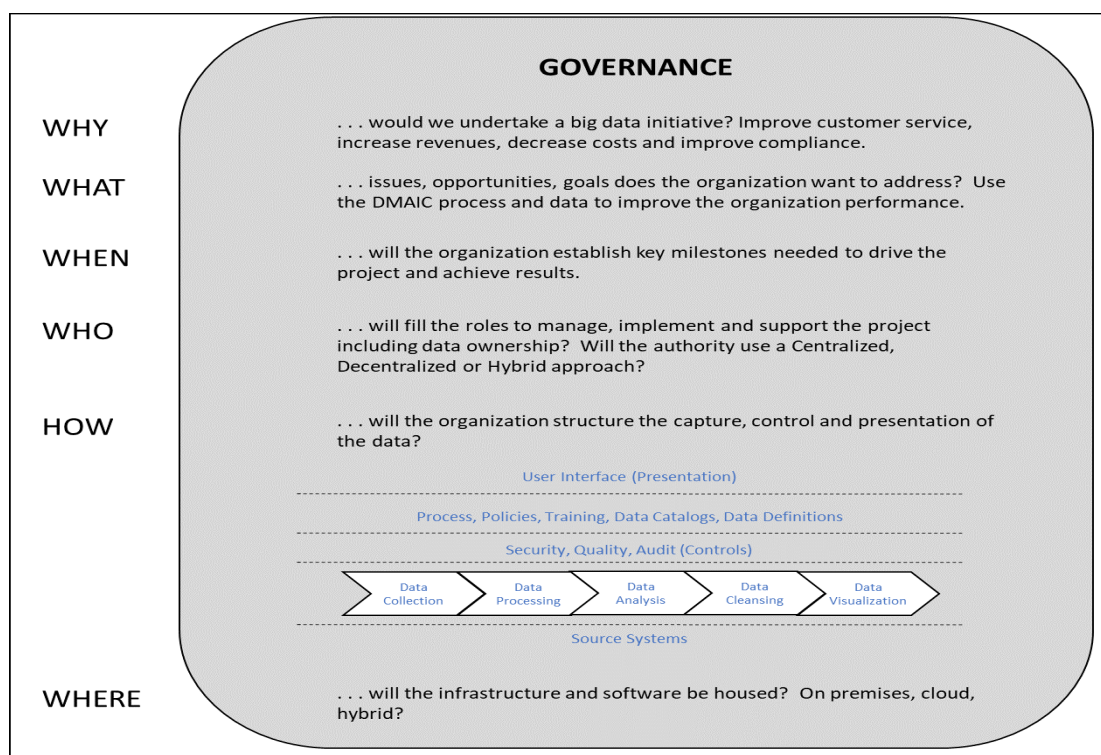


Figure 2. Governance

In this section, we want to focus on the critical success factors that ensure a sustainable and prosperous Data Governance discipline within the organization. As much as we try to focus on the longevity of the business and program, the reality is, it is quite common to launch Data Governance multiple times. Data Governance is a cultural shift and needs to align with your organizational culture, and there is no magical way to be successful. The bottom line is that most companies or organizations don't find success in their first or second efforts.

Best Practices

You can learn a lot from others who have been on a Data Governance journey. However, every organization is different, and you need to adapt the Data Governance practices all the way from the unaware maturity phase to the nirvana in the effective maturity phase.

Below is a collection of best practices that will apply in general:

1. Start small. Strive for quick wins and build up ambitions over time.
2. Set clear, measurable, and specific goals. You cannot control what you cannot measure. Celebrate when goals are met and use this to go for the next win.
3. Define ownership. Without business ownership, a Data Governance framework cannot succeed.
4. Identify related roles and responsibilities. Data Governance is teamwork with deliverables from all parts of the business.

5. Educate stakeholders. Wherever possible use business terms and translate the academic parts of the Data Governance discipline into meaningful content in the business context.
6. Focus on the operating model. A Data Governance framework must integrate into the way of doing business in your enterprise.
7. Map infrastructure, architecture, and tools. Your Data Governance framework must be a sensible part of your enterprise architecture, the IT landscape, and the tools needed.
8. Develop standardized data definitions. It is essential to strike a balance between what needs to be centralized and where agility and localization works best.
9. Identify data domains. Start with the data domain with the best ratio between impact and effort for rising the Data Governance maturity.
10. Identify critical data elements. Focus on the most critical data elements.
11. Define control measurements. Deploy these in business process, IT applications, and/or reporting where it makes the most sense.
12. Build a business case. Identify the advantages of rising Data Governance maturity related to growth, costs savings, risk, and compliance.
13. Communicate frequently. Data Governance practitioners agree that communication is the most crucial part of the discipline.

Section 7. Cost to Build, Operate, and Maintain Big Data Capabilities

Estimating the cost of a Big Data implementation is challenging due to the wide range of factors that impact cost. To provide some structure, this section organized costs around the size of data being analyzed, the type of data being analyzed, the method of capturing and storing the data, the number of users producing or consuming the analysis, and the complexity of data analytics being performed. Table 2 provides an overview of the segmentation used to organize the costs in Table 3.

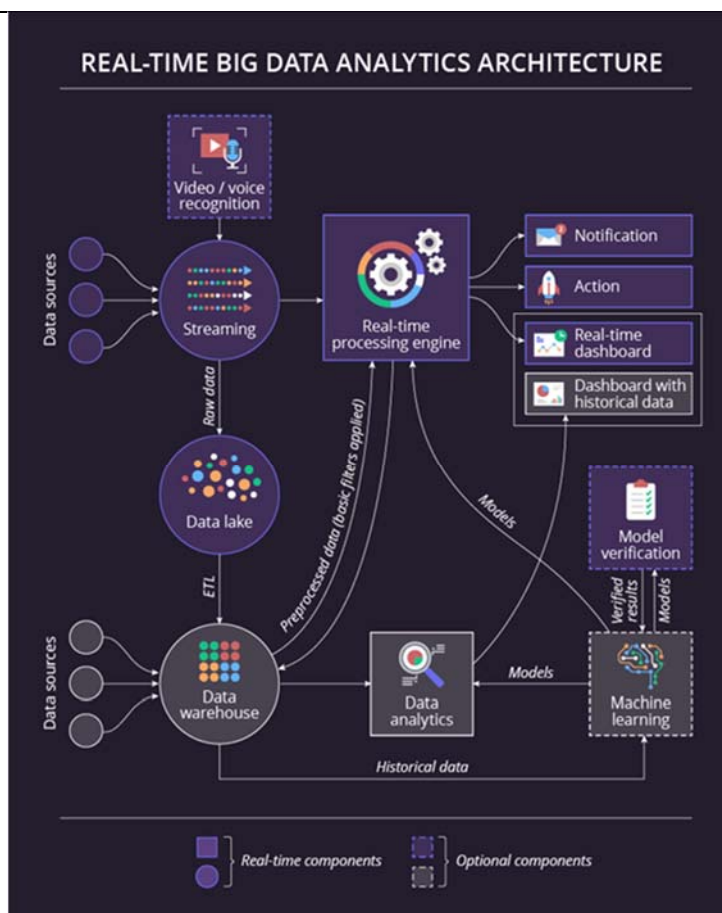
Because of the cost involved in implementing a fully comprehensive Business Intelligence program and the historical failure rate (50% or greater according to various organizations), it is recommended to start small with an “Investigation” implementation as is included in Table 2. It is highly recommended to use this initial implementation type to gain an understanding of the relationships data fields in your systems and to establish a governance approach prior to launching a full-scale implementation.

While broad cost numbers are provided, it is recommended that consulting services are sought during the initial planning stages to help ensure all the facets of establishing a Business Intelligence environment are considered prior to launching an initiative.

Although storing data is not a significant amount of the cost of an overall Business Intelligence implementation, it is indicative of the complexity of the system that would be needed to handle the daily data capture, processing and presentation of the information and therefore included in Table 3.

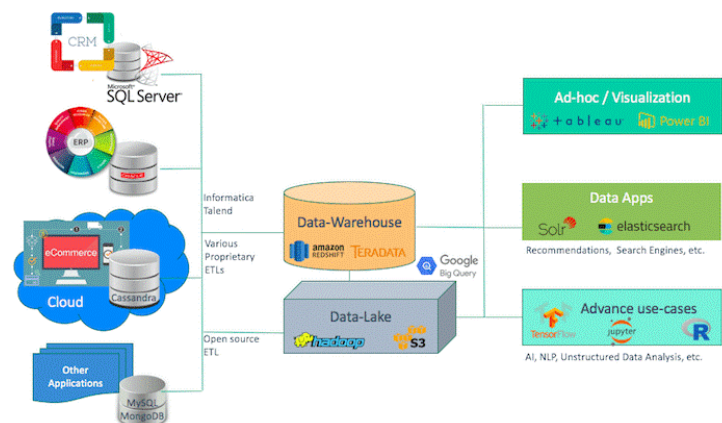
Table 2. Business Intelligence Segmentation

Segmentation		
Investigation		<p>Single-user system with multiple data sources fed into a Desktop presentation tool (Tableau, Power Business Intelligence) fed by flat files</p>
Traditional Business Intelligence	Simple	<p>Multi-user system with multiple data sources fed into a server-based Presentation Tool (e.g. Tableau, MicroStrategy). Data feeds are managed by the presentation tool.</p>
	Medium	<p>Multi-user system with multiple data sources fed into a standardized, server-based Enterprise Data Warehouse (EDW) using a formalized Extract, Transformation, Load (ETL) process and software tool. The server-based presentation tool now typically feeds from the EDW only to preserve the integrity of all data analyses.</p>
	Complex	<p>This is the same infrastructure as the Medium Tradition Business Intelligence architecture except that the scale increases with additional data sources, data processing, end users, number of reports, complexity of analyses, etc.</p>
Advanced Analytics		



(Source: ScienceSoft – Alex Bekker)
Advanced and Real-time analytics uses a much different physical infrastructure to provide specialized functionality like Artificial Intelligence (AI) and Machine Learning (ML) to perform Data Discovery and create an “in memory” system upon which analytics and modeling is performed. Typically, there is no formalized EDW or ETL; however, processes like Data Streaming, and Data Lakes take their place.

**NoSQL
(Hadoop)**



		Within the Business Intelligence industry, the term “Big Data” typically references a system infrastructure built to process and analyze disparate data (i.e. database data, image data, video data, CSV data, PDF data, etc.). Again, non-traditional Business Intelligence tools come into play like NoSQL databases, Data Lakes, and the Hadoop framework and utilities to make analyses possible.
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Table 3 provides cost estimates by segmentation and the categories of Infrastructure, Software, and Personnel.

Segmentation, see Table 2.

Infrastructure is the hardware and associated licenses required to store the data and the applications needed to process the data.

Software is the cost of the applications used to capture, process, and display the data.

Personnel is the different positions required to build and maintain the Business Intelligence system.

Depending upon the existing capabilities of the agency implementing the Business Intelligence system, personnel may already reside at the agency and can cover some of the roles required to implement and maintain the Business Intelligence system. External contractors or consultants may also fill roles until internal resources are developed to transition the roles.

Cost estimates for Advanced Analytics and NoSQL (Hadoop) systems are not included in Table 3 because these are very specialized applications, custom-built to deliver specific results. Artificial Intelligence and Machine Learning are typically factored into the design of these systems significantly impacting cost. As such, a generalized estimate of cost to build these systems would be inaccurate, if not misleading. What can be suggested is that these applications might more economically be built in the cloud, where these specialized tool sets are readily available, building the system a la carte rather than investing in custom development.

Table 3. Cost Estimates by Segmentation and the Categories of Infrastructure, Software, and Personnel

Segmentation	Size	Infrastructure		Software		Personnel	
Investigation Time to Initial Results: 2M – 6M	< 1TB	CPU Laptop/Desktop	\$1K - \$3K Per Computer	Presentation Desktop Business Intelligence	\$1K - \$2K Per Seat	Business SME	\$40K - \$100K Per FTE
		Storage Laptop/Desktop	See Above		\$0		
		Licenses (NA)	\$ 0	ETL (NA)			

Segmentation	Size	Infrastructure		Software		Personnel	
		Cloud (SaaS) NA	NA	NA	NA	NA	NA
Business Intelligence – Simple Time to Initial Results: 6M – 1YR	1TB – 5TB	CPU Server	\$20K - \$30K Per Server	Presentation Enterprise	\$3K - \$8K Per Person	Business SME(s)¹	\$40K - \$100K Per FTE
		Storage Included w/ server	\$0	ETL NA	\$0K	Assumes existing IT resources	
		Licenses (OS/DB)	\$5K - \$15K Per Server				
		Cloud (SaaS)	See Software	1 Power Business Intelligence User (Azure Pricing Tool)	\$4K - \$5K Per Month	See above	See above
Business Intelligence – Medium Time to Initial Results: 1YR – 2YR	5TB – 50TB	CPU MPP Appliance (not fully racked)	\$0.3M - \$.5M	Presentation Enterprise	\$2K - \$5K per seat	Manager	\$80K - \$150K Per FTE
		Storage MPP Appliance	See Above	ETL	\$100K - \$400K for the enterprise	Team Lead	
		Licenses (OS/DB)	\$0.5M - \$1M	Dev Ops	\$50K - \$100K	Business Intelligence Architect	
						ETL Developer	
						Data Modeler	
						Presentation Admin	
						Presentation Developer	
						Business SME(s)	

Segmentation	Size	Infrastructure		Software		Personnel	
		Cloud (SaaS)	See Software	Approximately 15 Users	\$15K - \$40K Per Month	See above	See above
Business Intelligence – Complex Time to Initial Results: 1YR – 2YR	> 50TB	CPU MPP Appliance (fully racked) Storage MPP Appliance Licenses (OS/DB)	\$1.0M - \$2.0M See Above \$1.5M - \$5M	Presentation Enterprise ETL Dev Ops	\$2K - \$5K per seat \$400K - \$1M \$50K - \$100K	Manager Team Lead Business Intelligence Architect ETL Developer Data Modeler Presentation Admin Presentation Developer Business SME(s)	\$80K - \$150K Per FTE
		Cloud (SaaS)	See Software	Approximately 15+ Users	\$40K+ Per Month	See above	See above

Segmentation	Size	Infrastructure		Software		Personnel	
Cost Driver(s)		CPU	Size of Data # of Concurrent Users Data Complexity Data Processing Frequency Response Time	Presentation ETL Dev Ops	Single or Multi-User Environment Frequency of Update # of Connections # of Transformations # of Environments # of Batch Jobs Scheduling of Batch Jobs Automated Alerts Automated System Checks	FTE Type	Implementation: Type Complexity Size of Team
		Storage					
		Licenses	Size of Data Data Growth Rate Redundancy Disaster Recovery Number of CPUs or Cores Number of Users				

Section 8. How to Assess Agency Readiness for Big Data?

To get started with a basic assessment of readiness to implement Big Data Analytics, leaders and managers must answer a few questions regarding the way they run their organization's business. This is a self-evaluation. After answering the questions under each of the seven categories, select a score from 1 (Strongly Disagree) to 5 (Strongly Agree).

Each category is scored. A tally of the seven scores gives an indication of the readiness level of the organization to implement Big Data Analytics. Deficiencies must be addressed first in order to increase the chances of a successful implementation.

Readiness Assessment

Strategic Alignment

- We are aware of the environmental factors that drive the business.
- We have a clear, actionable business strategy.
- We have implemented key management and business processes that reinforce each other.
- We have implemented key management and business processes that effectively execute business strategy.

1	2	3	4	5
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Continuous Improvement Culture

- We consistently measure business factors (costs, quality, outputs, ...).

- b. We continuously drive change to core business processes.
- c. We apply data-driven improvement techniques (Six Sigma, TQM, ...).
- d. We replace maturing best practices over time.

1	2	3	4	5
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Information Usage Culture

- a. We use historical performance information for planning (forecasts, budgets, plans, ...).
- b. We have enough relevant information to make fact-based decisions.
- c. We use quantitative methods (linear programming, optimization, modeling and simulation, collaborative filtering, ...).
- d. We use metrics and KPIs.

1	2	3	4	5
----------	----------	----------	----------	----------

Program Management

- a. We identify Big Data opportunities within key business functions.
- b. We manage Big Data opportunities as a program (portfolio of projects).
- c. We invest in core Big Data competencies.
- d. We use new Big Data applications to improve business performance.

1	2	3	4	5
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Decision-Making Processes

- a. We have well-established decision-making processes.
- b. We practice formal collaboration in decision making.

1	2	3	4	5
----------	----------	----------	----------	----------

Data Warehousing

- a. We have effective data warehousing processes.
- b. We have data quality skills.
- c. We have Extract, Transform, Load (ETL) skills.
- d. We have query and reporting skills.

1	2	3	4	5
----------	----------	----------	----------	----------

Business-IT Partnership

- a. We have business leaders and managers who are IT-savvy.
- b. We have IT leaders and managers who are business-savvy.
- c. We allow IT to contribute at a strategic level.
- d. We have instituted effective IT governance mechanisms.

1	2	3	4	5
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Scoring

For each of the seven categories above, you have selected a score from 1 to 5. The following example shows how to take the seven individual scores and combine them to determine the overall score for your organization's readiness to transform into a data-driven organization.

Scoring Example

Let's assume an organization has the following scores for the seven categories of the readiness assessment:

<i>Strategic Alignment</i>	5
<i>Continuous Improvement Culture</i>	4
<i>Information Usage Culture</i>	5
<i>Program Management</i>	1
<i>Decision Making Processes</i>	3
<i>Data Warehousing</i>	2
<i>Business-IT Partnership</i>	4

Next, sort the individual scores in ascending order (lowest to highest):

1 2 3 **4** 4 5 5

The median number, 4 in this example, is the overall score for this organization's readiness. This organization is mostly ready to go big with Big Data.

Section 9. Big Data Case Study

Pennsylvania Turnpike Commission

Vehicle to Infrastructure Broadcasts

Vehicles in small quantities are beginning to produce valuable data streams based on vehicle telemetry data. The Pennsylvania Turnpike Commission (PTC) has invested in the Road-Side Unit (RSU) hardware necessary to collect data being broadcast from DSRC-enabled vehicles. The IEEE 1609 Wireless Access in Vehicular Environments (WAVE) specification (variously referred to as J2735, 802.11p, or DSRC) provides both a method and means for producing and consuming vehicle telemetry data that includes useful vehicle performance information like location, instantaneous speed, braking behavior, and acceleration variables. DSRC data is unique in that it is crowdsourced, real-time, and relatively inexpensive considering the cost of the infrastructure required to utilize it. As DSRC adoption continues, it will become a ubiquitous 'Big Data' source for traffic management suitable for both 'nowcasting' and the production of analytics with longer time horizons.

PTC performed an exploratory analysis of DSRC data in a small study area with RSU's positioned on either side of the Susquehanna River near Harrisburg, Penn. The layout of the study area is shown in Figure 3. The figure shows the location of slower speed vehicles primarily on the entry/exit ramps located near the headquarters of the PTC as they enter and exit tolling areas. While the scope of the effort was limited, it was immediately apparent that this real-time data could support a number of uses including: 1) validating other road network data from third party vendors, 2) supporting real-time data analytics for detecting macro-level events like incidents, 3) providing a faster means of incident detection via vehicle telemetry, for instance by watching for acceleration vectors that were statistically significant.

As an example of the data available, Figure 4 shows vehicle behavior at a toll booth as vehicles approach and begin decelerating (North bound) or begin accelerating away from the system (South bound). DSRC has a unique strategy for data retention in its message specification. It gathers similar messages from the same broadcaster ID (anonymized) and increments a message count every 10 msec.. Consequently, very accurate telemetry is available in the DSRC stream without totally overwhelming the ability of the data infrastructure to keep pace.

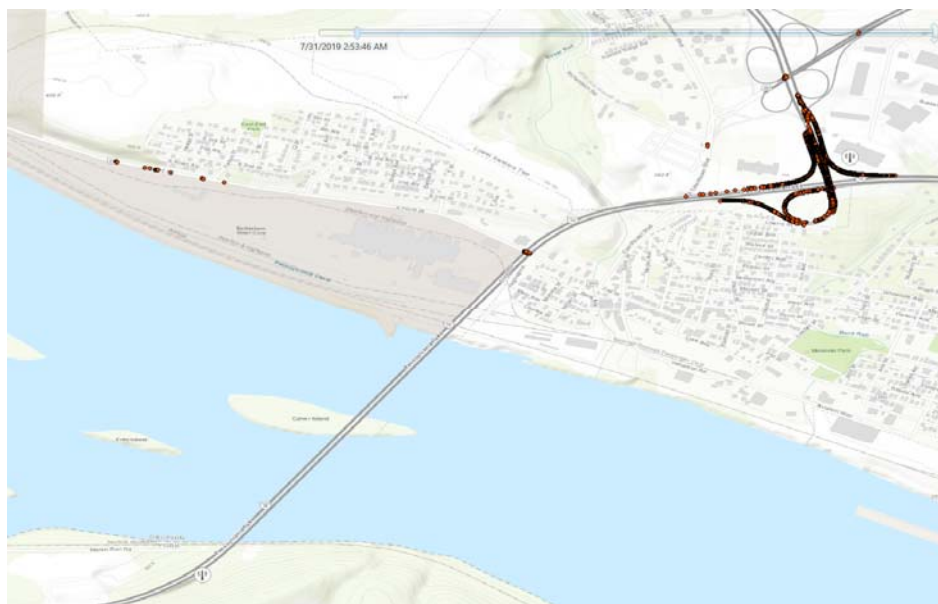


Figure 3. The DSRC Study Area for PA Turnpike. Note the comm's tower icons on either side of the river.

Once DSRC data is received, it is published to a specific endpoint. In the case of PTC, this infrastructure relies on the Cisco/Kinetics architecture to ingest, store, and re-publish the data to an endpoint. That endpoint can then be subscribed to in the same manner as any other feed for instance from an HTTP endpoint, RESTful service, or Kafka broker.

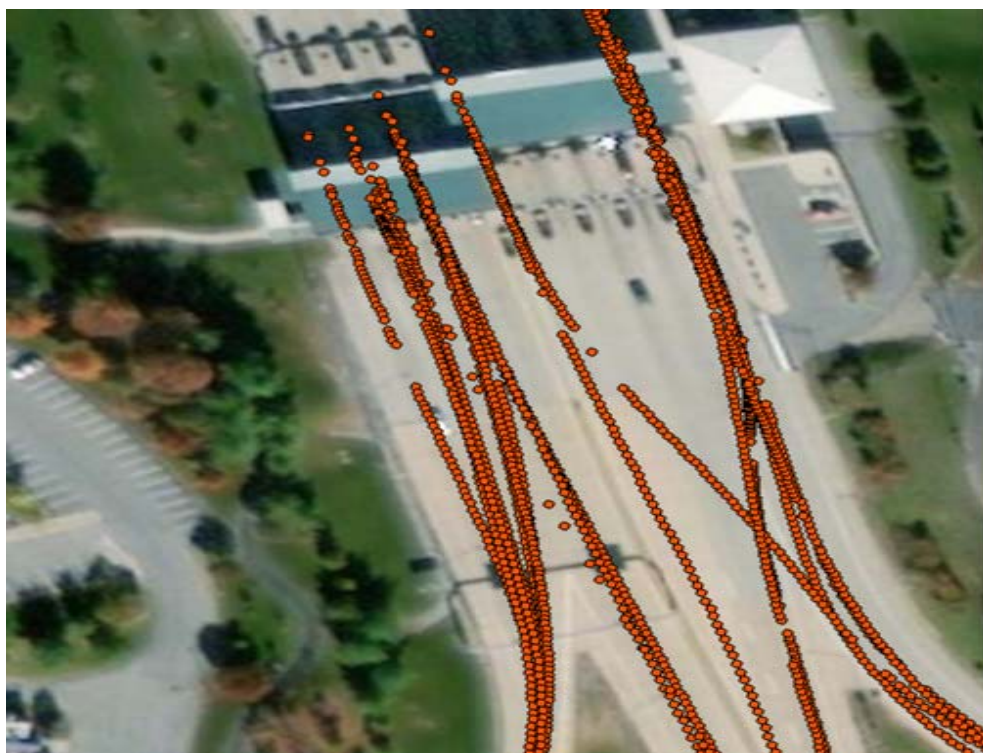


Figure 4. Braking vehicles arriving and departing from a tolling station on the PA Turnpike

A SaaS Big Data analytics package is used to ingest and process the DSRC data. Figure 5 below indicates the 24-hour profile of average speed < 50 mph received by the RSU and published at the endpoint. Most of this data is ramping and tolling acceleration and deceleration. This kind of profiling could potentially be performed across the roadway by highway segment (supplied by INRIX data) and used to compare a learned model of vehicle behavior against observed values over some time period. Variance to the model would provide the basis for real-time nowcasting, such as vehicle incident at location, dispatch emergency responders to scene, and prepare for delays > 1 hr.

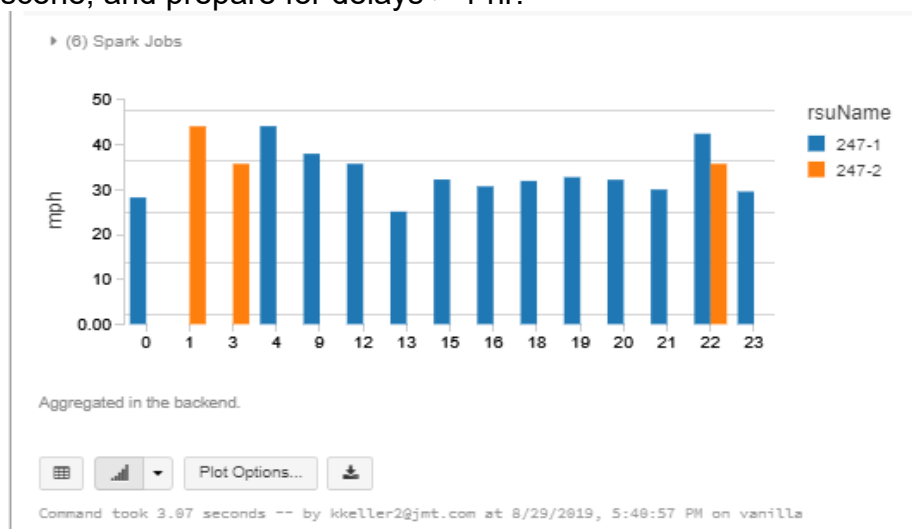


Figure 5. Vehicle Speeds <50 mph observed by roadside units

In addition to basic summarizations of DSRC data, more exotic analyses can be undertaken by using a Big Data engine. For instance, tracking DSRC vehicles for origin-destination travel times is of real interest as a road network performance metric. Below in Figure 6 is an example of computing the tracks for a given set of DSRC data. Although the tracks are close to what the raw DSRC data would suggest in Figure 5, Figure 6 uses an algorithm to tie together data points based on their spatial-temporal proximity. This is a complex algorithm the implementation of which uses the Spark parallel processing library to accomplish in reasonable time.

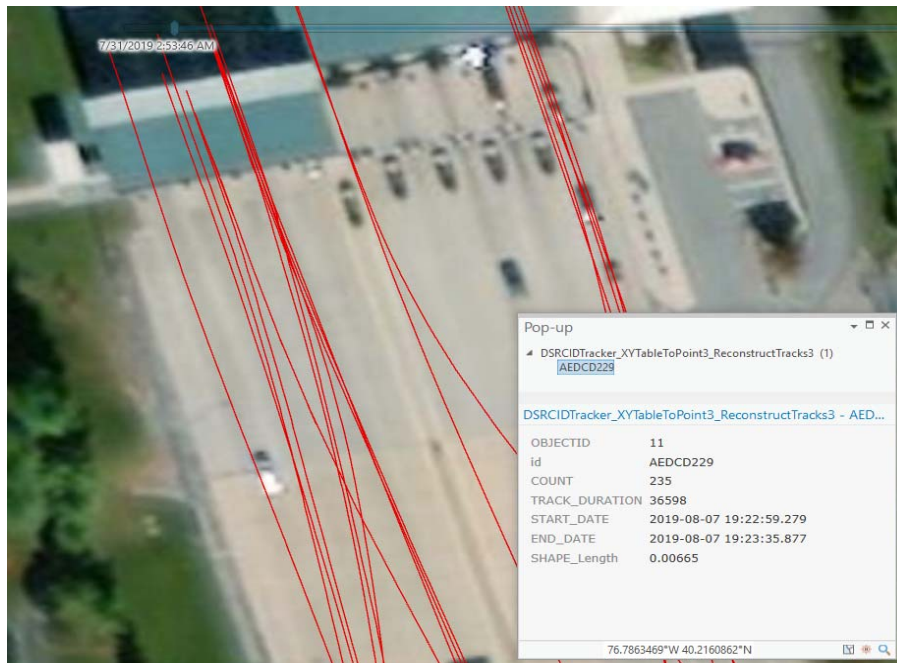


Figure 6. Tracking DSRC vehicle telemetry through the tolling station

While the promise of leveraging this kind of real-time data is significant, there are several requirements for an architecture to be able to handle the V3 aspects of the data.

IoT frameworks provide a general-purpose solution to this data ‘supply chain’ problem. IoT frameworks can organize the provisioning and secure communication of devices in large-scale environments. They support communications both from (data) and to (control) devices. In addition, they move data to the cloud where cloud-based services and storage assist in analyzing and persisting data. Finally, they provide message hubs that can be used to publish the data to interested parties.

The parties and their various interests in traffic data and the associated analytics are:

- Traffic Managers
 - situational awareness (assessing the current state of the network, understanding the reasons behind it, and predicting future states and necessary responses to ensure safety and mobility)
 - publishing (making that ‘awareness’ available to and consumable by other parties)
- Value-Added Service Providers

- timely data (making the sensed data available in a usable timeframe)
- enriched data (using other data to expand the offering)
- reliable data (reinforcing uncertain data with supporting data)
- The general Public
 - situational awareness (understanding what is happening or about to happen that will affect safety or mobility)
 - options generation (improving their current or predicted situation)
 - value-added services (getting more out of the travel scenario)

Each of these stakeholders is potentially well-served by an infrastructure that can securely and quickly organize and enrich data to enhance its reliability.

Section 10. Where Do We Go From Here?

Recommendations and Next Steps

The Big Data subcommittee recommends the following items for further investigation:

- Further investigate the source(s) of data to support a bid data enterprise.
 - How to collect data?
 - How to process data?
- Further investigate issues related to interoperability, security, privacy, using blockchain, and keeping data up to date as it related to building a Big Data platform for toll agencies.
 - For examples, explore whether agencies will need to develop security protocols and adopt new policies to ensure the protection of sensitive technical systems and appropriate use of the data they generate.
- Further investigate how Big Data can be used to improve Data Analytics.
 - How does Big Data translate into decision support systems?
 - How does Big Data benefit end users/customers and third-party providers?
- Consider inviting Big Data vendors to present to IBTTA and Toll Agencies the variety of sophisticated ways other industries are:
 - Adapting existing platforms to accommodate the scale of Big Data.
 - Transitioning and modernizing their systems and using Big Data platforms.
 - Warehousing/storing data.
 - Using portals to help guide business intelligence and investments in maintenance and operations.
 - Consider doing a Big Data pilot with one or more tolling agency.

Appendix A. Who Should Care About Big Data?

Internal --- Tolling Industry

In general, there are several major strategic drivers of the tolling industry that could be supported by accurate and thorough use of available big data. They are:

- Safety – to provide the safest possible environment
- Customer – to meet and exceed customer expectations
- Financial – to maintain a sound financial position
- Infrastructure – to make sound investments in new assets and maintain existing assets
- Mobility – to maintain an accessible, reliable, and available travel system

Managers, analysts, operators, enforcement officials, customer support and maintenance personnel, training staff, and developers should all be aware of and knowledgeable about various aspects of big data – it's availability and how to leverage it. Managers should use big data to make better decisions faster, enabling all the strategic drivers above. *For example, adding weather data into trip data could show differences in rain vs. travel by time of day. This would allow for the staging of safety vehicles and assist in provisioning dynamic messaging to customers.*

Value of Emerging Technology and Connected Data

There are multiple big data analytical techniques that can be useful to the above areas. They are:

- Basic Analytics – for producing summary data utilizing MapReduce style aggregations of data. *For instance, to summarize the traffic volumes throughout the day by hour for a given week, month, or year.*
- Predictive Analytics – for forecasting or nowcasting by leveraging various forms of regression including linear, logistic, and decision trees. *For instance, to predict the expected traffic volumes based on current trending data.*
- Classification – for identification and detection of common objects of interest in the domain. *For instance, whether a vehicle is a motorist, law enforcement, or an emergency responder.*
- Clustering – to identify related groups of objects. *For instance, understanding where incident hotspots are in the network to make targeted safety enhancements.*
- Network and Graph Analysis – to understand the interconnectedness of objects in the domain. *For instance, a road network as a set of intersections and road segments used for the purposes of re-planning detours.*
- Machine Learning – to provide a mechanism for learning about new objects in the domain and to apply the learned model to identification or prediction tasks. *Such as, what business indicators suggest that an increase in revenue for a location would be expected.*

Impact of Emerging Technology and Connected Data

There are four potential impacts of utilizing emerging technology: handling greater scope, saving time, reducing cost, and improving quality. Any or all can lead to significant disruptions of the status quo. In some cases, adoption of emerging technology can lead to overhauling long existing practices and procedures that might be overly time-consuming and even outdated, resulting in eliminating the need for those practices.

The primary benefit to the tolling industry of these technologies is to provide better KPI's that demonstrate the objectives of the strategic drivers are being met. By learning from significant datasets and incorporating that into programs, the time required for gaining insights and applying them to current operations is shortened.

Another practical benefit of adopting big data is the potential for reducing or eliminating backlogged analyses. Since analysis has traditionally been time consuming and talent intensive, often engaging external groups, tools that reduce both the time and the level of expertise required for sophisticated analyses can eliminate both outside engagement of experts and encourage analyses that have been neglected due to time or resource constraints.

Future Use of Emerging Technology and Connected Data

While streaming of entertainment media is now commonplace, the future of streaming data of all kinds seems likely. That capability is being demonstrated in the real-time streaming video of semi-autonomous vehicles, smart homes, and even doorbells. Consequently, as the volume of data increases, the processing paradigm will fully shift from gather, store, and process to simply gather and process, with storage being an option after the fact. The ability to work with streaming data that is continuously produced will become paramount to the agile organization.

In addition to a data streaming environment, multi-cloud operations seem inevitable. While cloud and other Infrastructure as a Service (IaaS) aka "cloud" vendors are currently battling for near exclusive commitments from customers, the logical alternative is that customers choose the best infrastructure, platforms, and services for their applications.

As autonomous vehicles are developed and gain market share, the traveling behavior of customers is likely to change. Autonomous vehicles show promise for reducing the number and severity of incidents as well as more efficient capacity utilization of the road network. There will be opportunities for investment in areas such as IoT (roadside sensing, communications, and control), Big Data (to ingest data streams in traffic), and Machine Learning to perform new predictions of customer usage and road network performance. It is likely that all of this will be built on the back of IaaS hardware with some basic change in management of data and its security and privacy.

External --- Customers

The major drivers for customers are accuracy, speed, safety, and relevance.

Value of Emerging Technology and Connected Data

There are multiple emerging technologies that can support customer drivers including:

- Nowcasting - Crowdsourcing and streaming data from platforms and devices provide the basis for nowcasting – to shorten the time required to make accurate predictions about future conditions or opportunities. *For instance, by leveraging real-time, vehicle-source data for predictive nowcasting, traffic managers might be able to provide ‘look ahead’ routing information to better manage traffic flow during events like incident clearing. This could help customers and their devices solve lane positioning and exit questions created by an incident and improve traffic flow.*
- Inferential Statistics (through space time pattern mining) – Data collected with space and time associated with it allows for the computation of inferential statistics to determine if emergent patterns are significant. *For instance, as the customer travels through the road network, certain patterns are historical while others deserve more significant consideration for near-term decision making.*
- The Semantic Web – The semantic web refers to a web of relationships. Knowing those relationships can help traffic managers provided tailored advice to specific drivers. *For instance, as traffic patterns emerge, the known driving pattern could be used to leverage targets of opportunity, like errand stops or tasks, to get the most out of imperfect traffic patterns.*

Impact of Emerging Technology and Connected Data

The primary impact of both large data sets and the technologies that use them is to provide tailored responses within a framework of maximizing the utilization of travel time.

If a traveler requires service along the roadway system, tailored service responses, for instances invoking preferences related to vendors, can be applied to the overall decision-making pattern.

Enabling optimized decision making.

If a trip involves multiple waypoints in a specific order to complete a set of tasks then that trip can be made more flexible by technologies that, as conditions change, can find alternative routes that still accomplish a task-oriented framework for decision-making.

Future Use of Emerging Technology and Connected Data

Ultimately, customers will be looking for better situational awareness – to avoid delays or missing tasks to accomplish – and the ability to take advantage of opportunities as they arise.

Future enhancements to situational awareness include the ability to perceive the situation faster via big data, comprehend the impact of changes to the plan through AI-based planning, and to project future states with greater accuracy via Nowcasting and data analytics.

Customers are always looking to optimize their trips either by taking advantage of new opportunities or being presented with alternatives that allow them to exercise their tradeoffs and preferences. Even in the face of what might seem like a delay, if future systems understand enough about the priorities and habits of the customers, then relevant opportunities, for instance to stop and get a meal early at your favorite eatery where you have a e-coupon, can increase customer satisfaction with the overall trip experience.

External --- Government/Regional Transit and Local Partners

Major drivers for governmental agencies, regional transit and local partners are:

- Accuracy, flexibility, and scale of analytics
- Accurate application of regulatory compliance
- Optimization of capital expenditures

Predictive analytics allow agencies to investigate uses of their systems and identify areas of fraud, waste, and abuse simply by investigating outlying or emergent data. With big data analytics, agencies are past the point of trying to use static reporting to understand complex data patterns.

Value of Emerging Technology and Connected Data

Several important technical capabilities deserve further consideration by related agencies including:

- Nowcasting – By utilizing streaming data sources and applying data analytics to the stream, agencies open the possibility of nowcasting trends to support their operations. *For example, to control budgets, agencies can determine earlier in complex projects whether they are on budget or how far limited resources will take them.* Additionally, data analytics can be used across all the budgets to realize benefits that can offset predicted budget overruns and accomplish the goals of their project base.
- Inferential Statistics – Often, decisions based on historical data might be skewed because of a long history of data that biases understanding away from current trends. Inferential statistics applied to large data sets at scale open the possibility of finding significant emerging trends in data and determining its direction over time. *For instance, if determining accessibility is important, then current trends considering recently completed infrastructure projects would be important to discern.*
- Data analysis of regulatory and compliance data – Regulatory compliance and the creation of business policies are often driven by data analytics. By performing a more accurate analysis on larger data sets where emerging trends and outliers can be

identified, business policy and compliance regulations can be written to deliver a desired effect.

Impact of Emerging Technology and Connected Data

The impact of data-driven policies on the performance of related agencies should not be underestimated. Rather than attempting to glean information out of standardized reports of descriptive data and trends, big data analytics can deliver key insights into data that will allow both compliance regulations and business policies to be measured and refined using predictive models, clustering, and decision tree analysis. This enables better decisions to be made faster which saves tax dollars.

What occurs when loopholes in compliance regulations are exploited? Variance between measured and expected outcomes begin to increase. Those changes can be detected and examined quickly using big data analytics by using a more flexible and responsive analytics approach. It is possible that these methods will allow regulators to reduce fraud, waste, and abuse by pinpointing the source of variances quickly.

Not only can regulations be crafted that are flexible in the face of changing data, business policies can likewise be developed and then modified either to correct shortfalls or exploit new opportunities. All of this relies on being able to process large volumes of data quickly and accurately to provide insights that can support data-directed decision making. For example, if a local partner's tolling system shows a significant drop in revenue after an infrastructure change, big data can be quickly analyzed to find out what has changed in a related system that may have inadvertently caused the side effect. To mitigate impacts to partners, big data can also be exploited to possibly craft business policies that offset an unanticipated negative consequence to maintain strong partnerships.

Future Use of Emerging Technology and Connected Data

The speed with which big data is going to be collected and analyzed could revolutionize the ability of agencies to optimize their businesses. If, as anticipated, big data processing moves directly into the data stream, methods of successive approximation, like gradient descent search, will become the norm rather than the exception for learning how to control governments and businesses. Rather than waiting for aggregation, storage, and retrieval for processing by lengthy and monolithic jobs, it is possible that virtually all business processes will become 'agile' using machine learning models to classify observations and make control decisions. Continuous monitoring of these models for re-training could deliver a highly flexible system capable of immediately reacting to fundamental changes in the business landscape.

Data privacy is a major consideration for government organizations and the shift toward preserving private data rights is clear. How governmental bodies address this requirement has impacts that could both drive consumers toward or away from providing data and increase or decrease legitimate business development for private organizations. Data privacy concerns could be addressed by the adoption of personalized, computable data policies associated with private data. This approach, coupled with the issuance of data certificates that support

provenance tracking and demonstrate ownership, rights purchase, or rental might form a flexible and personalized basis for leveraging private data.

Appendix B. New Business Models for Big Data

Why?

The Business Cases and Drivers to Implement Data Governance

Data is becoming the core corporate asset that will determine the success of your business. Digital transformation is on the agenda everywhere. You can only exploit your data assets and do a successful digital transformation if you can govern your data. This means that it is imperative to deploy a data governance framework that fits your organization and your future business objectives and business models. That framework must control the data standards needed for this journey and delegate the required roles and responsibilities within your organization and with the business ecosystem where your company operates.

Business	IT
<ul style="list-style-type: none"> • Increasing organizational efficiency • Compliance with financial regulations, audit requirements, etc. • Increased data volumes and complexity • More efficient technology implementation • Reduction of risk through greater transparency • Increasing revenue • Customer optimization 	<ul style="list-style-type: none"> • Poor data quality • Failed implementation • Infrastructure optimization and consolidation • Major application roll-out/upgrade • Technical challenges associated with BI/DW (environment) • Growth of unstructured content

The Data Governance Value Proposition

Data governance means better, leaner, cleaner data, which means better analytics, which means better business decisions, which means better business results, market positioning, mindshare in your space, reputation, and profit margin (everybody likes this one).

Barriers	Benefits
<ul style="list-style-type: none"> • Data ownership and other territorial issues • Lack of cross-business unit coordination • Lack of data governance understanding • Poor state of data management infrastructure • Resistance to change or transformation • Lack of executive sponsorship and buy-in • Resistance to accountability • Lack of business justification • Inexperience with cross-functional initiatives 	<ul style="list-style-type: none"> • Quality of data • Consistent data definitions • Data as an enterprise asset • Appropriate use of data • Collaborations among teams, business units, etc. • Accountability for data use • Quality of master and meta data • Sharing of data • Visibility into the enterprise via data • Change management processes for data use and management • Data security • Data Lineage

What?

Governance is a critical enabler to address some of the most common pain points felt by the business, including:

- Drive process improvement.
- Increasing customer demands, new regulations.
- Streamlines and unifies the approach to managing data.
- Ensures the right people are involved in determining standards, usage, and integration of data across projects, subject areas, and lines of business.
- Balances silo-ed short-term project delivery focus.
- Traditional projects don't give enough focus to data management.
- Systems are becoming more challenging to manage.
- Data quality issues are persistent.

When?

Establishing key milestones in the implementation of your big data project is critical. These milestones will:

- Set the organizations expectations for the implementation team.
- Measure progress.

Who?

Deciding what operating model your organization will adopt is part of the initial steps in setting up your data governance program. The operating model selected should:

- Outline how your program will operate
- Set the expectations of escalation and decision making as well as program oversight
- Provide the infrastructure for ownership and decision making

User Role Definition

Data governance will involve the whole organization in a greater or lesser degree, but let's break down the most commonly involved stakeholders:

DATA OWNERS: First, you will need to appoint data owners (or data sponsors) in the business. This must be people that can make decisions and enforce these decisions throughout the organization. Data owners can be appointed at the entity level (e.g., customer, product, or employee records, etc.) and supplementary on attribute level (e.g., customer address, customer status, product name, product classification, etc.). Data owners are ultimately accountable for the state of the data as an asset.

DATA STEWARDS: Next, you will need data stewards (or data champions) who are the people making sure that the data policies and data standards are adhered to in daily business. These people will often be the subject matter experts for a data entity and a set of data attributes. Data stewards are either the ones responsible for taking care of the data as an asset or the ones consulted on how to do that.

DATA CUSTODIANS: Furthermore, you may use data custodians (or data operators) to make the business and technical onboarding, maintenance, and end-of-life updates to your data assets.

DATA GOVERNANCE COMMITTEE: Typically, a data governance committee will be established as the main forum for approving data policies and standards and handle escalated issues. Depending on the size and structure of your organization, there may be sub fora for each data domain (e.g., customer, vendor, product, employee).

The roles highlighted above should optionally be supported by a Data Governance Office with a Data Governance Team. In a typical enterprise, here are some examples of who might make up a Data Governance Team:

- **Manager, Master Data Governance:** Leads the design, implementation, and continued maintenance of Master Data Control and governance across the corporation.
- **Solution and Data Governance Architect:** Provides oversight for solution designs and implementations.
- **Data Analyst:** Uses analytics to determine trends and review information.
- **Data Strategist:** Develops and executes trend-pattern analytics plans.

- **Compliance specialist:** Ensure adherence to required standards (legal, defense, medical, privacy).

One of the most important aspects of assigning and fulfilling the roles is having a well-documented description of the roles, expectations, and how the roles interact. This will typically be outlined in a Responsible, Accountable, Consulted, and Informed (RACI) matrix describing who is responsible, accountable, to be consulted, and to be informed within certain enforcement—a processor for a certain artifact as a policy or standard.

Operating Model

Three models to consider for your environment are: centralized, decentralized, hybrid/federated; each with their pros and cons outlined below.

CENTRALIZED OPERATING MODEL

Similar to a top-down project management model, a centralized operating model relies on a single individual to make decisions and provide direction for the data governance program. There can be many different titles reflecting this position, such as Chief Data Officer, Chief Information Officer, Chief Data Steward, Data Governance Director, Data Stewardship Director, and so forth.

Pros

- Dedicated Data Governance Lead
- More efficient decision making
- Easier to focus on policy, guidelines
- Easier to control costs
- Reporting structure clearly defined based on the org chart

Cons

- Incompatible for a more matured data governance program
- Increased bureaucracy due to the linear structure
- Operation rigidity
- More time required to accomplish data governance operations
- Potential loss of oversight over unique and detailed business considerations
- Mostly concerned with enterprise priorities

DECENTRALIZED OPERATING MODEL

Almost the exact opposite, there is no single Data Governance owner as everything is committee-based.

Pros

- Relatively flat structure
- All-encompassing representation from the business
- Relatively easy to establish

Cons

- Reaching consensus tends to take longer
- Difficult to coordinate and commit the needed resources from participants
- The committee's direction can heavily be influenced by those stronger willed

HYBRID OPERATING MODEL

This is meant to be the best of both worlds. There is still a centralized structure which oversees the enterprise data level for which it has bottom-up input wide participation from the business units. The centralized structure provides a framework, tools, and best practices for the business units to follow, but in theory, it also provides the units with enough autonomy to manage business unit specific data and offers channels of influence to gather input for data sets impacting enterprise data or the other way around.

Pros

- Top-down decision-making regarding enterprise data with bottom-up inputs
- Centralized enterprise strategy with a decentralized execution and implementation
- Ownership is given to the application owners for the data and metadata
- Broad membership for working groups
- Provides the ability to focus on specific data sets at the business unit level and their relationship with the enterprise data
- Full autonomy to develop standards, policies, procedures for the business level
- Issue resolution at a bottom-up approach

Cons

- A highly skilled Data Governance lead position is required full-time – not an easy find
- Can get very political at the working group level
- Decisions made at the group level will be pushed up to the upper levels for approval
- Difficult to find the balance between enterprise priorities and those of the individual business units
- Oversight over the autonomy of the business units can be challenging and relies heavily on self-reporting
- Business unit's efficiency depends on localized skills
- Metadata management not simple to address as it can differ widely from one unit to another

Deciding on an operational model while you are initiating your data governance program is important, but it can also be adjusted at a later time. Small organizations typically benefit from a centralized structure because the data governance lead would have the capacity to not only wear multiple hats but be able to learn enough about the business, its environment, and challenges to address these issues. A decentralized model can work well for an organization which has dispersed its operations to several remote locations. As an organization expands, it is usually advised to look into a federated operating model to better support the data governance needs of the organization.

How?

How the organization chooses to structure the capture, control, and presentation of the data has been addressed throughout this white paper. In this section we will focus on the policies, process and training needed for successful big data implementation.

POLICIES AND RULES

Policies and rules establish the basic requirements for the general structure, format, identity, ownership, usage, and access for all information within the agency. These documented set of guidelines ensure the proper management and usage of information and are aligned with elements such as Data Security, Data Transformation, Data Catalogs, and Definitions as well as intended usage and ownership of data.

PROCESS

Big Data brings insights into existing business processes across the enterprise through data discovery and analytics, resulting in incremental improvement of existing business processes and the development of new business processes. The insight from this data discovery and process focus will improve cost, quality, and time resulting in continuous process improvement. Metrics and Key Process Indicators (KPIs) should be developed for each organization and process.


TRAINING

With Big Data comes the need to develop Analytics Literacy within/across the Organization – both for the Business and IT. This training can start with bringing a small core group of people up to speed on the use of the selected front end tool(s) who can provide needed reports and dashboards to the organization. However, over time basic report building capabilities need to be taught to a broader cross section of the organization to facilitate rapid analysis of issues and the creation of a data driven culture.

Where?

Where the organization decides to house the capture and processing of the data is dependent upon multiple factors that have been discussed in other sections of this white paper. Some of the factors to consider include:

- Existing IT capabilities (both infrastructure and personnel)
- Cost considerations (See Section: Cost to Build, Operate, and Maintain Big Data Capabilities)
- Agency policies
- Type of BI implementation



White Paper

CAV/CASE Workgroup

CAV and Toll Agencies: Impacts, Role of Toll Agencies, and Roadmap for Deployment

Abstract

Connected and Autonomous vehicles are quickly evolving beyond conceptual ideas. With the rise in rideshare, in-vehicle technology advances, and changing travel behaviors, the automotive and transportation industries are experiencing an unprecedented rate of disruption. Though the possibilities for all of transportation are exciting, it also brings forth important considerations and planning needs for the tolling industry. This paper explores the following questions: What exactly does this mean for the toll industry? Why should we get involved? How should we get involved?

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Introduction

Connected and Autonomous Vehicles (CAVs) are hailed as a solution to many of today's challenges in urban traffic congestion, safety, and operations. However, potential increases in vehicle miles travelled due to behavioral changes that affect vehicle ownership, route choice, value of time and other demand parameters are expected to create challenges.

This paper outlines benefits and challenges of CAVs to infrastructure owners and operators (IOOs) such as toll agencies and the potential effect CAVs could have on IOOs. The paper also discusses the role of toll agencies, third-party players, and customers in advancing CAVs. The paper ends with a series of recommendations regarding potential additional research, piloting and testing, and policy formulation.

The audience for this paper is likely technical and engineering. While policy makers are important to the effort, any concept of operations developed as a result of analyzing these efforts will likely either drive changes in existing policy or identify new policy considerations. It is important to note that while this paper is intended as an informational overview, it also provides possible ideas and concepts for consideration. The examples are meant to be thought-provoking and should not be interpreted as prescriptive or directive in nature.

CAV Impacts and Why Should the Toll Agencies Get Involved?

There are many reasons toll agencies should get involved with early discussions on CAV. It is clear that CAV is an inevitable reality; however, each agency is different and will likely participate at various levels. It will be important to explore opportunities and potential effects of CAV on a toll agency from the following perspectives:

- Consumer – by getting engaged in the development phase, agencies can be part of leading this effort and affect decisions for their customer.
- Engineering & Technical – understanding changes in infrastructure requirements, as well as the pros and cons, will be important. For example, sensors required in the road for CAV could have a direct effect on sensors used for classifying and charging vehicles for tolling. Are there opportunities to consider sensors for both?
- Back Office Systems – understanding how CAV will affect user charging, evaluating new business rule requirements, financial responsibility assignments, and violations/notices.

The above are just a few points to consider in evaluating opportunities to explore CAV impact on the toll industry. Detailed considerations include:

Customer Needs

Innovative, evolving, and disruptive technologies present opportunities, challenges, and sometimes a threat. For the toll industry, early involvement in the connected, autonomous, shared and electric markets provide significant advantages and value. For example, an immediate opportunity would be for toll experts to begin defining user charging schemes that are flexible enough to work today, but sophisticated enough for future implementation. The industry is already experiencing vehicle to user charging issues related to rental vehicles, rideshare companies/drivers, and trucking companies. To mitigate these issues, the industry should outline account management and payment system options that will accommodate and support multiple users, independent of the vehicle owner.

Supply and Demand

This section summarizes CAV benefits and analyzes potential disadvantages for toll agencies as infrastructure owners and operators (IOOs). These benefits are broadly categorized as supply side, demand side, and “other benefits,” but could also be grouped as capital, operating or maintenance benefits. However, as CAVs become more integrated into the transportation landscape, it is likely that the lines between operations, maintenance, and even capital, could begin to blur. These intelligent systems, and the data derived from them, will enable continuous improvement in decision-support systems across project and infrastructure lifecycles (i.e. planning, design, construction, operation, maintenance and eventual retrofitting, rehabilitation or demolition).

The following describes supply and demand opportunities, benefits and challenges. In-vehicle and surrounding environmental information provides greater opportunities to manage supply and demand. There are also many ways to leverage vehicle, user, and infrastructure data to benefit traffic management, tolling and user charging schemes, as well as customer service and interactions.

Supply Side Benefits

Increased Capacity, Reliability, and Safety

Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications will allow vehicles to reduce following distances; merge, exit and change lanes more seamlessly; platoon with other vehicles to harmonize speeds; and pay tolls in open-road and mileage-based paradigms. These features and the reduced reaction time (i.e. the fact that V2I and V2V capabilities mean the vehicle is reacting before a human could) also dramatically enhance safety on roadways, reducing the probability of crashes. Together, these efficiencies produce highly-detailed vehicle acceleration, deceleration, lane changing, traffic density/spacing, and pavement conditions data. This data is extremely beneficial to IOOs in implementing more effective and intelligent Active Traffic Management (ATM) strategies with less human intervention (both in the form of TMC staff, as well as incident response vehicles).

Due to the expected volume of data, the ATM strategies can be designed to examine hundreds of parameters, then tactically adjusted when various weather, pavement, and traffic density conditions are observed. It's also likely that IOOs have detailed information on travel patterns, based on prior use, that could be used to suggest routes or requirements to certain vehicles.

Dynamic Pricing and Reduced Toll Leakage

An often-stated benefit of CAVs is the ability to dynamically set tolls on a granular level, since the infrastructure operator will be able to communicate directly with vehicles in real-time. This direct in-vehicle communication also helps the operator make instant routing decisions rather than relying on gantry posted signs to advertise pricing changes. At higher levels of automation, the vehicle could follow the instructions of the received message without operator intervention. The ability to identify connected vehicles in the traffic stream could improve toll leakage, since IOOs currently rely on transponder systems and video/photographic movement verification for charging tolls.

Incident, Work Zone, and Special Event Management

Traffic crashes, work zone conditions and special events could also inform strategies enacted by a decision support function at Traffic Management Centers (TMCs). With V2I and V2V infrastructure in place, decisions such as lane/ramp closures and temporary speed limit reduction can be automated and sent directly to vehicles to comply with TMC mandates. These mandates also increase safety of vehicle operators, personnel working in construction zones, or those investigating and resolving traffic incidents.

Interoperability and Reduced Administrative Costs

Increasing volumes of data fosters a greater ability to design, deploy and communicate strategies to drivers, ultimately enhancing the evolution and overall sophistication of TMCs. In addition, because constant information can be derived from these systems, there is potential to improve existing strategies quicker. This is particularly true since connected vehicles are expected to operate in a mixed-mode environment for some time (e.g. initially 10% market penetration, then 20%, then 30%¹, etc.). The large amount of data will enable TMCs and IOOs to extract a "big picture" view, which could ultimately, aid collaboration efforts with regional and neighboring state jurisdictions to better understand traffic movements. This opens the door for improved toll interoperability and opportunities for leveraging the on-board equipment for toll collection. These described scenarios present the chance to consolidate operational and administrative costs across many agencies, leading to reduced costs and improved efficiencies.

¹ Bansal and Kockelman (2016) suggests 25% Level 4 autonomous vehicles by 2045

Relationship with OEMs and Policy-Makers

IOOs are poised to be leaders in CAV deployment. Their existing knowledge and experience with Intelligent Transportation Systems (ITS), particularly the road-side and gantry-mounted equipment, is a meaningful and valuable source of information that is particularly beneficial to the overall deployment plan. It's possible that departments of transportation (DOTs) may rely on toll agencies to understand front and back office, and system operations, as well as maintenance needs of a highly-connected and instrumented facility. Toll agencies are already being integrated into working groups assisting with developing message sets for CAVs under SAE Standard J2735 and for tolling under ISO/IEC 1800-6C for automatic vehicle identification². These partnerships may allow toll agencies to have more input into statewide and regional programs and initiatives, as well as CAV-related and other innovative, emerging technologies.

Demand Side Benefits

More Direct Relationship with Customers

As CAVs proliferate and the appropriate instrumentation is installed, IOOs will gain more insight into precise origins and destinations of customers. This knowledge can be used to influence routing and departure time choices and optimize the transportation network. In other words, existing Advanced Travel Demand Management (ATDM) strategies, which use levers of choice and pricing to generate desired outcomes will become even more intelligent and predictable.

Other considerations directly related to the customer include:

Privacy and security: full strategies will need to be in place for protecting customer data.

Toll diversion: presently, toll operators market reliability and reduced travel time as major benefits. As CAVs, specifically the autonomous vehicles, become more prevalent, travel preferences and value may change and customers may opt to travel on untolled, slower roadways. IOOs will need to work with MPOs and other agencies to manage entire networks, in order to meet shared economic, environmental, and social objectives.

Changing Ownership Models

Car-sharing and ride-sourcing are beginning to take up a greater share of trips. Forms of "micromobility" such as bike-share and scooters are improving the last mile for travelers, which can make long-haul transit modes more attractive. These kinds of innovations could increase

² Others include IBTTA National Interoperability (NIOP), Interface Control Document (ICD) (V1.01), <https://www.ibtta.org/sites/default/files/documents/Interoperability/NIOP2019/NIOP%20Business%20Rules%20VERSION%201.01%20FINAL%20RELEASED%2020190507.pdf> and IBTTA North American Toll Interoperability ETC Requirement (V2.2014.09) <https://www.ibtta.org/sites/default/files/documents/IOP/Final%20NIOP%20Requirements%20Document.pdf>

congestion³. However, a congestion management system derived from the infrastructure that CAV yields would make ride-share schemes more efficient for the user. For example, could a traveler “reserve” a departure time and a lane along their desired route with a guaranteed travel time, similar to how parking applications allow for reserved parking spots during designated times? Will we move to a system where the complete time and space consumed by a vehicle will be defined? Because toll agencies understand congestion pricing and managed lanes, IOOs can help lead and influence these considerations as they already understand congestion pricing and managed lanes. With CAVs and smart mobility applications, agencies can go beyond mileage-based user fees and differentiate prices further, for example vehicle type, facility type, time of day, mixed modes, and more. One benefit of this shift to toll agencies is enhanced understanding of data and revenue generation across these market segments.

Increase in Vehicle Miles Traveled

Partly due to the changing value of travel time, vehicle miles traveled are projected to increase. On one hand, this could mean more revenue for IOOs, but on the other, it could result in increased congestion, which would likely push travelers to untolled facilities - potentially creating a greater need for mileage-based user fees. Again, IOOs will need to work with other agencies to balance regional objectives to ensure transportation infrastructure is adequately funded.

Additional Opportunities to Generate Revenue

In major metropolitan cities like London and New York, congestion pricing is already generating much-needed revenue while curbing urban traffic congestion. Other cities like Chicago, Illinois and Seattle, Washington are carefully evaluating congestion pricing strategies to help mitigate expected decreases in parking revenues, which will likely result from driverless taxis. Again, states, counties, cities and other jurisdictions will look to toll agencies to partner on deploying the equipment, tools and technology needed to price and manage these facilities. Toll agencies may become regional leaders in deploying the necessary technology, algorithms and analysis.

Other Benefits and Challenges

Other benefits and considerations for toll agencies largely result from the interaction of many of the influences/factors listed above. A few potential “other” items are long-range planning; reduced long-term infrastructure needs; and funding, financing and pricing considerations. Key challenges/uncertainties include governance, market penetration, and data volume.

As supply- and demand-side relationships evolve, one could speculate that the greater complexity and availability of data necessitates more consolidated governance of infrastructure to maximize network efficacy. Particularly in a fiscally-constrained environment, where adding capacity is unlikely, multiple operators could work together to realize the

³ <https://www.businessinsider.com/uber-lyft-creating-traffic-cities-bruce-schaller-2018-7>

benefits of CAVs. If such consolidation were to occur, toll authorities are poised to lead the testing and deployment of ITS equipment and TMC strategies. They might see not only growth in the number of managed facilities but increasing complexity of policies and operations.

It is likely that staff capacity levels for toll agencies would remain consistent with current numbers initially, but as the network grows in size and complexity, more staff would be needed to oversee ATM and ATDM strategy development and implementation. While these are important roles for toll agencies, associated growing pains and restructuring potential can be challenging to navigate.

Connected and autonomous vehicles can generate enormous quantities of data every second. Agencies will need to prioritize what data is needed, and when, in order to make informed decisions about roadside equipment purchases, TMC equipment and capabilities, and operational strategies.

Overall, CAVs are expected to improve reliability and predictability of the transportation network, primarily due to the increased safety features (so fewer accidents overall) and more harmonious speeds. These benefits alone will make operations more predictable. However, whether a toll agency chooses to leverage the other applications of CAVs to adapt organizational responsibilities and dynamic operations capabilities will be the difference between basic facility-level reliability benefits and regional mobility benefits.

Is There a Roadmap to CAV Vehicles?

An Agency Perspective

To establish a roadmap for a trip, questions regarding where to start, what route to take, what provisions will be needed, and what assistance is necessary will need to be answered. The assimilation of CAVs on America's roadways requires similar considerations by agencies who provide and maintain those facilities. While the first component of the roadmap is more historical and the second is largely determined by the automotive industry, Original Equipment Manufacturers (OEMs), there are agencies ready to assist with testing and infrastructure improvements/modifications once they are informed of what is needed.

Highway agencies want to adequately prepare their budgets and infrastructure for the provisions that CAVs will need, but currently, CAV development is occurring behind iron curtains. The inherent danger in this scenario is that the CAV technology advances to the point where CAVs are capable of being rolled out en masse, but the infrastructure is not prepared to accept them. Because there is a long lead time needed to prepare, this could potentially cause further delays.

If CAV technology requires changes and/or improvements to infrastructure, we may already be behind in preparing for it. There are approximately 4.1 million miles of roads in the U.S., almost 1.4 million of which are unpaved (1), and these roads are maintained by hundreds of agencies. To enact any change that will result in consistent infrastructure will take significant time and money.

Source: Volpe, the National Transportation Systems Center (USDOT)

Private companies such as Waymo, Apple, and Uber have been pushing the envelope working to bring AV Level 4/5 vehicles to the marketplace. In addition, the OEMs are aggressively pursuing AV solutions. There have been many predictions about AVs entering the marketplace, but most companies have realized the goal of achieving a true level 5 AV is not achievable as quickly as they once thought it would be.

Over the past several years, AVs operating on public roadways have documented safety issues listed in Table 1. Each issue is avoided using infrastructure data to supplement vehicle sensor information in the form of CV applications show

#	Documented AV Issue	Mitigation	Description
1	Running red lights due to sun phantoms	RLVW	Red Light Violation Warning
2	Forward crash due to background contrast	FCW	Forward Collision Warning
3	Sidestreet crash due to driver distraction	IMA	Intersection Movement Assist
4	EV Violation / Mutual Response	EVA	Emergency Vehicle Alert
5	Collides with vulnerable road user	PCW	Pedestrian Collision Warning
6	Lane departure	MAP	MAP lane location and rules

Figure 2 Safety Issues Related to AV Operating on Public Roads

OEMs have consistently advised that in order to best prepare infrastructure for CAV deployment, good pavement markings are needed. While this important, definitive parameters around highway agency goals are perhaps even more important to communicate. Pavement marking options primarily include paint, thermoplastic, polyurea, epoxy, methyl-methacrylate (MMA) and cold-applied plastic. If one or more of these is identified better by CAVs and/or enhances the performance of CAVs, knowing that now would enable infrastructure agencies to move their facilities in that direction. On a similar note, the reflectivity of pavement markings decreases from traffic use and damage, such as snowplowing. If a minimum pavement marking retro-reflectivity is needed for CAVs to perform appropriately, this is critical information for agencies to have.

Another area that must be addressed is keeping GPS and/or mapping services up to date in a more timely manner. There are many different services available and the way each approach map updates varies. Some require input from an agency/owner and others rely on manual and/or automatic input from motorists. Either way, updating a new or revised facility can take weeks and, in some cases, months. This will be problematic for vehicles that rely on these maps when the infrastructure itself has changed locations, lanes have been added or removed, or new roads have been added.

For CAVs to safely navigate roadways, agencies need to understand what CAVs need in order to “see” the roadway. The Federal Highway Administration (FHWA) in October 2018 announced it would pursue an update to the Manual on Uniform Traffic Control Devices (MUTCD) to include AV needs. FHWA’s goal is to release the update for comment before the end of 2019. In February 2019, a report by the National Committee on Uniform Traffic Control Devices CAV Task Force on Traffic Control Device released suggestions for Automated Driving Systems (ADS). This report was created in cooperation with the Alliance of Automobile Manufacturers, who is the leading advocacy group for the auto industry and represents 70 percent of all U.S. car and light truck sales. A request for standardized marking at gores, striping, etc. was included, noting the following additional examples of standardization needed:

- Roadway lane locations
- Signage, such as wrong way, speed limits, lane closures, construction zones and others
- Traffic signal states
- Lane associated with each traffic signal head
- Oncoming vehicles
- Construction zones
- Lane closures

As evidenced by the more than 60 applicants to be a designated Autonomous Vehicle Proving Grounds (USDOT, 2016) and the 73 that applied for this year’s USDOT Automated Driving System Demonstration Grants (USDOT, 2019), there are countless agencies who see CAV technology as the next step in improving safety and efficiency on U.S. roads. These groups are ready to develop, test and fine-tune the technology and to alter and/or improve respective assets to support it. But those changes cannot be made overnight; it will take a significant investment in planning and resources to be ready.

Stronger collaboration and communication between the transportation and automotive industries will go a long way in preparing for and advancing CAV efforts. Agencies need to

better understand what is happening in “behind the curtain,” through existing initiatives and pilot efforts.

What can Agencies do to Continue to Participate?

Current CAV Applications for Tolling

As CAV technology integrates with roadway infrastructure, it reduces cost, removes physical barriers to travel, and increases mobility and convenience. Research shows overall VMT is likely to increase with AV adoption. As the number of miles traveled rises, tolled miles will increase.

Roadway infrastructure will need to reflect CAV needs in order to operate effectively. Toll roads, in turn, find utility as both a method to alleviate budget shortfalls and to benefit from early adoption of CAV and V2I technology.

On the user end, toll roads and managed lanes often benefit from a direct customer relationship and are driven by customer demand. Toll roads and managed lanes operators thus feel increased incentive to invest in CAV infrastructure to meet user needs. Increased

incentive for use of connected vehicles on facilities, in turn, improves safety and efficiency of travel with increased saturation of advanced vehicles. ⁴

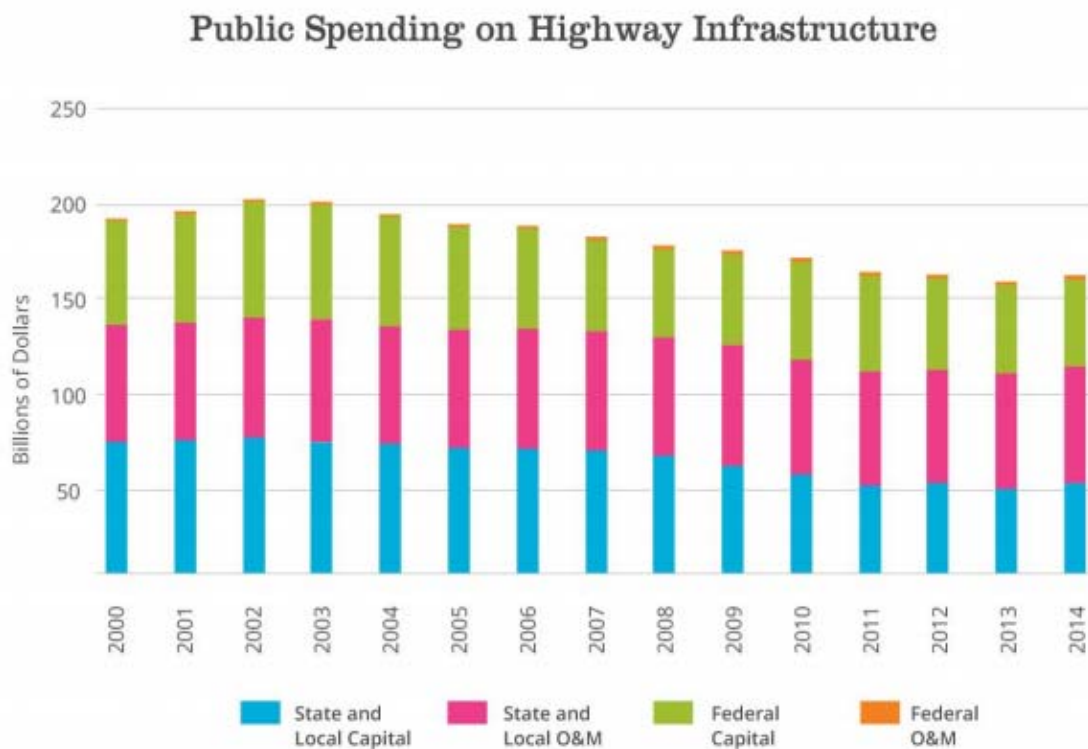


Figure 3 Public Spending on Highway Infrastructure

Even with standards such as MUTCD, there remains some variability in signing and pavement marking standards. Coordination between agencies/owners will be vital for more consistent and efficient approaches to CAV deployment.

As CAV technology advances and implementation gets closer, industry leaders expect that CAV will most likely to be seen first in urban environments. The speeds are typically lower in urban areas and there is typically easier access to communications and power to install communications devices. In addition to refining infrastructure in urban areas, agencies/owners should be evaluating ways to provide the bridge to those services in rural areas.

Some leaders are expecting that operational centers will be needed to take over and/or direct CAVs, at least during the transitional machine learning period to full autonomy. Agencies/owners should begin/continue this conversation with OEMs to determine whether

⁴ Robert Deans (December 2016), How Connected Autonomous Vehicles Could Benefit the Tolling Industry <https://www.ibtta.org/sites/default/files/documents/CAV%20Committee/ArticlesReports/How%20CAV%20Benefit%20Tolling-Rob%20Deans%20PWF-December%202016.pdf>

this effort will be needed and if so, what type of coordination if any will be needed (e.g., access to traffic cameras, additional traffic cameras, etc.).

There are many examples of agencies and organizations who have organized and are addressing the future of CAV/CASE through pilot projects, research, and testing. Attachment 1 describes use cases and existing efforts to explore CAV/CASE.

The Evolution of Payments and Third-Parties

Third-Party Account Providers

Changes in roadside and in-vehicle technologies, as well as changing vehicle ownership are all opportunities for the toll industry to look at how, when, and where to participate. The opportunity to categorize changes and evolutions and analyze their effects on our industry is a good first start.

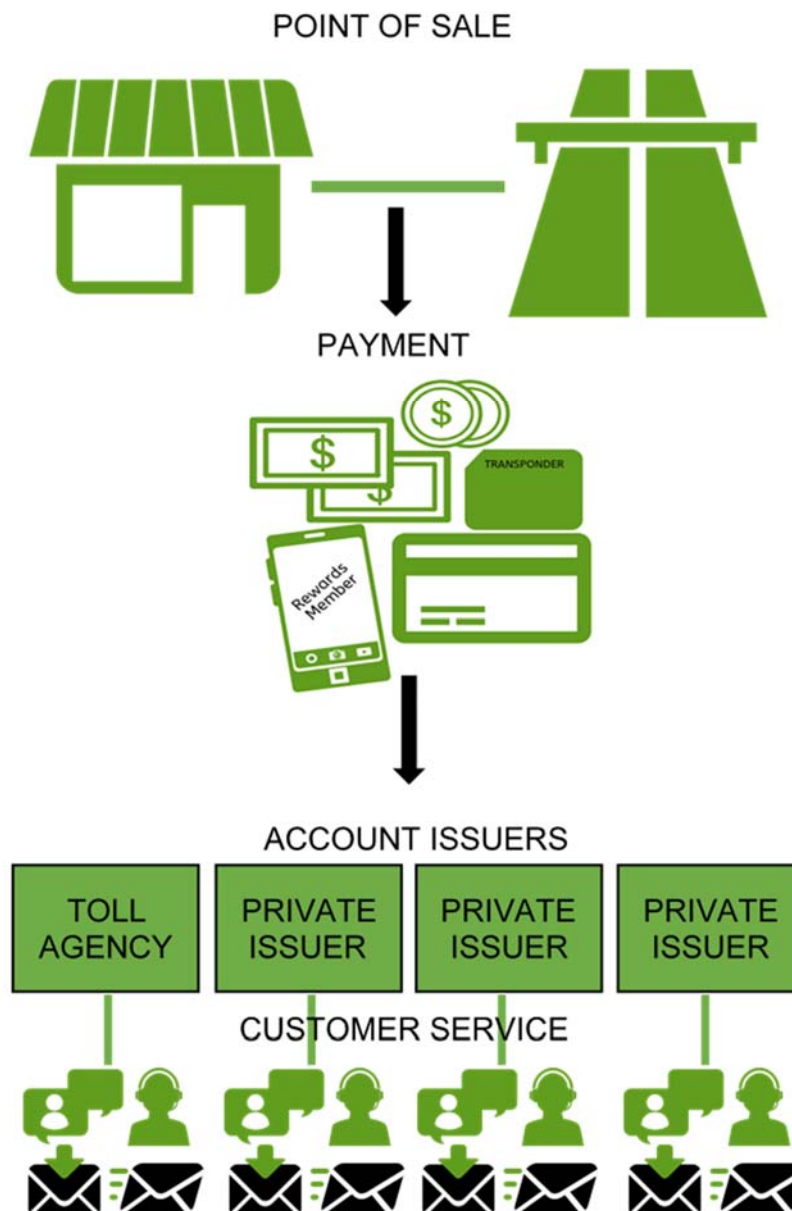
The immediate consumer consideration, however, will be the method used to pay for new roadside and in-vehicle technologies. Regardless of CAV technology, the need to pay for tolls remains and is still required. Who gets charged and how is a question we should look to solve, now. CAV/CASE vehicles will not change this particular aspect of toll road usage.

Changing Vehicle Usage and Ownership

The trending change in vehicle ownership remains to be seen, and while millennials are most likely to lead that change, so far, there does not seem to be a significant shift. However, rideshare and car rental companies are presenting issues that call for immediate solutions to charging structures, toll invoicing and violation notices.

Industry Considerations

As vehicle ownership changes, it is incumbent upon us to begin to develop an architecture for charging that does not necessarily revolve around the registered “Owner” but rather the registered “User”. Whether autonomous, rented, leased, or loaned, not only does the ability for toll agencies to collect tolls become more challenging, the ability for users to actually pay tolls becomes more challenging. As an industry, we need to consider and embrace third party solutions to increase users’ options for payments, and also develop an architecture that reflects the evolution of vehicle usage. Utilizing a retail style solution would provide users with a choice for making payment and agencies a greater opportunity for capturing payment from its ridership. See example below:



One of several potential models for a future solution is an architecture that supports multiple account issuers should also consider the dynamics of vehicle ownership and usage. An example of the existing rideshare model is below:



As illustrated in the above model, the number of layers adds a complexity that toll agencies currently do not support. This results in increased costs passed through the chain, and ultimately, onto the user. In some cases, drivers avoid tolls to avert the challenge of charging the correct toll, and ultimately recouping the paid toll from the end user. Typically, rideshare companies use GPS and map tolling points to provide toll costs to drivers; however, this is not an entirely accurate way to charge the user/rider.

Considerations for a Possible Solution

As presented by Glenn Deitiker, Chief Technology Officer at the IBTTA 87th Annual Meeting, a possible solution to charging vehicle users versus registered owners is a Financial Responsibility Subscription Service. The process provides for the change between vehicle assignment and payment responsibility and becomes a cascading chain where individuals can be added and removed dynamically. Attachment 2 describes the chain of ownership and subsequent subscription processes amongst the participants, as well as possible next steps for consideration.

Where Do We Go From Here?

Recommendations and Next Steps

Recommendations for how the toll industry can initiate participation are outlined below:

General Overview & Commentary

CAVs will share the road with human drivers for many years. It will be incumbent upon road agencies/owners to provide infrastructure that supports both of these individually as well as their coexistence.

Almost all drivers today rely on navigation services, and with several options to choose from, most motorists adopt one. However, for effective CAV deployment and functionality, accurate mapping is critical. In addition to working with the navigation industry to update maps in real time, agencies/owners also need to make decisions related to planned and unplanned closures and lanes shifts, especially in edge-case scenarios, such as rain, fog and snowfall. Even if the navigation industry resolves current issues and develops solutions for more accurate mapping, agencies/owners will need to figure out how to feed information regarding sudden changes to road conditions to CAVs. This may be addressed through permanent or portable DSRC and/or cellular units, but this information must be communicated and planned for accordingly.

The proper function of CAVs can largely depend on the condition of its roadway environment. But one of the biggest problems facing agencies/owners today is keeping an aging infrastructure in good condition. According to the 2017 American Society of Civil Engineers (ASCE) Report Card, surface road conditions are currently rated a D. Exacerbating the issue, ASCE estimates that America's backlog for highway and bridge capital needs is \$836 billion. The federal contribution to highway construction typically originates from the Highway Trust Fund, which is funded by the motor fuels tax. However, the rates for these taxes have not been raised since 1993 and inflation has cut their purchasing power by 40 percent. Many agencies/owners rely on their own gas taxes to supplement those of the federal government, and revenue from this source has been decreasing in recent years due to more fuel-efficient vehicles and the growing popularity of electric vehicles. The decreased revenue has resulted in decreased spending on highways and bridges (see chart below). While a mileage-based

user fee is a popular topic of discussion to remedy this revenue decline, agencies/owners are going to have to be more diligent in resolving this funding issue if infrastructure is going to be prepared for the widespread use of CAVs.

Continued focus on CAV Testing and Development

Tolling agencies should consider further investment in infrastructure, enabling CAV adoption to prepare for and meet future user needs. CAVs can be advantageous for the tolling industry with the likelihood of increased VMT on all roadways. Tolling and transportation agencies recognize this, and are heavily focusing on various development, testing and ongoing demonstrations.

Toll and managed lane facilities can take advantage of the ability to provide a safer, well-maintained environment for CAV adoption, and may even consider being an early adopter of CAV testing. With comparatively fewer variables to interfere with CAV operation (i.e. traffic signals, pedestrians and cyclists), toll facilities are potentially ideal for development and integration. Further, a natural focus on customer demand and performance makes them more likely to bring current facilities up to the necessary standards for CAVs compared to other roadway types.

- Consider partners outside the industry to explore testing and development e.g. Ford or other auto manufacturer participating in CAV/CASE
- Determine specific pilot projects regarding transaction testing, identify host agencies

Payments and Third-Party Providers

The industry will no doubt see additional third-party providers for payments. The industry is already familiar with third-party providers (e.g. rental car fleet providers, commercial trucking fleet providers, consumer facing fleet providers). Auto manufacturers, CAV/CASE infrastructure providers, and OEMs, are all potential third-party providers. Suggested next steps include:

- Explore the development of standardized interfaces for third-party providers
- Establish a payment architecture for “Users” rather than “Registered Vehicle Owners”
- Develop an additional white paper that analyzes requirements for additions or alterations to existing lane and/or back office systems directly related to payments. The paper should take into consideration existing use cases such as ride-share and evolving vehicle ownership or lack thereof. The paper could also explore modeling future use cases based on CAV/CASE developments.

Attachment 1

CAV/CASE Agency & Various Organizations Participation

Below are case studies and descriptions of agencies who are working to evaluate, test, and research CAV/CASE.

IBTTA CASE Working Group

IBTTA's pursuit of CAV technology lead to the launch of the IBTTA CAV Working Group in May 2017, later adding shared and electric to the groups focus in 2019 to become the CASE Working Group. The group's objectives are to:

- Share local and regional initiatives in the CAV space
- Discuss IOO issues stemming from CAV developments
- Collaborate on ways the tolling industry can respond to the emerging connected, autonomous, shared and electric field of practice

The group also contains two sub-groups focusing on

- CAV tolling standards
- Tolling-CAB policy at the state and federal level

Each month, the group meets to discuss relevant developments and invites members within the group and relevant external parties to present on the latest advancements throughout the industry.

Examples of toll and infrastructure agencies' involvement in CAV development are listed below. These examples come from various presentations, with express permission from each speaker. It should be noted that there are numerous developments happening throughout the world by tolling and infrastructure agencies beyond examples directly noted in this white paper.⁵

Tampa Hillsborough Expressway Authority

One example of CAV pilots conducted on toll roads and managed lanes across the country is the Connected Vehicle Pilot, Tampa Hillsborough Expressway Authority (THEA), in Tampa, Florida. THEA tested congestion reduction congestion and safety improvement by displaying safety messages and issuing alerts on enhanced rear-view mirrors to generate data for the

⁵ IBTTA, CASE Working Group
12/1/19

USDOT on connected vehicle impacts on a corridor. Approximately 1,000 private vehicles (THEA toll customers), nine streetcar trolleys, and 10 transit buses were equipped with on-board units (OBUs). The focal point of the pilot is Meridian Avenue (THEA-owned) and the Selmon Expressway reversible lanes. Additional roadway facilities in downtown Tampa were included to measure specific use cases such as Transit Signal Pre-emption, Pedestrian conflict avoidance, and Multi-Modal Intelligent Traffic Signal System (MMITSS) for traffic signal optimization. The total CV technology installation involved 14 miles total, with 11 miles located on the reversible lanes.

The THEA CV Pilot demonstrated how CV technology can be tested on integrated expressways as well as surface street networks. Testing involved over 10 CV applications, including Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I), and Vehicle to Everything (V2X). The pilot is especially interested in alerts to the driver for use cases where road operators can control the deployment and operations such as:

- End of Ramp Deceleration Warning (ERDW) for main line backups
- Intersection Movement Assist (IMA) for T-bone crashes
- Wrong Way Entry, Intelligent Traffic Signal System (I-SIG) was used for optimal signal timing
- Pedestrian Collision Warning (PCW)
- Transit Signal Priority (TSP) for transit vehicles
- Vehicle Turning Right in Front of a Transit Vehicle (VTRFTV) alert for transit vehicles

As an urban freeway with downtown ramps, THEA has a special interest in pedestrian safety applications such as Pedestrian in a Crosswalk Vehicle Warning (Ped-X), Pedestrian Mobility (PED-SIG) which gives pedestrians signal phase priority, and Pedestrian Transit Movement Warning (PTMW) which provides warnings to pedestrians that a transit vehicle is starting or stopping at an intersection. ⁶

Florida Department of Transportation

The Florida Department of Transportation (FDOT) developed a Driver Assisted Truck Platooning (DATP) pilot, using V2V technology on the Florida Turnpike Mainline from Orlando to Palm Beach. During testing, two Class 8 trucks covered more than 1,000 miles. The pilot evaluated impacts of platooning on surrounding road infrastructure and aimed to determine feasibility

⁶ THEA CV Pilot, Tampa Hillsborough Expressway Authority (October 14, 2018).

<https://www.ibtta.org/sites/default/files/documents/2018/Baltimore/Frey%20-%20ITS%20Wisconsin%202018.pdf>

of conducting enforcement responsibilities. The DATP pilot also looked to assess impacts on infrastructure on the Florida Turnpike utilizing electronic tolling, among other options.⁷

Ohio Turnpike

On the Ohio Turnpike (I-80), DSRC Roadside Equipment (RSE) was installed at 15 locations along a 52-mile stretch between Toll Plaza 135 (Amherst, Ohio) and Toll Plaza 187 (Streetsboro, Ohio). The RSEs broadcast DSRC standard Traveler Information Management System (TIMS) messages for incidents, work zones, curve speeds, and weather warnings. On-Board Equipment (OBE) was installed in 38 fleet vehicles as well.

The OBE includes an iPad that functions as a Human-Machine Interface (HMI) to share alerts and advisories with the driver. The OBE also includes a cellular modem that sends snow and ice information back to the data center, including: Plow State, Wing State, Liquid Rate, Salt Rate, Spin Rate, Light Bar status, and Air/Road Temp. Basic Safety Messages (BSMs) Part 1 information, which includes latitude, longitude, direction, and speed, is collected and sent back to the data center when the vehicle is out of range of the RSE as well. Future incorporated applications may include customer service applications related to toll points, service plazas, and border crossings.⁸

Panasonic and Colorado Department of Transportation

Panasonic has partnered with Colorado Department of Transportation (CDOT) and Utah Department of Transportation (UDOT) on multiple deployments of an end-to-end V2X system, spanning multi-year and multi-phase partnership programs. The first of these deployments began in 2018 in Colorado on a 90-mile stretch of I-70. This I-70 Mountain Corridor was selected as a model for scaled deployment due to high-utilization, steep grades, sharp curves and tunnels that often experience extreme winter weather conditions. During Phase 1 of the CDOT partnership program, the 90-mile stretch was equipped with 100 Roadside Units (RSUs) and 94 CDOT fleet vehicles were equipped with OBUs.⁹

FHWA, Virginia Department of Transportation, and Transurban

In Virginia, the Federal Highway Administration (FHWA) partnered with Virginia Department of Transportation (VDOT) and Transurban, a private operator, to test connected automation applications off and on public roads. The agencies tested speed harmonization, vehicle platooning, and cooperative ramp merge using the CARMA Platform. Public road testing was done with a 4-vehicle platoon, merge vehicle, and police escort on Transurban's I-95 Express Lanes. These FHWA research vehicles were equipped with Society of Automotive Engineers

⁷ Michael Shannon, P.E., Connected and Automated Vehicle Initiatives in Florida (September 1, 2017). https://www.ibtta.org/sites/default/files/documents/CAV%20Committee/Presentation/Mike%20Shannon%20Presentation_CAV%20Initiatives%20Florida_FINAL.PDF

⁸ Randy Cole, Connected Mobility: Ohio Turnpike (October 24, 2017). https://www.ibtta.org/sites/default/files/documents/CAV%20Committee/Presentation/Randy%20Cole_Connected%20Mobility%20Update_10-24-2017.pdf

⁹ Panasonic and Colorado DOT

(SAE) Level 1 vehicle automation technology. The CARMA Platform fused GPS, radar, and communications for both DSRC, using the 5.9 GHz safety band, and the cellular LTE network to conduct the testing for the proof-of-concept cooperative driving automation maneuvers. This managed lanes facility provided a safe and controlled environment for testing. ¹⁰

Virginia Tech Transportation Institute and Transurban

Transurban and the Virginia Tech Transportation Institute (VTTI) have partnered to develop and test Automated Truck Mounted Attenuator (ATMA) leader-follower scenarios. CAVs will largely impact work zones and ATMA's will take the driver out of harm's way and can improve work zone safety. The ATMA is currently under development and undergoing closed-road testing at VTTI but will soon be tested on the I-95 Express Lanes.

Transurban has also partnered with VTTI, VDOT, and an automotive company consortium to demonstrate AV interfaces with dynamic, on-road scenarios related to public safety. Transurban has been awarded a USDOT Automated Driving Systems (ADS) grant that will allow the I-95 Express Lanes to be developed into a real-world, AV-ready corridor. The I-95 Express Lanes corridor will serve as a next-generation example for future and modernized road development as well as improved freeway mobility. ¹¹

Maryland Transportation Authority

The Maryland Transportation Authority (MDTA) has developed a strategic plan for CAVs that focuses on current and future actions. Currently, MDTA focuses on preparing their workforce by educating people about CAVs to raise general awareness and outreach to internal and external stakeholders as developments take place.

MDTA wants to improve safety and travel time as well as provide the latest vehicle technology to improve customer experience. MDTA is interested in conducting a Highly Automated Vehicle (HAV) Emergency Response Operations (HERO) field exercise that would consist of different scenarios to address emergency response and traffic incident management operations situations. Scenarios ranging from an ADS moving over due to obstructions in the roadway or when being approached by an emergency vehicle to the ADS pulling over when pursued by a police car would be tested. ¹²

INFRAMIX

In Europe, INFRAMIX, a project that will help prepare infrastructure for CAVs, has proposed Infrastructure Support Levels for Automated Driving (ISAD Levels). An expert group at INFRAMIX analyzed the required physical and digital infrastructure elements and their respective functionalities. The levels range from E to A, with Level E as conventional infrastructure / no AV support and Level A as cooperative driving. At Level A, AVs are guided by infrastructure to

¹⁰ FHWA, VDOT, and Transurban

¹¹ VTTI and Transurban

¹² Maryland Transportation Authority

optimize traffic flow. As the CAV space grows, infrastructure will need to have the necessary level of support for CAVs to properly operate. According to the ISAD model, tolling facilities will likely need to have an ISAD level greater than E to support integration with CAVs.¹³

IBTTA CAV Tolling Standards Sub-Group

Aside from pilot testing in the CAV space, the IBTTA CAV Tolling Standards sub-group, part of the CASE working group, has been working to define the concept of operations, performance requirements, message, related data elements, user needs, and other aspects enabling V2X toll and other financial transactions. The sub-group is also working with the SAE to create a CV-based standard for tolling transaction messaging. It is important to develop tolling standards as a baseline. So far, the sub-group has been collecting all existing work done, including Oregon DOT and European standards, and definitions for standard terms.¹⁴

IBTTA Tolling-CAV Policy Sub-Group

Another area of focus within the CASE Working Group, the IBTTA Tolling-CAV Policy Sub-Group, is keeping track of Federal and State CAV-related rules and opportunities to comment, especially as it relates to toll roads. It is important for IBTTA to monitor and provide comments on CAV policies because legislation could affect toll operators. In 2016 and 2017, 20 and 33 states introduced legislation, respectively, and 15 states enacted 18 AV-related bills in 2018. The sub-group has been working on tracking policies and issues.¹⁵

¹³ Jacqueline Erhart, Infrastructure Support Levels and Operational Design Domain definition for Connected and Automated Vehicles.

https://www.ibtta.org/sites/default/files/documents/CAV%20Committee/Presentation/2019-07-24_ISAD_IBTTA.pdf

¹⁴ IBTTA, CAV Tolling Standards Sub-Group

¹⁵ IBTTA, Tolling-CAV Policy Sub-Group

Attachment 2

Financial Responsibility Subscription Model

Below is a description of a subscription model service for consideration as payments and financial responsibilities evolve, and to address existing ride-share/shared use vehicles. This model could potentially prepare the industry for CAV/CASE.

Note that the subscription model requires a real-time interface to implement; however, there are many reasons for agencies to move to a real-time interface beyond this subscription model.

Agency Example

- A cloud-based service holds the keys (user responsibility) to all levels of assignment for each vehicle.
- A vehicle drives the road, the agency sees a car/plate that is not registered in the agency system.
- The agency pings the cloud-based subscription service with the vehicle's license plate number, and receives back either acknowledgement to pay, or failure to find the vehicle.
- If the vehicle is registered in the system, the system remits payment to agency.
- If the vehicle is not registered in the system, the agency treats the vehicle as a violator.

User/Subscription Example

- The owner enrolls the vehicle in a cloud-based solution with various levels of assignment.
- The owner leases the vehicle, and requires lessee to sign-up next, assigning the vehicle to lessee.
- The lessee makes the vehicle available to the driver, and the driver accepts financial responsibility, possibly using a phone application (app), for the period of time that they are using the vehicle.
- The user gets into the vehicle and is notified they must accept financial responsibility and the user does so, using the app.

- When the user leaves the vehicle, they release the vehicle and the driver once again accepts responsibility.

Possible Technical Rollout


- Each participant has a token assigned based on signing up for rideshare.
- Each participant has a means of payment (MOP) registered.
- When the participant agrees to join, the token generates a key.
- The key is stored on a secure chain, possibly a block-chain.
- When the user leaves, a new key is generated for the next user.
- When toll charges are posted by the agency, the system determines which user was responsible, and charges the user.

Considerations

- Advantages for a toll agency include no violations or collections as well as no overwhelming calls to the customer service center to dispute payment responsibility.
- Each new car sold includes a payment liability.
- Manufacturers are looking for ways to monetize vehicles.
- There is a distinct opportunity to approach vehicle manufacturers and proactively sign up new vehicles, while providing them a role in the system.
- The vehicle manufacturer will cascade sign-ups down to the owner, etc. and potentially have a means to monetize their participation.

Suggested Next Steps - Subscription Model

- Begin to explore the requirements to implement the Financial Responsibility Subscription Model – Agencies should participate; however, the model can be implemented using the existing infrastructure.
- Create a standardized real-time interface for agencies wishing to participate, which also creates an opportunity to participate in other types of charging schemes.



White Paper Unmanned Aircraft Systems (UAS) Workgroup *A Guide for Building an Agency Drone Program*

Working Group Chair: Mike Davidson

Abstract

Unmanned aircraft systems, or drones, have exploded in popularity due to their ability to enhance safety, save time, and reduce costs. Agencies are faced with incorporating drones into their day-to-day business practices but starting a program can be a daunting task. This white paper provides guidance and considerations for starting a drone program, including potential use cases, equipment and technology, regulations, and program administration.

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1. Introduction

Once reserved to military operations, unmanned aircrafts (UA) and unmanned aircraft systems (UAS), commonly called drones, are exploding in popularity worldwide for its benefits and uses in a wide number of civil sectors and applications.

In early 2019, the Federal Aviation Administration (FAA) released its aerospace forecast for the next twenty years. The report noted the market for commercial drones could triple between 2019 and 2023, with the number of commercial drones reaching 835,000 by 2023.¹ Similarly, the European Commission forecasted that within 20 years, the European drone sector is expected to directly employ more than 100,000 people and have an economic impact exceeding €10 billion per year, mainly in services.²

The dramatic increase in popularity of drones should come as no surprise, as drones have been shown to enhance safety, save time, and reduce costs. These benefits will create new businesses and jobs worldwide and will fundamentally change the face of the transportation industry.

With the explosive growth and benefit of UAS, IBTTA member agencies are faced with incorporating drones into their day-to-day business practices. Starting a drone program can be a daunting task, as agencies struggle to lay a solid program foundation, wrestle with program topics and areas to consider, and are fearful of managing a drone program.

The purpose of this paper is to provide guidance and considerations in starting a UAS program at an agency. The following topics are discussed in this white paper:

- Use cases to help determine how UAS can be used at an agency. This is an important first step, especially if the agency will be procuring a UAS.
- After determining how UAS will be used, then the agency can assess the technologies available to procure.
- Regulations for flying drones and certification needed to pilot and operate UAS.
- Program administration and behind the scenes details, which are critical aspects of an agency's UAS program. While these things may not be as exciting as flying a drone, addressing staffing, insurance, flight planning, and other considerations are critical to creating and administering a program.
- Ongoing research projects and programs in the United States and Europe.
- Recommendations and next steps for creating your agency's UAS program.

At the time of writing this white paper, the data was current, but not comprehensive. As such, this white paper is not intended to be a complete guide. It is a resource to use as a starting point when building a drone program. Readers may want to research other topics in depth, and the links and guides located in Appendix A: Quick Guide provide additional information.

¹ https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2019-39_FAA_Aerospace_Forecast.pdf

² http://ec.europa.eu/growth/sectors/aeronautics/rpas_en

2. Use Cases

The first step in building a drone program at an agency is to determine how drones will be used. Create use cases to help guide this process and document the use cases in a Concept of Operations.

The following use cases are just a few examples of how UAS can be used to reduce costs, save time, and enhance safety at an agency. There are many more examples not listed here, but these use cases have been vetted, either through research or the experience of this working group. If interested in more detail regarding a specific use case, Appendix B: Further Reading on Use Cases includes a table of white papers, reports, and studies for further reading on the use cases discussed.

Asset Inspections

Drones can be used to inspect agency assets, such as building rooftops and communication towers. Equipment located on rooftops become a hazard during inclement weather. Using a drone to initialize the visual inspection process will enable agencies to prioritize their attention on those assets requiring repair and maintenance first. In regard to communication towers, coupling current drone imagery technology with powerful software allows agencies to create an accurate baseline of antennas and cables to conduct a tower analysis.

Bridge Inspections

Drones can be used by structural engineers, as another tool in their tool kit, when it comes to bridge inspections. It is important to note, using a drone for bridge inspections does not replace the tactile inspection, but serves as a viable tool. Drone equipment with high-resolution cameras can document conditions and target required areas for manned inspection. These outcomes are achievable in a very safe and cost effective manner by reducing the need for lane closures and traffic patterns.

Construction Progress

UAS are a useful tool for capturing the progress of construction projects, and the photos or video can be shared on the agency's website or social media accounts.

Crash Reconstruction

While crash reconstruction is within the purview of law enforcement, using drones for crash reconstruction has great benefits for agencies. During conventional crash reconstructions, law enforcement marks the scene and then records measurements using surveying equipment, which can take hours. With drone crash reconstruction, the measurements can be recorded in the matter of minutes. The UAS collects high-resolution imagery and there are numerous software programs being used to create point clouds (3D Visualizations) to model the scene. A study by North Carolina has shown that using UAS can reduce the time to map a crash scene by 77%.³

³ <https://www.ncdot.gov/divisions/aviation/Documents/ncshp-uas-mapping-study.pdf>

Engineering Design

There are many unique ways to utilize UAS to assist with engineering design. For example, drones can be used in the planning and design of Dynamic Message Signs (DMS) and CCTV. The Pennsylvania Turnpike used drones during preliminary engineering to verify line of sight between the DMS and microwave towers. UAS can also be used to help locate the best position installing CCTV to have the best vantage of traffic by flying different locations at the planned height of the cameras.

Incident/Emergency Management

There is great interest to use UAS for incident management, particularly to provide enhanced situational awareness for first responders. Enhanced situational awareness helps to determine the magnitude of crashes and other traffic incidents, determine appropriate personnel and equipment to dispatch to a scene, coordinate and manage on-scene resources, and direct the movement of emergency vehicles. The enhanced situational awareness can also help personnel in the Traffic Management Center (TMC) if there is a livestream video connection back to the facility.

Using drones at incidents also enables first responders to document information for after action reviews, record video for training, identify secondary incidents, and view the length of backlogs/queues. Similar to incident management, UAS for emergency management can help with situational awareness and damage assessments, in addition to search and rescue.

Insurance Documentation

Drones can be used to collect photos and video to supplement insurance claims and perform damage assessments. UAS can document areas inaccessible to humans due to topology risks, which raise safety concerns. Drones can capture the magnitude of large-scale disasters quickly and safely.

Security

Flying a drone at night and over crowds require special waivers. Nonetheless, if permission is granted, drone surveillance can provide enhanced security benefits to outdoor events. Imagery capture can provide security professionals and law enforcement with a live birds-eye view of crowds. In addition, conducting flights with infrared cameras provides useful images and videos in areas of dense fog, pollution, and foliage.

Special Event Observations

Similar to incident management, drones allow for enhanced situational awareness and traffic management during special events. Venues near a toll facility may have large events, which disrupt traffic entering and exiting at the interchanges.

Surveying

UAS have been used to collect data such as stockpile size, excavation volume, and other survey-grade measurements. Many drones have high-resolution cameras capable of surveying, and software tools combine the high-resolution images captured by the drone with control measurements. The software algorithms can associate control measurements with the

images and create accurate orthomosaic imagery. The technology is becoming increasingly advanced, with some off-the-shelf models including surveying capability with centimeter-level accuracy.

Traffic Studies/Assessments

Traffic engineers can use drones to collect data and observe traffic conditions where traditional traffic count data would not suffice. For example, drones have been used to observe weaving behavior at interchanges. Often, vehicle speed data is recorded using a device scanner. If one is not available or if there are no safe locations for a person to position himself or herself to take readings, another way to obtain vehicle speed data is to mark two spots a few hundred feet away from each other and record video of traffic. Then, review the video and record the time it takes vehicles to traverse the two spots to obtain speeds.

For facilities or motorway sections that do not currently have 100% CCTV coverage this can provide a valuable resource that could also reduce the need for vehicles patrolling the motorway. The fact that UAS can reach an altitude that is significantly higher than the one of current highway cameras means that once equipped with powerful optics can monitor longer stretches of the motorway.

3. Equipment and Technology

Once the potential use cases are documented, then the agency can determine what technology it needs to accomplish its goals. The use cases should drive the technology, not vice versa, and one agency should not purchase equipment simply because another agency has that equipment. Use the Concept of Operations to decide what equipment and technology should be procured and document the decisions.

The following are the key characteristics that an agency should consider when selecting a UAS and accessories.

UAS		
Drone Equipment	Options	Description
Battery (Extra Batteries)	<ul style="list-style-type: none"> Smart Battery 	Smart Battery technology will report battery health. Low battery mode will begin to land the drone at a safe decent.
Flight Time	<ul style="list-style-type: none"> Battery Capacity Weight of Drone 	When looking for the longest flight time be sure to look for the largest capacity battery. The Weight or payload will impact flight time
Operation Range	Drone Control Range	Several factors can impact drone range. Controller Antenna, Transmitter, Frequency and Signal

		interference. Be sure to have the return to home set.
Speed	Avg Drones clock 50 * 70 mph	"Important to balance:
Payload	<ul style="list-style-type: none"> • Small Drones = 3 to 5 pounds • Heavy Lifting Drones = 30 to 40 pounds 	The weight a drone can carry. Typically calculated outside the weight of the drone itself
Waterproof / Wind Resistant	Unfavorable weather	Waterproof drones are built to withstand wind and rain. Be sure to understand the difference between Waterproof and Water Resistant
App Connected	Used for submitting Flight Plans	Research App that allows you to map flight, has detailed compliance and flight authorizations

Controller/App

Controller Equip	Options	Description
Integrated on Control Pad	Flight controller	The flight controller will manage the motors according to the pilots instructions.
Attach IPAD/Android	Flight controller	Some drones have the ability to sync to an IPAD/Android.
FPV	First Person View	Virtual reality perspective when flying the drone.
Autonomous	Automated v Autonomous	Not fully autonomous but they are unmanned aircrafts. Flight is controlled by pilot. Functionality exist to avoid structures and land when low on battery.

Camera

Camera equip	Options	Description
Picture quality	2K / 4K / HD	Drone cameras can be used to capture still images or videos. Higher quality cameras will cost more but will also provide better functionality.
FLIR/Night Vision	Forward Looking Infrared versus Night Vision	Some drones offer thermographic cameras that sense infrared energy. Night

		vision is highly sensitive to tiny amounts of visible light in darkness.
Memory Card	Image storage	Options exist for SD and Micro SD cards. Items to be considered are Storage, Size and Speed.
Zoom Capability	After market	Most Drones do not come with a camera with the ability to zoom. This would have to be an aftermarket purchase.
Gyro/Axis		360 degree rotation, 3 axis gimbal and image stabilization

Additional Features

While the drone industry is rapidly changing, the list above is a basic guide before purchasing your drone and provide the information your agency will need before entering the exciting world of drones. The table below includes indicative ranges of key performances and features of enterprise UAS, at the time of compilation of the white paper. The “Low” and “High” columns indicate values at the low and high ends of the range, with units defined for each performance indicator.

Performance indicator	Low	High
Flight time with payload (min) <i>Note: extended flight time can be achieved with hybrid fuel/electric UAS</i>	16	24
Wind resistance (m/s)	8	12 (GPS mode)/ 16 (Manual mode)
Service ceiling (ft)	9,842	13,123
Operation range (km)	1.0	1.6
Control transmission range (km) <i>Note: restrictions to maintain visual line-of-sight with the UAS may apply</i>	1.0	5.0
Video transmission range (km)	0.5	1.6
GNSS Systems supported	GPS, GLONASS	GPS, GLONASS, Galileo & Space Augmentation Systems (QZSS, WAAS, EGNOS, MSAS)
Number of rotors	4	8
Weight (kgr) <i>Note: excluding payload</i>	1.20	9.5
Dimensions (mm)	820 x 770 x 160	1670 x 1520 x 730

<i>Note: dimensions have been rounded to the nearest cm</i>		
Operating temperature range (°C)	-5 to +40	-20 to +50

4. Piloting a Drone

In the United States, flying drones for work under the Part 107 rules (refer to the next section for more details on regulations for flying drones) requires operators to have a remote pilot certificate. In order to obtain certification, one must pass an aeronautical knowledge exam.

The purpose of having a remote pilot certificate is to ensure that the operator is consistently operating with the knowledge and privileges that come with flying a small UAS. Overall, having a drone license is a way to make sure that drone pilots are safely abiding by the rules and regulations of the sky that have been established by the FAA and National Airspace System (NAS).

This section discusses some of the aeronautical topics that are covered on the remote pilot certification exam. It also discusses best practices for flying UAS. While hobbyist drone operators, or people flying for fun, do not require any certification or license, it is a good idea for all to become familiar with the material in this section.

Airspace Classification

One of the most important parts of remote pilot certification is knowing the airspace classification. It should be noted that the following paragraphs attempt to simplify the explanation of airspace. There are more nuances to the NAS that are not discussed, such as temporary flight restrictions, military operation areas, restricted areas, etc.

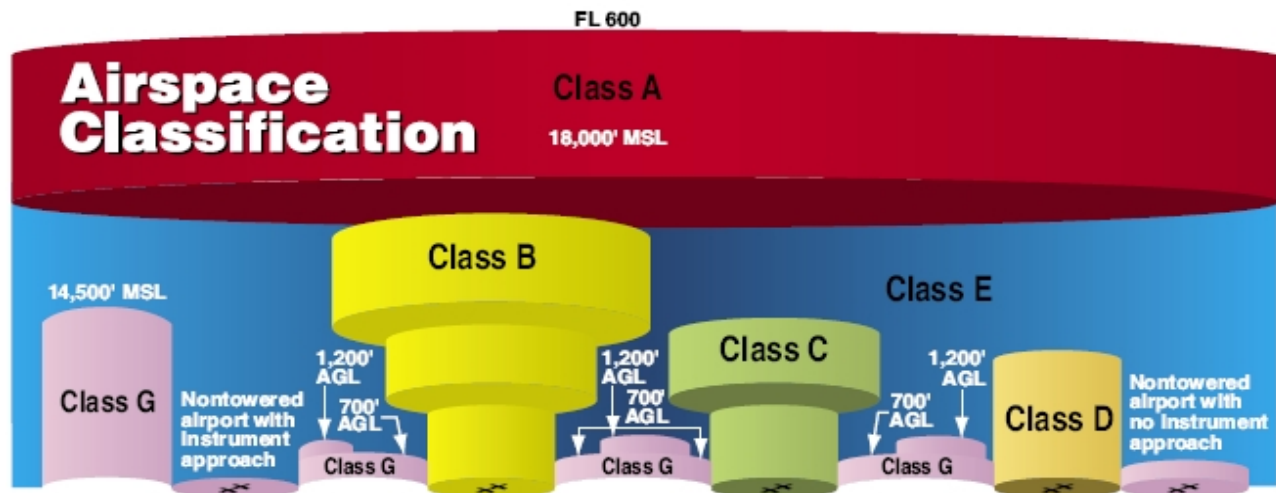
Most airspace is classified as either “controlled” or “uncontrolled”.⁴ Controlled airspace is airspace around airports and where airplanes typically fly at altitude. Uncontrolled airspace is airspace near the ground where air traffic control service is not provided. Controlled and uncontrolled airspace is further categorized into classes – Classes A, B, C, D, E and G (Class F is not used in the U.S.). Classes A through E are controlled and Class G is not.

In order to describe how classes of airspace are related, the FAA created a general diagram which is shown below. Some things to note about the diagram:

- MSL stands for “mean sea level”.
- AGL stands for “above ground level”.
- FL 600 is an altitude of 60,000 feet, assuming standard air pressure at sea level.
- Class B surrounds the nation’s busiest airports.
- Class C surrounds medium-sized airports.
- Class D surrounds small airports with a functioning control tower.

⁴ Other types of airspace include “special use” and “other airspace”.

- Class E is controlled airspace that is not Class A, B, C, or D. Most airspace is Class E.
- Class G is uncontrolled airspace and the only class of airspace where drones can be flown under Part 107 rules without needing any additional approvals or authorizations.



It is possible to fly a drone in controlled airspace. The FAA's Low Altitude Authorization and Notification Capability (LAANC) system automates the application and approval process for airspace authorizations. Once a pilot submits a request using LAANC, the system checks it against several data sources. If approved, the pilot receives authorization just a few minutes after filing the request.

Weather Assessment

Weather is another important aspect of remote pilot certification and operating drones in general. Pilots must understand how atmospheric conditions affect the performance of aircraft, basic weather principles, and how to read standard weather reports.

Flying in dense air is ideal, because as the density of the air increases, aircraft performance increases. Conversely, as air density decreases, so does aircraft performance. If temperature increases, humidity increases, or air pressure decreases, the air becomes less dense and aircraft performance decreases.

Wind obviously affects the flight of an aircraft, but wind shear, a sudden, drastic change in wind speed and/or direction over a very small area, is especially hazardous. Low-level wind shear is commonly attributed to passing frontal systems, thunderstorms, temperature inversions, and strong upper level winds. Wind shear often occurs rapidly and without notice, and pilots should always be aware of the possibility of wind shear, especially when flying near thunderstorms and frontal systems.

In fact, flying a drone where there is a possibility of a thunderstorm is highly discouraged, even if current weather conditions are amenable to flying. Thunderstorms can form rapidly and can

damage UAS or create safety hazards due to turbulent winds, hailstones, tornadoes, lightning, and large quantities of rain, all of which can be byproducts of thunderstorms.


In meteorology and aviation, there are standard coded weather reports and forecasts that are issued. A Meteorological Aerodrome Report (METAR) is a report of current weather conditions and a Terminal Area Forecast (TAF) is a forecast of weather conditions up to 30 hours in the future. Remote pilots must know how to read and interpret METAR and TAF, and they can expect a few questions on these topics on the remote pilot certification exam.

Emergency Procedures

The remote pilot in command is responsible for the safe operation of the unmanned aircraft at all times. Prior to each takeoff, the pilot must:

- inspect the aircraft to confirm it is airworthy and in safe operating condition,
- brief all people associated with the mission on the purpose of the flight and any emergency procedures, and
- review the flight area to ensure there are no hazards to people or property.

If there is an emergency during the flight, the pilot may take any action to avoid hazards to people or property and is permitted to deviate from any Part 107 rules to respond to the emergency. The following table is a convenient guide for responding to various emergencies.

Emergency Procedures Checklist DARTDRONES 		
Fly Away	Loss of GPS	Battery Low
MAINTAIN visual contact with aircraft CONTACT ATC via two way radio (as required) VERIFY remote controller is powered on TOGGLE mode switch to middle or lower position IF UNABLE TO REESTABLISH LINK: CONTINUE to maintain visual of aircraft UPDATE ATC with aircraft position (as required)	<i>If GPS signal is lost in flight, "Return to Home and Intelligent Flight Mode will not be functional"</i> IF UA IS FLYING ERRATICALLY BUT STILL LINKED SWITCH to "A" or "ATTI" Mode to disable GPS CONTINUE flight without GPS PILOT the UA to a safe landing area aircraft PERFORM a manual landing and shutdown	MAINTAIN visual contact with aircraft IMMEDIATELY return aircraft to you for landing IF DISORIENTED: USE "Home Lock" to bring aircraft back for landing IF STRONG WINDS PREVENT RETURN FLIGHT: USE camera to locate suitable divert location LAND aircraft
Battery Fire	Lost Link	Collision
EXECUTE flight termination procedures ATTEMPT to extinguish the fire ONCE EXTINGUISHED: USE non-alcoholic liquid to continue to cool IF UNABLE TO EXTINGUISH: CALL 911	MAINTAIN visual contact with aircraft VERIFY remote controller is powered on MOVE toward aircraft if possible IF UNABLE TO REESTABLISH LINK: CONTINUE to maintain visual of aircraft UPDATE ATC with aircraft position (as required)	IMMEDIATELY release all control sticks IF AIRCRAFT REGAINS STABILITY AND HOVERS: MANEUVER aircraft away from object RETURN for a safe landing and aircraft inspection IF AIRCRAFT DOES NOT REGAIN STABILITY: INITIATE manual motor shutdown to reduce speed of impact and protect people and property

Understanding Aviation Communications

Although UAS pilots are not required to communicate with other pilots over radio frequencies, it is helpful to understand "aviation language". Using a radio while operating a drone can

enhance situational awareness when operating, especially if the pilot has authorization to fly in controlled airspace. Furthermore, the remote pilot certification exam includes questions on communications. Remote pilots are required to know the phonetic alphabet, manned aircraft traffic patterns, and radio procedures.

Risk Assessment and Management

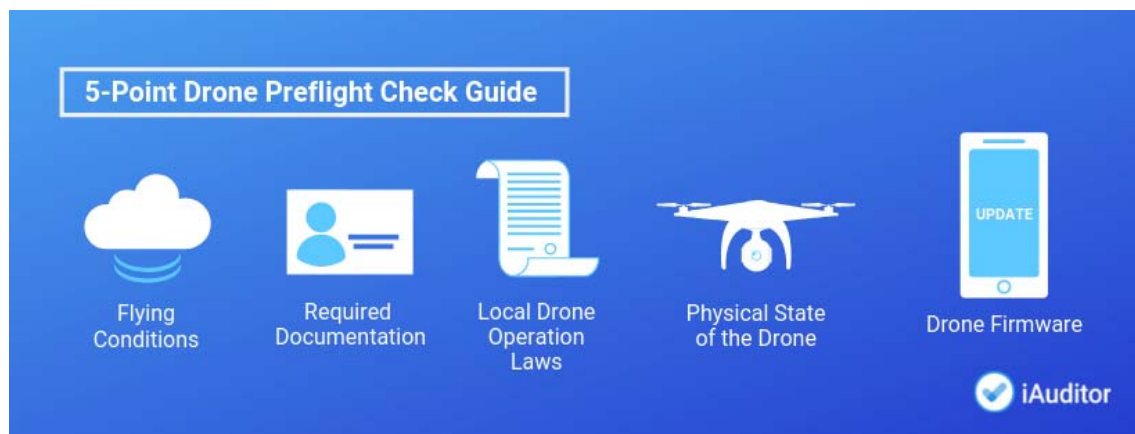
Before each UAS mission, the remote pilot must perform a risk assessment by reviewing all mission parameters, flight hazards, potential safety issues, and hazard mitigation actions. The FAA has developed the PAVE checklist to mitigate risk. The checklist divides flight risks into four categories: **p**ilot in command, **a**ircraft, **e**nvironment, and **e**xternal pressures (PAVE).

- Pilot in command – The pilot must ask themselves, “Am I ready for this flight?” by reflecting on physical and emotional state, experience, and when their last flight occurred.
- Aircraft – Did the aircraft pass the pilot’s inspection? Is it the right aircraft for this flight? Is the pilot familiar with this aircraft and its controls?
- Environment – Pilots must evaluate current and forecasted weather, the terrain, and any potential hazards such as trees or utility lines.
- External pressures – External pressures are influences that create a sense of pressure to complete a flight. Examples include a pilot’s desire to impress someone or a project manager urging a flight to be completed due to a deadline.

Once the risks are identified, the pilot must decide whether the risk(s) can be managed. If not, the flight must be cancelled. If the risk(s) can be managed, the pilot must develop strategies to mitigate the risk(s).

Preflight Checklists

A preflight checklist is a best practice that helps ensure safe and legal operation of drones. The following is a checklist that can be used as a guide before each flight.



- Flying conditions – Check temperature, precipitation, wind, and visibility. Never fly

within restricted areas, near emergency response efforts, or over moving traffic or directly over people.

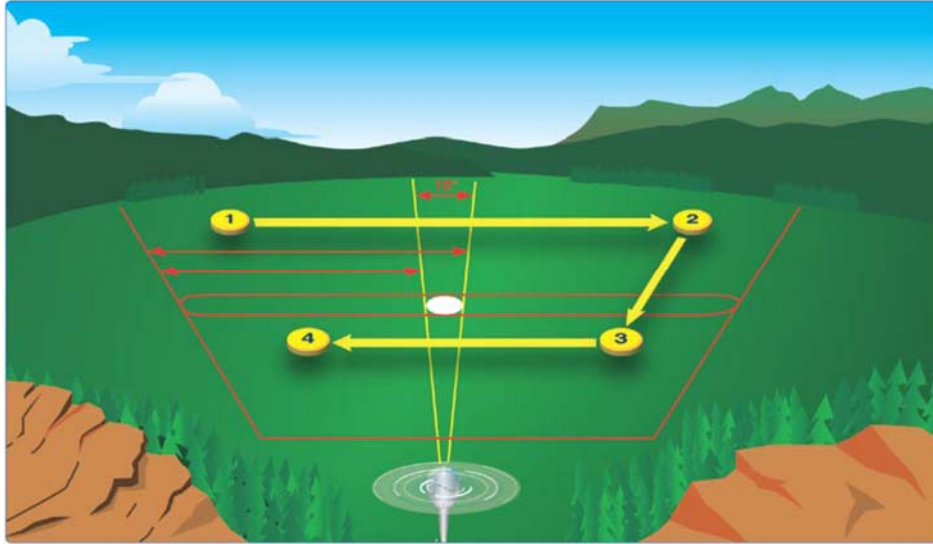
- Required documentation – The pilot should have their remote pilot license on hand, and it is a good idea to carry any additional paperwork such as insurance policies, permits, approvals, etc. If flying in controlled airspace authorization is required.
- Local drone operation laws – Pilots should research local laws related to drones prior to flying. A good overview of state laws is provided at <https://uavcoach.com/drone-laws/>.
- Physical state of the drone – As discussed previously, the pilot must inspect the aircraft to ensure airworthiness. Luckily, most drone manufacturers include a preflight checklist for inspections. Also, the UAS crew should charge the UAS batteries, ensure the memory cards have enough free space, and confirm camera settings.
- Drone firmware – In order for the UAS to operate, all firmware must be up-to-date, and the drone may need to be calibrated.

Visual Observer

While Part 107 regulations do not require a visual observer (VO), it is a good practice to have one to assist the pilot during flights. The main reason to use a VO is for greater situational awareness during a flight. While the pilot needs to look back and forth from a screen, to the sky, to his or her hands, the VO can maintain a line of sight with the drone at all times, ensuring that even in those micro-moments where the pilot has to look away the drone is still flying safely.

The VO can also scan the air around the drone to anticipate any potential problems. The FAA has guidance on the best scanning techniques, which are reproduced below.

To scan effectively, look from right to left or left to right. Begin scanning at the greatest distance an object can be perceived (top) and move inward toward the position of the aircraft (bottom). For each stop, an area approximately 30° wide should be scanned. The duration of each stop is based on the degree of detail that is required, but no stop should last longer than 2 to 3 seconds. When moving from one viewing point to the next, overlap the previous field of view by 10°.



5. Regulations

Before flying, it is crucial to know the rules for operating a drone. This section gives a brief overview of U.S. and European regulations for flying drones. A useful link for drone laws in particular countries is <https://uavcoach.com/drone-laws/>.

United States Regulations

There are three different sets of rules drone operators can fly under in the United States:

- Recreational, or hobbyist, rules for people flying drones for fun (which is not discussed in this white paper)
- Commercial rules for those utilizing drones for business purposes
- Public aircraft operations to perform governmental functions

Commercial Rules—Flying for Work

To fly a drone for commercial purposes in the U.S., one must obtain a Remote Pilot Certificate from the FAA. Here are the requirements for obtaining a certificate:

- The remote pilot must be able to read, speak, write, and understand English (exceptions may be made if the person is unable to meet one of these requirements for a medical reason, such as hearing impairment).
- The remote pilot must be in a physical and mental condition to safely operate a small UAS.
- The remote pilot must be at least 16 years old.
- The remote pilot must pass an Aeronautical Knowledge Test—also known as the Part 107 test—at an FAA-approved knowledge testing center.
- The remote pilot must undergo Transportation Safety Administration (TSA) security screening.

Once a person obtains their Remote Pilot Certificate, they may fly drones commercially. The following is a sample of rules which apply to flying drones for commercial purposes.

- The UAS must be registered with the FAA on the [FAADroneZone website](#).
- The UAS must weigh less than 55 pounds, including payload, at takeoff.
- The UAS must be flown in Class G airspace, unless the commercial operation applies for, and obtains, a special airspace authorization from the FAA.
- The UAS must remain within visual line-of-sight.*
- The aircraft must remain at or below 400 feet above ground level, or within 400 feet of a structure.*
- The operator must only fly during daylight or civil twilight.*
- The aircraft must fly at or under 100 mph.*
- The operator must yield right of way to manned aircraft.*
- The operator cannot fly directly over people.*
- The operator cannot fly from a moving vehicle, unless in a sparsely populated area.*

*Excluding the weight requirement and the requirement to fly in Class G airspace, the above restrictions can be waived if the person submits and receives a Part 107 waiver from the FAA. More information on Part 107 waivers can be found at https://www.faa.gov/uas/commercial_operators/part_107_waivers/.

Public Aircraft Operations

Government agencies (including Federal, State, and tribal), law enforcement, and public safety entities have two options for operating drones under 55 pounds.

- Fly under 14 CFR part 107, the small UAS rule. Part 107 allows operations of drones or unmanned aircraft system (UAS) under 55 pounds at or below 400 feet above ground level (AGL) for visual line-of-sight operations only.
- Fly under the statutory requirements for public aircraft (49 U.S.C. §40102(a) and § 40125). Operate with a Certificate of Waiver or Authorization (COA) to be able to self-certify UAS and operators for flights performing governmental functions.

If an agency is having trouble determining how they should operate drones, they can use the FAA's User Identification Tool, located at https://www.faa.gov/uas/getting_started/user_identification_tool/.

Right of Way and Privacy Concerns

In the United States, the FAA has primary authority over aviation safety, use of navigable airspace and air traffic control. However, state and local governments retain control over land use, zoning, privacy, and law enforcement operations, which are generally not subject to federal regulation. The increased use of drones has uncovered potential conflicts and confusion with these two separate entities presiding over different regulations that affect UAS operations. There is little legal precedent established, and there are many questions that are

not addressed by current laws. One of the most important questions is “How much airspace does a property owner own above their right of way?”

It is clear that it is an invasion of privacy to fly a drone ten feet over a person’s property to look inside their house. But it is unclear where the invasion of privacy ends – 50 feet, 100 feet, or higher? A bill introduced in Congress in October 2019 would redefine the NAS by excluding 200 feet above any given property from FAA regulation. In other words, the “Drone Integration and Zoning Act of 2019” would give localities and private property owners the authority of 200 feet of airspace over their right of way.

The proposed bill would essentially prohibit any commercial or recreational drone operators from using 200 feet above a property without receiving consent from the property owner. The bill would also grant local authorities control over the establishment of unmanned aircraft takeoff and landing zones within their jurisdictions. The bill can be accessed at <https://www.lee.senate.gov/public/index.cfm/2019/10/sen-lee-introduces-drone-integration-and-zoning-act>.

The Drone Integration and Zoning Act of 2019 creates an interesting opportunity for IBTTA members. If toll agencies are able to regulate the airspace 200 feet above their infrastructure, they may be able to charge tolls for use of that airspace. Furthermore, could the agencies establish UAS takeoff and landing zones and charge tolls for their use? IBTTA must keep abreast of this bill and other opportunities to monetize the airspace above tolled infrastructure.

European Union Regulations

On June 11, 2019 common European rules on drones, Commission Delegated Regulation (EU) 2019/945 & Commission Implementing Regulation (EU) 2019/947, have been published to ensure drone operations across Europe are safe and secure. The rules will help to protect the safety and the privacy of EU citizens while enabling the free circulation of drones and a level playing field within the European Union. This section is a summary, and more information on the rules can be found at <https://dronerules.eu/en/>.

The new rules include technical, as well as, operational requirements for drones. The rules define the capabilities a drone must have to be flown safely. For instance, new drones will have to be individually identifiable, allowing the authorities to trace a particular drone if necessary. This will help to better prevent events similar to the ones, which happened in 2018 at Gatwick and Heathrow airports, where hundreds of flights were cancelled following reports of drone sightings close to the runway. The reports caused major disruption, affecting approximately 140,000 passengers and 1,000 flights.⁵

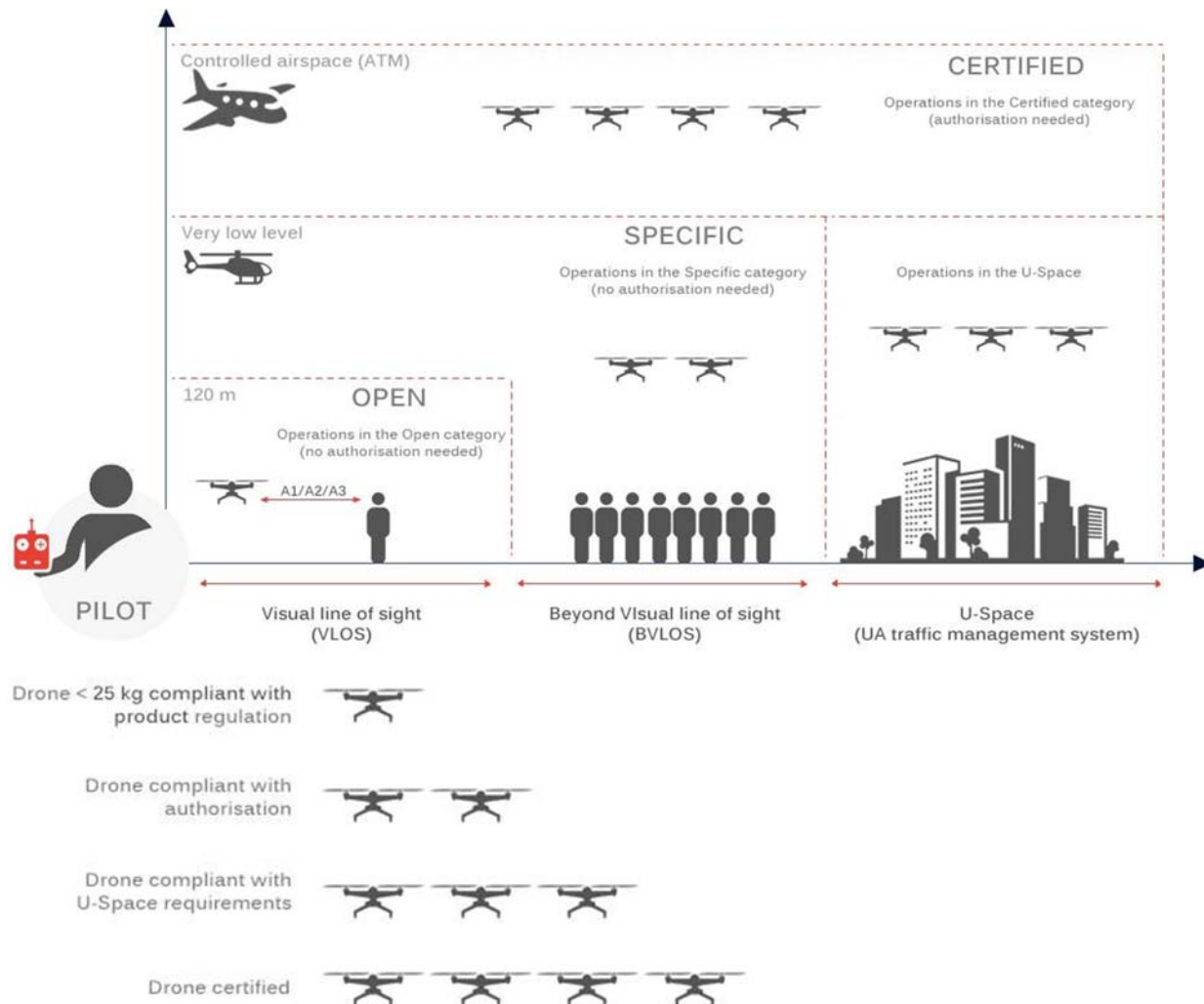
On the other hand, the new framework will introduce three categories of operations (open, specific and certified) according to the level of risks involved. A different regulatory approach will be adopted for each category.

- Low-risk operations (“open” category) will not require any authorization but will be subject to strict operational limitations.

⁵ https://en.wikipedia.org/wiki/Gatwick_Airport_drone_incident

- Medium risk operations, operators will have to require an authorization from the national aviation authority based on a standardized risk assessment or a specific scenario (specific category).
- High-risk operations, classical aviation rules will apply (certified category).

These new rules will replace existing national rules in EU Member States.



Open category

Operations in the open category do not require prior authorizations or pilot license. However, they are limited to operations: in visual line of sight (VLOS), below 120 m altitude and performed with a privately built drone or a drone compliant with the technical requirements defined in the regulation. To demonstrate this compliance drones that can be operated in the open category will bear a class identification label. Additional operational restrictions apply to each class of drone, in particular with regard to the distance that must be maintained between the drone and non-involved persons.

The following table provides a summary of the operations authorized in the open category for each class of drones as defined currently by EASA opinion 01/2018.

UAS		Operation			Operator/pilot	
Class	MTOM	Subcategory	Operational restrictions	Distance from people	Operator Registration Required	Remote pilot competence
Privately built	< 250 g	A1		You can fly over uninvolved people (not over crowds)	No	Read owner manual
C0						
C1	< 900 g					
C2	< 4 kg	A2	<ul style="list-style-type: none">▪Operate in visual line of sight below 120 m altitude▪Fly away from airports▪Respect specific rules defined by the zone in which you operate	You can fly at a safe distance from uninvolved people	Yes	<ul style="list-style-type: none">▪Read owner manual▪Perform online training▪Pass online test▪Pass a theoretical test in a centre recognised by the aviation authority (only if you intend to fly close to non involved people)
C3	< 25 kg	A3		You should: <ul style="list-style-type: none">▪ Fly in an area where it is reasonably expected that no uninvolved people will be endangered▪ Keep a safety distance from urban areas		<ul style="list-style-type: none">▪ Read owner manual▪ Perform online training▪ Pass an online test
C4 (model aircraft)						
Privately built						

Specific Category

When the intended operation exceeds the restrictions of the “open” category, the operator should consider operating under the “specific” category (medium risk). Only high-risk operations require compliance to classical aviation rules under the “certified” category (like operating in controlled airspace). Operations involving drones of more than 25 kg and/or operated beyond visual line of sight will typically fall under the “specific” category.

Before starting an operation in the specific category, operators must either perform a risk assessment and define mitigation measures or verify that they comply with a specific scenario defined by EASA (or the national aviation authority). On that basis they will be able to obtain an authorization from the national aviation authority (in some cases a simple declaration may be enough). The authorization or the specific scenario will define the authorized operation and the applicable mitigation measures (drone technical requirements, pilot competence, etc.).

Certified Category

The “certified” category (high risk) includes operations involving large drones in controlled airspaces. Rules applicable to the “certified” category will be the same as for manned aviation: drones must be certified for their airworthiness, pilots shall be licensed, and safety oversight will be performed by the relevant National Aviation Authorities and EASA.

EASA is currently working on the necessary amendments of existing regulations in order to accommodate drones.

U-Space

In recent years, the need for traffic management focused on unmanned aircraft systems (UAS) emerged in many parts of the world. This UAS traffic management system (UTM) would ensure safe operation of a large number of drones at low-altitude (especially in urban areas). As traditional air traffic management (ATM) ensures the safety of aircraft operations at high altitude, so does UTM at a lower altitude. The Commission mandated the “SESAR Joint Undertaking” to lead the development of a UTM concept for Europe, called U-Space. A blueprint was released in June 2017 with a preliminary vision for the U-space. It consists of a set of services enabling complex drone operations in all types of operational environments.

Transition period for the new EU regulations

While the EU regulation entered into force in June 2019, it will be applicable in one year, to give Member States and operators time to prepare and implement it. As of June 2020, operators of drones will need to register in the Member State where they have their residence or their main place of business.⁶

The applicability will be gradual according to a timeline that can be consulted on the EASA (European Union Aviation Safety Agency) drone page:

<https://www.easa.europa.eu/easa-and-you/civil-drones-rpas>

The rules will apply to all operators of drones – both professionals and those flying drones for leisure.

Finally, Member States will be able to define so-called "no-fly zones" where – through satellite geo-location – drones will not be allowed to enter. "No-fly zones" may include airports and airfields or city centers.⁷

6. Program Administration

While it is evident UAS can be used to save time, reduce costs, and enhance safety, a significant effort is required to create and operate, or administer, an agency UAS program. It could be argued that the “behind the scenes” work requires more time than actual flight time. This section offers some considerations when running a UAS program.

Staffing

One of the first steps in administering a program is to decide who will be flying and operating the drone. The agency may decide to outsource/contract all UAS services or fly the drone using in-house staffing and equipment. The table below shows some pros and cons of each approach.

⁶ <https://www.easa.europa.eu/newsroom-and-events/news/eu-wide-rules-drones-published>

⁷ https://ec.europa.eu/transport/modes/air/news/2019-05-24-rules-operating-drones_en

UAS Services	Pros	Cons
In-house	<ul style="list-style-type: none"> Using internal labor to fly and maintain the UAS is generally cheaper than contracting services More flexibility performing UAS operations 	<ul style="list-style-type: none"> Unless the agency has full-time staff dedicated to the program, the people working on the program will have other priorities Staff will need to be trained in operating equipment and regulations
Contracted	<ul style="list-style-type: none"> No need to dedicate time maintaining equipment, which can be more time consuming than flying the drone Vendors can provide more specialized services (e.g., bridge inspections) 	<ul style="list-style-type: none"> More expensive than using in-house staff

Generally, agencies will want to use a mix of contracted and in-house drone operations to accomplish their goals and objectives for a UAS program. At a minimum, an individual or group should be assigned as the “go-to” UAS resource within the organization to ensure that the program is up to date on the constant evolution of drone regulations, applications, and products.

Right of Way Infringement

Negative public perception has the ability to shut down a program, so it is crucial for agencies to know where their right of way ends, and private property begins. Always locate ground operation within the agency right of way. If it is necessary to operate from private property, it is recommended the agency obtain written permission from the property owner before the flight occurs.

While current U.S. regulations do not address flying drones over private property, try to fly within the boundaries of the organization’s right of way as much as possible. Even if it may be legal, flying over residential areas can quickly turn into a public relations dilemma.

Flight Planning

Proper planning before performing a UAS operation is key to saving time, reducing risk, and controlling drone activities.

A pre-flight planning meeting should be held with the project manager, or person who is requesting the use of the drone, and everyone on the UAS operation team who will be on-site during the flight. This meeting will allow the project manager to explain the purpose of the operation, so the information needed is captured and repeat flights are not required. Specifically, the pre-flight planning meeting should be a working session to create a detailed

plan of activities, which will become an operating document for the UAS flight. Some things to consider for the pre-flight plan meeting are:

- Purpose, goals, and objectives of the flight
- Approximate start time of flight
- Names and contact information of flight personnel
- A description of the flight activity, including maps or diagrams of the area over which operations will be conducted and the altitudes essential to accomplish the operation
- List of potential obstacles or hazards for the flight
- Location of structures that have potential to be hazardous
- Communication plan for all participants
- Other information that may be considered useful

If possible, the planning meeting should include a site visit in order to view any obstacles and locate an area where the pilot and other team members can safely operate the drone. At a minimum, review aerial imagery to locate these limitations and safe areas. To add an additional layer of safety to the operation, consider using a visual observer to keep an eye on the drone, look out for any other air traffic, and provide situational awareness to the pilot.

In addition to holding a pre-flight planning meeting, it is a good idea to have an approval or check-in/check-out process for each operation. This will help keep track of the drone and an approval will ensure the UAS is being used for worthwhile causes.

Insurance

Another decision agencies need to make is regarding insurance. Some agencies decide to self-insure, where they do not take out any third-party insurance for operating UAS. As such, the agency chooses to bear the risk of paying any claims. If the drone crashes and becomes inoperable, the agency must purchase a new one out of pocket. In addition, the agency will be responsible for any litigation costs, if an injury occurs and the agency is sued.

Most UAS insurance policies are reasonably priced and covers damage and liability costs (to a certain extent) if a drone is lost or an accident occurs. Different types of UAS coverage are:

- Liability – This is the base insurance that is included with any policy.
- Hull – Hull coverage covers the value of the aircraft in case any damage occurs.
- Payload – Payload coverage accounts for cameras or sensors in the event of an accident. This type of coverage is designed for more expensive payloads.
- Ground equipment – Ground equipment covers any equipment on the ground that is associated with the UAS. This includes remote controllers, laptops, tablets, ground stations, etc.

If the agency has private consultants, contractors, and other third parties flying drones for projects or as a service to your organization, it is recommended to require the third parties to

have their own UAS insurance policy. In addition, consider requiring their insurance policy to name the agency and its agents as additionally insured.

7. Research and Development (R&D) Projects

With the dramatic rise in popularity of UAS, there are several national and international research and development projects taking place to further the advancement of this technology. The following paragraphs provide a brief overview of some major R&D projects that are being funded by public institutions, and which may be relevant to the transportation sector.

US Projects/Program

UAS Integration Pilot Program⁸

In 2018, the FAA entered into agreements with nine different teams as part of the UAS Integration Pilot Program. The fundamental purpose of the program is to provide an opportunity for stakeholders to identify and propose a broad spectrum of innovative and beneficial concepts of operations, and models of local management, for UAS operations subject to FAA oversight. The teams are evaluating various operational concepts, such as night operations, flights over people and beyond the pilot's line of sight, package delivery, detect-and-avoid technologies and the reliability and security of data links between pilot and aircraft.

UAS Traffic Management System⁹

Managing UAS traffic is a crucial part of advancing drone technology. In order to fully deploy some UAS applications, such as drone delivery of packages, a widespread traffic management system must be created and implemented. The FAA recognizes the importance of traffic management and has partnered with NASA, other agencies, and industry to collaborate and explore concepts of operation for an Unmanned Aircraft System Traffic Management (UTM) system.

UTM will be an ecosystem for uncontrolled operations that is separate from, but complementary to, the FAA's Air Traffic Management (ATM) system. The UTM project will focus on concept and use case development, data exchange and information architecture, communications and navigation, and sense and avoid in order to manage low-altitude uncontrolled drone operations, including beyond visual line-of-sight flights.

UAS Center of Excellence/Alliance for System Safety of UAS through Research Excellence¹⁰

The FAA has established Centers of Excellence (COE) in individual mission-critical subject areas. One such COE is the Alliance for System Safety of UAS through Research Excellence (ASSURE), which is comprised of 23 of the world's leading research institutions and over 100

⁸ https://www.faa.gov/uas/programs_partnerships/integration_pilot_program/

⁹ https://www.faa.gov/uas/research_development/traffic_management/

¹⁰ <http://www.assureuas.org/>

leading industry/government partners. ASSURE's mission is to provide the FAA the research they need to quickly, safely and efficiently integrate unmanned aerial systems into the National Airspace System with minimal changes to the current system. Their research includes a broad spectrum of areas including:

- Air traffic control interoperability
- UAS airport ground operations
- Control and communications
- Detect and avoid
- Human factors
- UAS noise reduction
- UAS wake turbulence signatures
- Unmanned aircraft pilot training and certification
- Low altitude operations safety
- Spectrum management
- UAS traffic management

EU Projects/Program

In Europe, the main publicly funded R&D initiative is the Horizon 2020 R&D program. This program began in 2014 and will end in 2020. Horizon 2020 was the biggest EU Research and Innovation program ever with nearly €80 billion of funding available over 7 years (2014 to 2020). It promised more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.¹¹

Horizon Europe is a planned 7-year European Union scientific research initiative meant to succeed the current Horizon 2020 program. The European Commission drafted and approved a plan for the Horizon Europe to raise EU science spending levels by 50% over the years 2021-2027. As of April 2019, the Commission proposes €94.1 billion for Horizon Europe – due to launch in 2021 – up from €77 billion for the current Horizon 2020.¹²

All new initiatives funded under the Horizon 2020 program regarding drones are under the umbrella of the Single European Sky ATM Research (SESAR) platform. The SESAR project was launched in 2004 as the technological pillar of the Single European Sky (SES). Its role is to define, develop and deploy what is needed to increase ATM performance and build Europe's intelligent air transport system.

Established in 2007 as a public-private partnership, the SESAR Joint Undertaking (SESAR JU) is responsible for the modernization of the European air traffic management system by coordinating and concentrating all ATM relevant research and innovation efforts in the EU. From 2014 to 2018, following is a list of all R&D projects funded by Horizon 2020, related to drones adoption and usage, within the transportation environment.

¹¹ <https://ec.europa.eu/programmes/horizon2020/what-horizon-2020>

¹² https://ec.europa.eu/info/designing-next-research-and-innovation-framework-programme/what-shapes-next-framework-programme_en

Title of the Project	Acronym Description	Year	Link	Topic
FireSpec	Integrated spectroscopic sensors for the risk assessment of fires	2015	https://cordis.europa.eu/project/rcn/199218/factsheet/en	Safety and Security
MoNIfly	Mobile-Network Infrastructure for Cooperative Surveillance of low flying drones	2017	https://cordis.europa.eu/project/rcn/209481/factsheet/en	Traffic Management
IMPETUS	Information Management Portal to Enable the integration of Unmanned Systems	2017	https://cordis.europa.eu/project/rcn/210371/factsheet/en	Safety & Security
KNOX	Cost advantageous and scalable drone alarm and protection system for urban contexts	2017	https://cordis.europa.eu/project/rcn/211671/factsheet/en	Safety & Security
OCENTSOLAR	Optimal Control of Thermal Solar Energy Systems	2018	https://cordis.europa.eu/project/rcn/216250/factsheet/en	Traffic Management

In the last couple years (2018-2020) of the program, the Horizon 2020 program is funding R&D Projects about drones, which are mainly focused on the following topics:

- Airworthiness of mass-market drones
- Innovative applications of drones for ensuring safety in transport

8. Conclusion and Recommendations

This white paper provides a starting point for agencies seeking to establish a UAS program. The following is a list of key recommendations and takeaways readers can use to help start their program.

- Create a Concept of Operations document to help guide the creation of the UAS program and record the decision-making process.
- Determine use cases before procuring equipment and technology. The technology should not dictate the use cases.
- Evaluate who will be operating the drone, whether all operations will be outsourced, performed in-house, or a mixture of both.
- Assign an individual or group to ensure the agency remains up-to-date with the constant evolution of drone regulations, applications, and products.
- Negative public perception can shut down a UAS program, so operate the aircraft within the right of way. If operating from private property is necessary, obtain written permission from the property owner.
- Prior to each UAS operation hold a meeting with the project manager and UAS team to review information and prepare for the flight.

- Consider drone insurance. Most policies are reasonably priced. If a consultant, contractor, or other third party is performing UAS services for an agency, the agency should require the third party to carry insurance and name the agency on the policy as additionally insured.

In addition to the recommendations for individual agencies, there are recommendations for IBTTA:

- Remain informed about the Drone Integration and Zoning Act of 2019 and other opportunities to monetize airspace above tolled infrastructure.
- Stay up-to-date on UAS technology and inform IBTTA members of advances in the technology.
- Consider organizing a demonstration at an Operations and Maintenance Workshop by inviting drone vendors to exhibit and demo their products.

9. Appendix A: Quick Guide

General Information

- [The Wire Guide to Drones](#)
- Wikipedia has a comprehensive entry on Unmanned Aerial Vehicles, located [here](#).

Building a UAS Program

- The National Cooperative Highway Research Program (NCHRP) commissioned a report, "[Successful Approaches for the Use of Unmanned Aerial System by Surface Transportation Agencies](#)," to provide recommendations in seven topic areas to consider when getting started using UAS.
- The Federal Highway Administration hosted a peer exchange to discuss the state of the practice, along with possible future uses of UAS. The paper, entitled "[Use of Unmanned Aerial Systems \(UAS\) by State DOTs](#)," also discusses lessons learned when beginning a UAS program.

Equipment and Technology

- UAV Coach routinely updates their list of top professional drones on their website, [here](#).
- [PC Magazine](#) has a yearly roundup of best drones.

Regulations

- For information on drone laws in the U.S., see [this page on the Federal Aviation Administration \(FAA\) website](#).
- For an overview on European drone laws, see the European Union Aviation Safety Agency's [website](#) on civil drones (unmanned aircraft).

10. Appendix B: Further Reading on Use Cases

For more information on the use cases discussed in the white paper, refer to the following table for reports and studies.

Institution	Project Title	Year	Link	Topic
NCHRP	Successful Approaches for the Use of Unmanned Aerial Systems by Surface Transportation Agencies	2018	http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-68A_17-01.pdf	Drone Use cases
Florida DOT	Proof of Concept for Using Unmanned Aerial Vehicles for High Mast Pole and Bridge Inspections	2015	http://www.fdot.gov/research/Completed_Proj/Summary_MNT/FDOT-BDV28-977-02-rpt.pdf	Drone Use cases

Institution	Project Title	Year	Link	Topic
Idaho DOT	Fatigue Crack Detection Using Unmanned Aerial Systems in Under-Bridge Inspection	2017	http://apps.itd.idaho.gov/apps/research/Completed/RP256.pdf	Bridge Inspection
Michigan DOT	Evaluating the Use of Unmanned Aerial Vehicles for Transportation Purposes	2015	https://www.michigan.gov/mdot/0,4616,7-151-9622_11045_24249-353767--,00.html	Drone Use cases
Minnesota DOT	Unmanned Aerial Vehicle Bridge Inspection Demonstration Project Phase 1	2015	http://www.dot.state.mn.us/research/TS/2015/201540.pdf	Bridge Inspection
Minnesota DOT	Unmanned Aerial Vehicle Bridge Inspection Demonstration Project Phase 2	2017	http://dot.state.mn.us/research/reports/2017/201718.pdf	Bridge Inspection
Minnesota DOT	Unmanned Aerial Vehicles Enable Safe and Cost-Effective Bridge Inspection	2015	http://www.dot.state.mn.us/research/TS/2015/201540TS.pdf	Bridge Inspection
Missouri DOT	Unmanned Aircraft Systems: An Overview of Strategies and Opportunities for Missouri	2018	https://library.modot.mo.gov/RDT/reports/TR201808/cmr18-009.pdf	Drone Use Cases
New York DOT	Exploring Applications for Unmanned Aerial Systems for Transportation Related Operations	2017	https://www.fhwa.dot.gov/exist.cfm?link=http://www.utrc2.org/sites/default/files/Final-Report-Exploring-Applications-Unmanned-Aerial-Systems.pdf	Drone Use Cases
Oregon DOT	Driving Distraction Due to Drones	2018	https://www.oregon.gov/ODOT/Programs/Research/Documents/Driving_Distraction_due_to_Drones.pdf	Road Safety
Vermont DOT	Unmanned Aerial Systems for Transportation Decision Support	2017	http://vtrans.vermont.gov/sites/aot/files/planning/documents/planning/UAS_for_Transportation_Fact_Sheet.pdf	Drone Use Cases

Institution	Project Title	Year	Link	Topic
Vermont DOT	Using Remote Data Collection to Identify Bridges and Culverts Susceptible to Blockage During Flooding Events	2016	https://www.fhwa.dot.gov/exit.cfm?link=http://www.uvm.edu/~transctr/research/trc_reports/UVM-TRC-16-003.pdf	Drone Use Cases
North Carolina DOT	Collision Scene Reconstruction & Investigation Using Unmanned Aircraft Systems	2017	https://www.ncdot.gov/divisions/aviation/Documents/ncshp-uas-mapping-study.pdf	Crash Reconstruction
U.S. Federal Highway Administration	Use of Small Unmanned Aerial Systems for Emergency Management of Flooding	2019	https://www.fhwa.dot.gov/uas/resources/hif19019.pdf	Emergency Management
Maryland Transportation Authority Police	Unmanned Aircraft System Program	2019	https://www.facebook.com/TheMDTA/videos/1972218046131705/?v=1972218046131705	Crash Reconstruction



White Paper

Strategies for Innovation and Technology

*A Roadmap to Establishing Innovation Practices, Engaging Technologies,
and Preparing for The Future of Mobility*

November 27, 2019

Abstract

Our transportation paradigm is rapidly shifting, fueled by the need for capacity, innovation and emerging technology. A comprehensive understanding of the challenges facing the toll industry and the strategies for addressing them is necessary to develop an integrated mobility ecosystem. This paper provides an overview of the changing mobility landscape, the drivers of innovation, and strategies for furthering innovation and rapid technological advancements. Organizations can meet future challenges by growing organizational capacity for innovation and advancing regional collaboration in the planning, deployment, and operation of innovative solutions. This paper also contains a [“Technology and Innovation Matrix,”](#) which identifies and tracks emerging technology of interest to the toll industry, and which is useful for prioritizing innovations that require the attention of, or additional study by, the International Bridge, Tunnel and Turnpike Association (IBTTA).

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1. Introduction: Innovation Strategies and Technologies

The International Bridge, Tunnel & Turnpike Association (IBTTA) is the worldwide association for the owners and operators of toll facilities and the businesses that serve them. Founded in 1932, IBTTA has members in 26 countries on 6 continents. Through advocacy, thought leadership, and education, IBTTA members are implementing state-of-the-art innovations in user-based transportation solutions that address the critical infrastructure challenges of the twenty-first century.

The IBTTA Emerging Technologies Committee developed this White Paper to provide an overview of the changing mobility landscape, the drivers of innovation, and the challenges posed by rapid technological advancements. This paper identifies two broad strategies for effectively meeting the challenges ahead: **building innovation capacity and advancing regional collaboration/interoperability**. It also includes recommendations on strategies and a process to identify, evaluate, track, and deploy emerging technologies and innovations.

A listing of innovative technologies and systems is provided in the Technology and Innovation Matrix in [Appendix C](#). The purpose of the matrix is to identify and track technologies that are nearing maturity and have the potential to significantly impact, or even disrupt, the toll sector. A summary of recommended strategies on how IBTTA and its member organizations might engage on these topics are provided in the [Next Steps for IBTTA](#) section. In addition, [Appendix E: Useful References](#), provides summaries and links to references that support many of the recommendations provided herein.

1.1. Drivers of Change and the Integrated Mobility Ecosystem

We are living in the Technological Revolution, or the “Fourth Industrial Revolution,” in which disruptive technologies and trends such as the Internet of Things (IoT), robotics, virtual reality (VR), and artificial intelligence (AI) are changing the way we live and work. Transportation-specific innovations such as automated and connected vehicles (CV) will further drive change in the mobility landscape. Consumers demand more interaction from mobility and transportation service providers – they want choices in how they pay for, and how to consolidate, mobility services, but organizations may be unprepared to meet these demands. This section provides a brief overview of some of the major transportation trends anticipated to impact the toll industry in the future.

When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance. – Schwab, 2016¹

¹ Schwab, Klaus. 2016. “The Fourth Industrial Revolution: what it means, how to respond.” *World Economic Forum*, January 14, 2016. <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>

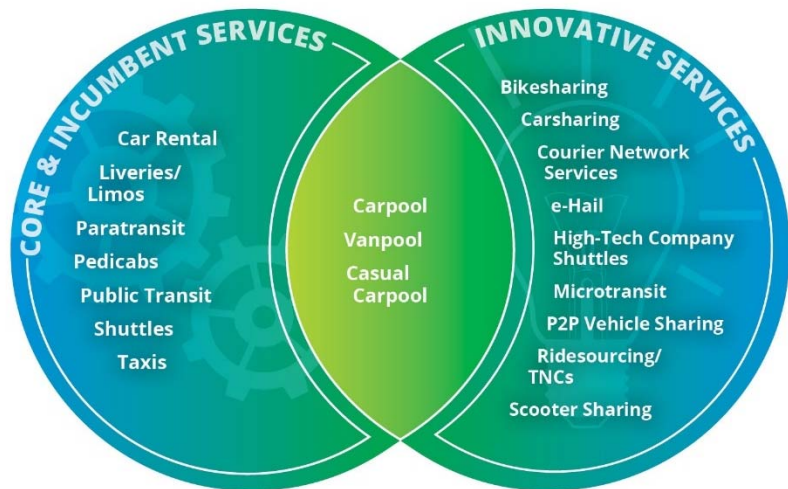
The Connected, Autonomous, Shared, Electric (CASE) concept combines the most prominent mobility trends into a comprehensive future vision, which encompasses vehicle automation, vehicle and infrastructure connectivity, shared vehicles, and fleet electrification. The emergence of this mobility concept will change the way vehicles are owned and operated, could impact the number of vehicle miles traveled, and may also affect road-usage charges collection methods (e.g. toll or per-mile vs. per gallon). The following subsections discuss the manner in which each aspect could change the way we travel and pay for that travel.



- **Connected technologies** enable real-time communications between vehicles and infrastructure, which can be used to transmit safety and travel information (e.g., incidents, congestion, construction zones, weather, and travel times), road maintenance needs (e.g., pothole detection, missing signs), and other system aspects that can be used to improve trip planning and increase the capacity and safety of the transportation ecosystem. These involve sensors, devices, and applications as part of a larger connected environment often referred to as the “*Internet of Things (IoT)*” – all producing evermore data, often referred to as “*Big Data.*” The cybersecurity risk profile for the IoT and data will continue to grow and become more complex. To ensure organizations are positioned to take full advantage of the benefits offered by connected technologies and expansion of the IoT, organizations should make certain that they are well equipped with information technology resources and specifically qualified staff.
- **Automated technologies**, ranging from existing driver-assistance technologies such as adaptive cruise control to more-fully automated systems such as full driver-less vehicles, and more specifically automated vehicle applications, are among the most high-profile emerging innovations. Although vehicles with fully automated capabilities are available, they represent an extremely small share of the overall vehicle market and are very expensive. As technologies improve, costs decline, and a regulatory framework for their development and operation evolves, organizations must decide how to adapt. Fully automated vehicles will fundamentally impact drivers’ interaction with transportation infrastructure. For the toll industry, there is uncertainty as to how autonomous vehicles will be incorporated and accommodated on tolled facilities. It is unknown whether drivers will be willing to pay tolls for quicker, more-reliable travel times if they can perform other tasks while driving.

- **Shared mobility applications**, including car-sharing, ride-hailing, and multimodal single point-of-sale payment options, are penetrating the market at a rapid rate. Users can hail rides for single trips, or “rent” cars for hours or days at a time. Transportation Network Companies (TNC) such as Uber and Lyft enable travelers to access and benefit from the transportation network in a personal vehicle without necessarily having to own one. This has significant implications for long-term infrastructure needs due to potential increases in vehicle miles traveled and increased congestion in urban cores and roadway networks. Mobile applications will continue to evolve into a system that connects all modes of

SHARED MOBILITY SERVICE MODELS



transportation (e.g., roads, bridges, transit, rail, waterways, airports) as customers increasingly expect multimodal transportation. Future applications will provide a full suite of transportation modes offered by numerous organizations and providers that can be booked and paid for by a mobile device. Mobility on Demand (MOD) and Mobility as a Service (MaaS) applications represent an initial step in this development.

- **Electrification** of the vehicle fleet will have significant impacts on infrastructure funding in the United States. Highways are funded predominantly with fuel taxes, which exclude fully electric vehicles. Adoption of this technology is expected to increase as the cost of electric battery systems decline and charging infrastructure becomes more widely available. To the extent that electrification trends continue to impact transportation funding sources, there will be an even more pronounced role for the toll industry in meeting infrastructure needs. An electrified vehicle fleet will require significantly different fueling (charging) infrastructure, and many emerging technologies offer the opportunity to integrate charging infrastructure in new and innovative ways. This paper outlines some of these in the *Technology and Innovation Matrix* found in [Appendix C](#).

Similar to preceding revolutions, the Fourth Revolution has the potential to improve the quality of life for everyone. The toll industry's ability to embrace these drivers of technological change and engage with partners from other public, private, and other industry sectors will position them to advance innovation and improve operations and service delivery to all citizens.

1.2. Innovation in the Toll Industry

The toll industry has undergone transformational changes. In the 1980s, electronic toll technology introduced the ability to charge and pay a toll while on the move. This evolved to all-electronic, open-road tolling, which enabled high-speed toll collection while allowing for a cash payment option via a barrier-separated toll booth, bringing significant improvements to roadway capacity, safety, operational efficiency, and customer service.

In the 1990s, all-electronic tolled managed lanes were introduced with congestion pricing to make better use of existing roadway capacity. This included incentivizing the formation and use of carpools through High Occupancy Vehicle (HOV) discounts. . Some of the first operators of High Occupancy Toll (HOT) Lanes were also transit providers, and the operational intersection of the tolling and transit industries accelerated from there. . In recent years, innovations extended to roadway operations through the delivery of driver-assistance services and intelligent transportation systems that provided traveler information, customer communications, or innovative project delivery.

The next major evolution involved the use of all-electronic and license plate-based tolling, which brought about further operational efficiencies and customer conveniences by allowing the option for infrequent users to receive a toll bill in the mail and then make a payment online, by telephone, in person, or more recently, from an app.

The United States toll industry is now amid an effort to achieve toll interoperability, which began with the passage of Moving Ahead for Progress in the 21st Century Act (MAP 21) in 2012. When MAP 21 is fully achieved in the next few years, it will allow a user's toll account to pay on toll roads anywhere in the United States – again improving customer convenience and extending the toll industry beyond local boundaries into other regions, other states, and throughout the nation.

1.3. An Opportunity for the Toll Industry

With thousands of tolled roadway miles around the world, the toll industry is primed to evaluate the ways in which emerging trends affect personal mobility and take advantage of these innovations that will shape the future user experience. Toll organizations generally have regional/interstate responsibilities and governance, agility in the delivery of infrastructure improvements, innovative culture, use of technology, flexible funding sources, and an established customer base with a commitment to customer service. Case studies on several agencies already leveraging their strategic advantages are discussed in [Appendix D](#) of this white paper.

The toll industry will need to proactively monitor emerging technology and innovations to understand, influence, and prepare for change. Inside and outside the toll industry, more organizations are stepping up their innovation profile by making deep and broad changes in their organizational culture, trailblazing pilots of emerging technologies, considering new business models, and receptive to new methods for the delivery of services. However, as stewards of the transportation system, toll agencies must also be responsible in their pursuits and deliberate in adopting new technologies and innovative approaches. The toll industry

should be on the *leading edge* of innovation, and organizations should carefully consider whether they want to be on the *bleeding edge*. Many organizations have accepted this challenge and blazed the trail for innovation, but there are significant risks.

The toll industry is poised as a potential leader and central to the integrated mobility ecosystem of the future. A 2019 report by KPMG² reinforces this view by noting that “with the right investments, these players could be placing themselves at the center of an integrated mobility platform.”

“Innovation distinguishes between a leader and a follower” – Steve Jobs

2. Building Innovation Capacity

Organizations, both public and private, often have limited capacity to maintain their existing day-to-day processes and technologies, let alone respond to continual evolution in technology markets and implement new services. They are frequently forced to choose between competing priorities. Furthermore, even when resources are available, making the “right investments” is not a clear-cut exercise. Organization decision making is driven by many differing factors, but innovation can be facilitated with the right culture.

The toll industry must build its capacity for innovation to support the integrated mobility ecosystem and associated innovations of the future. This means structuring organizations from the bottom up to innovate. It means stressing innovation as part of day-to-day activities and holding staff accountable for making progress. And it means giving employees the knowledge and resources they require.

“Innovation is a question of mindset, and creating that mindset precedes everything else. In my opinion, it's the innovation mindset that overrides the aspects of human nature that are often holding back innovation in large organizations.” – Björling, 2018³

This section provides recommendations for building innovation capacity within an organization.

2.1. Leadership committing to building innovation capacity

Leaders at all levels of an organization, with their words and actions, must make a visible and ongoing commitment to innovation. This means institutionalizing innovation as a core value and objective in organization strategic planning initiatives. Agencies may consider establishing a Chief Innovation Officer (CIO) with responsibility for maintaining organizational focus on innovation and ensuring the accountability of staff, contractors and executive leadership to the organization’s long-term vision.

² KPMG, 2019. “Toll Benchmarking Study 2019.” <https://home.kpmg/xx/en/home/campaigns/2019/07/toll-benchmarking-study-2019.html>

³ Björling, 2018. Mikael Eriksson, “5 key steps to creating an innovation mindset.” <https://mikaelbjorling.com/2018/05/14/5-key-steps-to-creating-an-innovation-mindset/>

“There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new order of things...Whenever his enemies have the ability to attack the innovator, they do so with the passion or partisanship, while the others defend him sluggishly, so that the innovator and his party alike are vulnerable.” – Niccolò Machiavelli, 1513

Leadership seeks business goals, not technical ones. An iterative and incremental approach should be employed where leadership is regularly informed of progress through the use of status reports, Gantt charts, budget reports, and focus-group study reports. It is critically important to bridge the communication divide by using non-technical language instead of business-jargon and geek-speak.

2.2. Establishing a dedicated innovation team or department

Organizations should identify, establish, and empower an agile innovation team or department consisting of management, subject matter experts, and practitioners both internal and external to the organization. It is vital that this team work collaboratively to lay the foundation for a smooth integration and obtain buy-in from operational teams who may be reluctant to change. Policies, practices, and competing departmental priorities and purposes may require modification to advance new ideas and innovation. Organizations may also have to consider organizational changes, and leadership must have the authority to set priorities, change policies, and establish budgets as required. The organization innovation team/department may be tasked with any number of responsibilities in terms of helping the organization achieve its vision but, at a minimum, organizations should consider the following:

- **Commissioning or supporting research with universities and research institutions** – Partnerships with universities and research institutions allow organizations to access expertise and information they would otherwise not have and to conduct research that informs investment decisions and improves operations. Such institutions can also provide independent validation of technology products and guide decision making while adding credibility and lowering risk to organizational efforts.
- **Participating in technology-focused professional organizations** – Regardless of level of technical maturity, an initial step any organization can take in being more innovative is to simply get involved and get educated. This includes participating in events and activities with other industry professionals, practitioners, vendors, consultants, and contractors. The toll industry's primary professional organizational resource is IBTTA, but other organizations such as the Intelligent Transportation Society of America (ITS America), the American Public Transit Association (APTA), the Transportation Research Board (TRB), the Institution of Transportation Engineers (ITE), and the Association of Unmanned Vehicle Systems (AUVSI) are where beneficial crossover with other industries will occur. Such groups provide insight and access to expertise, capabilities, and interests in industries that may play significant roles in the integrated mobility ecosystem of the future.

- **Tracking and communicating performance** – Organizations should establish key performance indicators for innovation and incorporate those into their regular performance monitoring and management activities. The innovation process works when it is repeatable and complemented with a process for sharing and connecting ideas, building out and testing ideas, and socializing that success far and wide. It is important to articulate value by establishing a set of metrics such as ideas or initiatives generated and implemented, revenue collected/cost savings realized, operational efficiencies realized, or customer sentiment. Innovation departments need to decide what to track, report on it regularly, and promptly resolve potential problems that may result in missed metrics. The validity and applicability of metrics should be periodically reevaluated as priorities, systems, and expectations change over time.
- **Identifying, tracking, and evaluating emerging technologies** – Organizations should stay current on new and emerging technologies that may be relevant to the tolling industry. This requires significant interaction with consultants, vendors, contactors, and industry organizations. A basic emerging technology tracking and evaluation process is outlined for IBTTA in [Appendix B](#) of this paper.

2.3. Developing an organizational staffing and resource plan

Organizations will need to regularly reevaluate their organization and staffing/resource plans and required skill sets. These should be aligned with the organization's adopted strategic plan and should anticipate potential shifts in staffing requirements as various technologies and innovations emerge and become mainstream. The self-assessment provided by the Federal Highway Administration's (FHWA) [Capability Maturity Framework](#) is a good tool to understand and guide the development of an organization's staffing, resource, and technology plans.

At this stage, many toll organizations may not currently have optimal staffing with the requisite expertise and skill sets to implement and operate many technology-based mobility applications. A recent study by Pearson (Bakhshi, H., Downing, J., Osbornem M., and Schneider, P., 2017⁴) indicated a strong need for workers with interpersonal skills, higher-order cognitive skills, and systems skills. Core skills and roles of toll industry personnel in the future are likely to include:

- **Creative problem solving** – The ability to look at problems from different perspectives and determine effective solutions that involve emerging technologies, data use, and regional integration.
- **Data analytics and programming** – The ability to make sense of large amounts of data, as more decisions will be based on data. Software developers and programmers need to network with innovators and cultivate a deep sense of critical thinking and creativity.

⁴ Bakhshi, H., Downing, J., Osbornem, M. and Schneider, P. 2017. The Future of Skills: Employment in 2030. London: Pearson and Nesta. <https://futureskills.pearson.com/research/assets/pdfs/technical-report.pdf>

- **Collaboration** – Making human connections at work. Collaborating with others on significant projects using agile strategies to accomplish goals.
- **Self-awareness and emotional intelligence** – Recognizing and understanding one’s own emotions and having the discipline to control them is the foundation of personal growth and success.
- **Competent and flexible leaders** – Ability to take on many roles to rally and guide the team in the right direction to lead change and evolve technology.

Traditionally, an organization’s executive team was comprised of an Executive Director/Chief Executive Officer (CEO), Chief Financial Officer (CFO), Chief Engineer, Chief Technology Officer (CTO) or Chief Information Officer (CIO). However, as technology and business processes continue to become more intertwined along with the exponential increase in data, the CIO is an increasingly common position in executive organizational structures. CIOs translate business information requirements into technology requirements, ensuring that the right resources are leveraged to meet new demands – they are viewed as critical in everyday operations as well as championing new technology and innovation. Organizations should therefore consider adding a CIO with innovation responsibilities to oversee development and implementation of the organization’s vision for innovation, emerging technology deployment, team building, budgeting, and associated staffing/resource plans.

Reports by McKinsey & Company, “[The Department of Transportation of the Future](#)” (Fuchs, S. and Shehadeh, R., 2017) and the National Cooperative Highway Research Program (NCHRP) “[Guide to Creating and Sustaining a Culture of Innovation for Departments of Transportation](#)” (Lorenz, J., Rotert, D., Link, A., Crossett, J., 2018), are potential references for organizations interested in learning more. [Appendix E](#) contains additional resources for agencies to use when implementing innovative approaches and evaluating potential changes to staffing and internal resources.

2.4. Delivering innovation using an agile program/project management process

The typical “waterfall” system development model is likely to be insufficient as system needs will likely have to be identified “on the fly” and continually revisited. High-functioning agile teams have adapted to this need while adhering to time-honored project management principles. Such processes are lightweight, fast-moving versions of “plan, test, execute, and measure.” A basic Scrum process blends development activity into successive iterations of the deployment process that are adapted based on the lessons learned from the previous iteration. Regardless of the approach pursued, most agencies use a consultant for some aspect of systems development, installation, and systems integration.

2.5. Developing and adopting a new future-ready technology plan

Along with adding new positions and resource plans, organizations should consider developing a technology plan. The plan should anticipate and support IoT, Big Data – data sharing, security and storage, and data analytics within the organization. The technology plan should also consider how the organization interacts externally with regional and private

sector partners. The planning process should begin with a review and assessment of the organization's technology capability that considers current and future needs. The technology plan should include a needs assessment for customers and external and internal stakeholders. The plan should address the potential need for modernizing technology infrastructure and software systems to support the full capabilities of new technologies, and strategies for maintaining a progressive, forward-looking infrastructure. This requires a diligent commitment to projecting evolving needs and keeping systems current over time rather than repeating cycles of lagging schedules, slipping performance, and attempts to catch up.

2.6. Considering iterative, flexible procurement and contracting approaches involving the private sector

In an increasingly information technology (IT) oriented world, the “low-cost bidder” approach to procurement is increasingly likely to result in lower quality service delivery. Agencies need new ways of identifying and prioritizing value but are generally unable to truly evaluate proposers without first becoming smarter themselves. This increases reliance on private vendors, consultants, and other agencies to understand the available range of options before pursuing new innovations.

To obtain the necessary insight, agencies will often host vendor days or issue requests for information (RFI). California, for example, established a new process (“RFI2”) that solicits solutions to public sector challenges from the private sector. The governor’s [Executive Order N-04-19](#) established a new, iterative procurement approach known as the “Innovation Procurement Sprint” process where California government organizations issue problem statements and the private sector responds with innovative approaches to address the problem. This is a shift away from a specifications-based methodology in favor of a two-phased collaborative process.

CV applications, for example, represent a significant departure from the types of systems toll agencies typically procure. Writing specifications for such “new to market” products is therefore a significant challenge. One option is to adopt a procurement process that facilitates dialogue between vendors and the organization and gives the best opportunity to find the ideal partner. Agencies should further aim for flexible contracts that allow emerging technologies to be introduced throughout the life of the contract. Agencies should also consider applying performance-based system specifications as opposed to prescriptive specifications.

A recent U.S. Department of Transportation (USDOT) study⁵ found that agencies implementing “Smart City”⁶ programs typically use one of two approaches:

⁵ U.S. Department of Transportation. 2018. *Connected Vehicle Procurement State of the Practice Assessment: Summary Findings Report (Final)*. Produced by Noblis. Report No. FHWA-JPO-18-703. https://rosap.ntl.bts.gov/view/dot/37173/dot_37173_DS1.pdf?

⁶ The Smart Cities Council defines a smart city as one that “uses information and communications technology (ICT) to enhance its livability, workability and sustainability.”

- **Traditional design, bid, build approach** – Gives the organization more control but requires expertise in CV technologies that organization staff may not have.
- **Design build (operate-transfer) approach** – Uses a single contractor team to design, procure, develop, and install necessary software and equipment. Contractor may operate the system initially before transferring it to the organization and is responsible for managing all technology subcontracts, equipment, and software specifications.

Procurement and deployment models for large-scale CV projects are still under development but there are few lessons learned at this point in their development. Agencies have little-to-no previous experience in procuring CV systems on a large-scale and are testing multiple procurement techniques to determine the optimal approach. Options include sole source contracts, releasing task orders via the standard procurement process, using firms on an Indefinite Delivery, Indefinite Quantity-like (IDIQ) on-call contract, as well as directly procuring CV equipment. This is a common approach for agencies working with universities or other agencies who can procure the required equipment through an intergovernmental contract. In such cases, the organization will generally assume responsibility for installation or utilize an existing contract with the state DOT. Using a state DOT contract for system installation, integration, and maintenance ensures competition from numerous firms that are pre-approved to provide services.

2.7. Implementing data platforms and data sharing hubs

Data platforms and data-sharing hubs not only compile and store data from various sources, but also organize the data for external sharing with the general public, other agencies, or the private sector. These systems make available information and data such as lane status (e.g., open, closed, direct), traffic (e.g., density, instantaneous and average speed, travel time), incidents, weather, toll price, traffic signals, emergency response time, transit, and construction widely available to unleash opportunities by both the public and private sectors. Too often, information and data are siloed and inaccessible to the organization due to constraints and complexity of older technologies and business processes. Modern information technology systems are now more cost effective with the capability to provide seamless access, analysis, and reporting without interfering with day-to-day operations or compromising security.

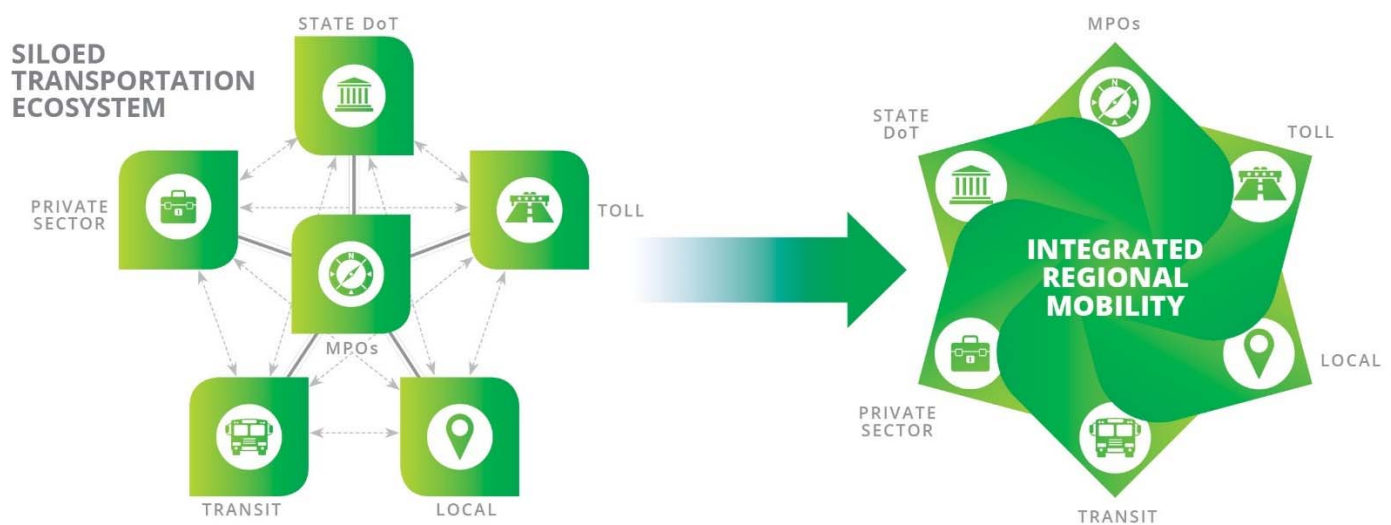
3. Advancing Regional Collaboration/Interoperability

An initial challenge facing the deployment of many innovative mobility services is the lack of coordination among service providers and organizations, as well as the lack of system integration. Enabling seamless intermodal mobility will require the mobility ecosystem to be far more integrated than the siloed transportation ecosystem in place at many organizations. While the Smart City movement is spurring collaboration among organizations and their private partners, there remains significant room for improvement. For example, organizations may share common planning visions, but the focus is, by far, on their respective organizational interests,

which may not always align with one another. As the transportation industry advances toward a more integrated mobility ecosystem, organizations must prioritize improved regional integration to more-fully realize the benefits of emerging technologies and data sharing.

Our current siloed transportation ecosystem (left figure below) generally functions where project planning is coordinated between the entities through a metropolitan planning organization or a similar regional coordinating entity.

On the other hand, in the likely future scenario, the integrated regional mobility ecosystem (right figure below) coordinates and interconnects project planning and operations across all modes and jurisdictions. Through collaboration and cross-organizational innovation planning, organizations in the integrated mobility ecosystem work together to align goals and refine solutions that reflect broader, regional needs.



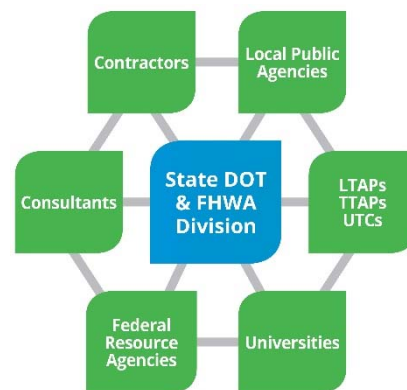
3.1. Committing to advancing regional collaboration and interoperability

Regional integration could potentially expedite the planning and implementation of priority services and applications in a smart, connected, and interoperable mobility ecosystem. Regions can benefit from improved system performance and enhanced access for users while organizations realize enhanced buying power and improved efficiency in the design, construction, integration, financing, and operation of critical infrastructure. However, political and transportation institutions will require radical change to effectively embrace and manage the changes ahead. The process is already underway with increases in partnering and collaboration among organizations and the private sector as seen in the Smart City movement.

The following are strategies and approaches that can be used to initiate this process or guide coordination efforts that are already underway.

3.2. Participating in transportation innovation councils or task forces

Participation in innovation councils or task forces allows organizations to engage national, state, provincial, or regional entities and transportation stakeholders as a group to learn, exchange information, evaluate innovations, and spearhead deployment. Task force representatives may also include industry, academia, and other partners who meet to comprehensively consider innovation and strategically advance technologies and processes that promise the greatest impact. This group engagement allows each state or province transportation community to evaluate and deploy innovations that best fit their program needs and put the innovations into practice quickly. It also gives organizations exposure to vendors and services they might not normally work with. In the U.S., the [State Innovation Council](#) (STIC) process has been formalized through the FHWA and state DOTs, as shown in the figure to the right.

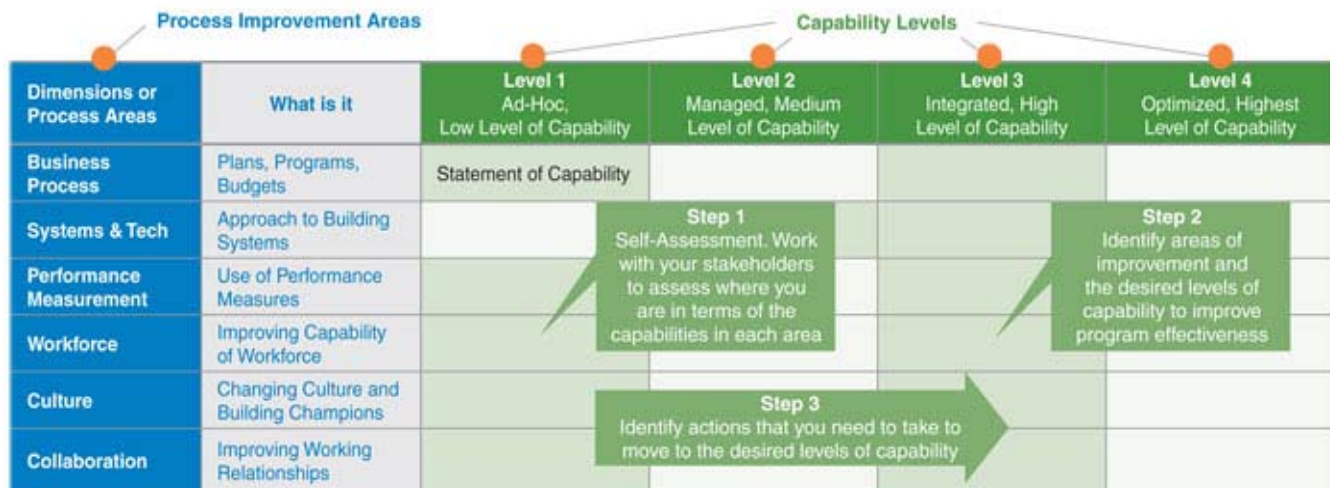


Source: FHWA

3.3. Supporting or leading in Transportation Systems Management and Operations (TSMO)

TSMO involves systematic, comprehensive, planning and coordination of activities involving state, provincial, or regional transportation organizations. The goal of TSMO is to operate the transportation network as a unified whole, breaking down governmental jurisdictional barriers, making the various transportation modes and facilities work together and perform better, benefiting the region as a whole. Mobility does not stop at city limits – and some impactful mobility innovations may only make sense when scaled well beyond city limits.

TSMO uses the FHWA's [Capability Maturity Framework](#) to assess capability levels in business processes, systems and technology, performance measurement, organization and workforce, culture, and collaboration of an organization's or region's capabilities in organizing and planning operations. This systematic process is based on prioritizing the right actions, focusing on the weak links, and continual improvement in operations. As seen in the figure below, capability levels range from Level 1, Ad-Hoc low-level, to Level 4, optimized high-level. Most organization and region capabilities are Levels 1 or 2. The integrated mobility ecosystem of the future will require Level 4 maturity.



Source: FHWA - <https://ops.fhwa.dot.gov/publications/fhwahop16026/index.htm>

4. Next Steps for IBTTA

Today's rapidly changing environment poses new challenges and opportunities. Timely and relevant information is therefore critically important to properly plan and conduct daily operations. IBTTA and its member organizations might benefit from a systematic approach that assesses and reports on new technologies and innovations. There are also opportunities to increase collaboration and information sharing through existing IBTTA tools. It is recommended that IBTTA, through the Emerging Technologies Committee, implement the following:

- **Technology and Innovation Matrix** – Identify, track and evaluate applicable new and emerging technologies for the tolling industry. This includes establishing a process for proposing and developing association white-papers and other targeted research. Research efforts may include industry research from thought leaders such as McKinsey & Company, Deloitte, and PricewaterhouseCoopers. The matrix will include deployment strategies, operational practices, potential tolling system use cases and will link to any available association white papers, briefs, or other information.
- **Toll Industry Surveys** – Routinely survey IBTTA member organizations to collect information and support updates to the Technology and Innovation Matrix, white papers and related efforts, such as the Chief Technology Officer Roundup conducted in conjunction with the 2019 IBTTA Annual Technology Summit. IBTTA member organizations might also be surveyed to measure and track innovation capacity within organizations.
- **Annual “State of the Industry” Report** – Prepare an annual report on the state of technology and innovation. The report will discuss relevant technology innovations and provide insight on strategies for their integration into tolling systems. The annual report will be informed by the Technology and Innovation Matrix as well as the results of member surveys, forums, whitepapers, and other IBTTA research initiatives.

- **Information Sharing, Collaboration** – Store and share reports, white papers, briefs and other relevant information by using existing IBTTA tools such as “The Exchange”, “TollMiner™”, “Smart Briefs”, or other publication or meeting channels. The committee will also increase information sharing and collaboration through IBTTA’s “Peer Exchange” program. This may be ad hoc or facilitated by IBTTA or another process.
- **Recognition of Notable Member Innovation Initiatives** – Establish a program to identify and recognize member innovations, possibly through a new IBTTA awards category for innovation.
- **Develop an Innovation Capacity and Regional Collaboration Self-Assessment Tool** – As part of its information sharing responsibilities, the committee will explore the development of industry innovation tools, perhaps facilitated through the IBTTA Peer Exchange initiative.

5. Technology and Innovation Matrix

Technologies were identified, listed, and prioritized in the *Technology and Innovation Matrix* tables presented in [Appendix C](#). This initial evaluation led to the grouping of technologies into the following categories:

- **Communications** – These are technologies that can be used for the transmission of information between vehicles, tolling systems, infrastructure, and other instrumented roadway elements. Many of the technologies listed are well established and have been in use by the tolling industry for decades. Others may have limited deployment or current applicability but could impact aspects of toll system operations if certain improvements are realized.
- **Sensing & Detection** – These are technologies used in a tolling context to detect and identify objects, including vehicles and pedestrians, in a roadway environment. Such technologies are commonly used in existing automated vehicle identification (AVI) applications, but subsequent improvements to emerging technologies could enable operational use cases.
- **Physical Infrastructure** – These innovations relate to infrastructure assets such as pavement, asphalt, roadway signs, striping, and lighting, etc. Such innovations have the potential to impact facilities’ construction and maintenance and could enable higher-tech applications.
- **Data & Analytics** – This category represents a broad range of data, data processing, and analytics-based applications and encompasses business and operations processes applications that might be used in advanced modeling and simulation efforts.
- **Automation & Connectivity** – This category includes technologies and applications that automate activities such as driving that connect people, vehicles, and infrastructure for improved safety and system performance.

- **Consumer Goods & Services** – This category includes a broad range of goods and services that are likely to be utilized by consumers (and toll road users) over the long term and might be leveraged by toll organizations for improved operations, maintenance, and administration.
- **Transportation Demand Management** – These represent established and emerging strategies for managing demand on roadways. It includes strategies such as congestion pricing as well as active traffic management strategies that support the dynamic management of roadway conditions in real time, such as speed harmonization and adaptive ramp metering.

The Emerging Technology Committee is responsible for evaluating technologies, making recommendations, and with ongoing support from IBTTA and its members, updating the matrix to maintain its timeliness relevance.

Appendix A: Quick Reference Brief

Strategy for Innovation and Technology Quick Reference Brief and Recommendations

New innovations will change the way transportation organizations provide mobility services and system users' expectations for those services. The integrated mobility ecosystem of the future will include connected, automated, and shared vehicles that are more likely to be electrified than the current fleet. Users will be able to book, pay for, and use multiple modes under a single account platform. Organizations will possess system-wide performance data, enabling real-time operations management and supporting next generation modeling and simulation for planning.

The tolling industry has shown that it can innovate and adapt in response to technological advancement as evidenced by the growth of electronic tolling systems. However, the current rate of innovation is rapid, stressing already stretched organizations. Two broad strategies are recommended for effectively meeting the challenges ahead while engaging and remaining relevant in our rapidly evolving mobility ecosystem: **1) building innovation capacity, and 2) advancing regional collaboration/interoperability.**

1. Building innovation capacity

To build innovation capacity, organizations will need:

- Leadership commitment to innovation.
- A Chief Innovation Officer (CIO) or similar executive position and/or dedicated innovation team or department.
- An organizational staffing and resource plan that reflects innovation-oriented skill sets.
- Use agile program/project management processes.
- Develop and implement a future-focused technology plan.
- Use an iterative, flexible procurement and contracting approaches involving the private sector.
- Implement Data Platform/Data Sharing Hubs.

2. Advancing regional collaboration/interoperability

The new integrated mobility ecosystem will require a stronger focus on regional collaboration in the planning and deployment of new transportation services. Organizations must seek out opportunities to learn and collaborate with their regional partners and should:

- Commit to advancing regional collaboration and interoperability.
- Participate in a Transportation Innovation Council or Task Force.

- Participate in, support, champion, or lead in TSMO (Transportation Systems Management and Operation).

3. **Next Steps for IBTTA**

IBTTA can take a leadership role in enabling these two strategies. Doing so requires a commitment to sponsor an ongoing, industry-wide dialogue on overcoming transformational challenges and identifying opportunities. The following recommendations will prepare IBTTA and its member organizations for the integrated mobility ecosystem of the future.

- **Technology and Innovation Matrix** - Establish processes for systematically identifying, evaluating, and monitoring emerging technologies, practices, and strategies. Commission white papers, briefs, and other research efforts to inform a Technology and Innovation Matrix that identifies emerging technologies relevant to the toll industry, tracks their progress, identifies deployment strategies, describes operational practices, and links to additional resources.
- **Toll Industry Surveys** – Survey IBTTA member organizations to inform and support recommendations by the Emerging Technologies Committee related to the Technology and Innovation Matrix. Survey IBTTA member organizations to measure, track, and advance the progress of innovation capacity building within the toll industry.
- **Annual “State of the Industry” Report** – Prepare an annual report on the state of technology and innovation and the potential application of these innovations within the tolling industry.
- **Information Sharing and Collaboration** – Store reports and other relevant documents in IBTTA “Smart Briefs,” “The Exchange” And “TollMiner”™. Increase capacity through IBTTA’s “Peer Exchange” program. This may be ad hoc or facilitated by IBTTA or another process.
- **Recognition of Notable Member Initiatives** – Identify and recognize member initiatives through IBTTA publications or meeting channels and a new IBTTA awards category for innovation.
- **Develop an Innovation Capacity and Regional Collaboration Self-Assessment Tool** – This may be facilitated through the IBTTA Peer Exchange initiative.

Appendix B: Technology and Innovation Recommendations

As discussed in Section 2, this paper outlines an approach for building organizational capacity including the need to remain current with new and emerging technologies and establish an evaluation process for determining appropriateness or readiness for adoption. This section includes initial example recommendations identified from such a process. Emerging technologies (see Appendix C) were reviewed for level of maturity and categorization: 1) Toll Industry Leadership, 2) Toll Industry Engagement, and 3) Toll Industry Monitoring. A description of each of these categories follows along with a set of recommended actions and examples of innovations and technologies captured within the category.

Toll Industry Leadership

These technologies are highly applicable to the toll industry and are mature or nearing maturity. They have been implemented in an operational environment or are in the final stages of system testing for future deployment.

Recommendations

- Work with developers and vendors to deploy
- Work with staff Subject Matter Experts (SMEs) to identify all use cases, not just the obvious ones
- Active engagement with relevant regulatory entities
- Identify and synthesize emerging best practices

Innovations

- Dedicated Short-Range Communications (DSRC), Big Data Analytics
- Automated Vehicles
- Vehicle-to-Vehicle Communications (V2V)
- Vehicle-to-Infrastructure Communications, (V2I)
- Vehicle-to-Pedestrian, Bike, etc.
- Smartphone Toll
- Integrated Toll Modules (ITM)
- Electronic License Plates
- Shared Mobility
- Unmanned Aerial Vehicles (UAVs, or Drones)
- Mobility as a Service/Mobility on Demand
- Congestion Pricing, Road-Usage Charging
- Active Traffic Management
- Integrated Corridor Management

Toll Industry Engagement

These technologies are likely applicable to the toll industry but are not yet mature. There may only be prototypes of initial models or limited system testing. This category also includes innovations that are already deployed within niche toll industry applications but have not yet led to fundamental changes in how toll systems are operated or administered.

Recommendations

- Work with developers and vendors to pilot test
- Identify and track relevant regulatory and rule-making activities
- Identify and assess potential use cases
- Identify potential implementation, operation and administration costs
- Identify institutional gaps

Innovations

- Bluetooth
- Wi-Fi Communications
- 5G (fifth-generation wireless) Cellular
- Infrared Detection
- Microwave Detection
- In-vehicle Telematics
- Nano materials
- Blockchain
- Artificial Intelligence
- Tokenization
- Immersive Interfaces (heads-up displays)
- Smart Pavement
- Geofencing

Toll Industry Monitoring

These technologies are more mature but their applicability within a toll context is not yet established. There is a high potential for disruption in these technologies, as improvements could potentially open new use cases. This category includes technologies and applications found in the transportation industry in general that have not yet migrated to a toll environment.

Recommendations

- Monitor technology developments
- Assess potential disruption to operations and/or administration
- Identify and assess potential use cases
- Identify potential implementation, operation and administration costs and risks
- Identify institutional gaps

Innovations

- Piezoelectric Pavement
- Shape Memory Metal
- Self-Healing Pavements
- Solar-Powered Photovoltaic Highways
- LiDAR, Optical Detection

The following figure represents the technology evaluation process results, showing how the scoring of each technology was carried out, and where certain technologies appear on the evaluation matrix (assessing technology maturity level by the applicability to the tolling industry). Technologies fell into one of four quadrants: Engage, Lead, Get Informed, and Monitor. These

assessments were made using research and empirical data, when available; however, many were assessed based on the expertise of the committee.



Appendix C: Technology and Innovation Matrix

1. Communications Technologies

Communications Technologies	Technology/ Innovation	Description	Possible Toll Use Cases	Maturity
	Bluetooth	A standard wireless technology for two-way data transmission over short- to medium-range distances. Operates with Ultra-High Frequency (UHF) radio waves in the unlicensed ISM (originally designated for the industrial, scientific, and medical field) band at a frequency of 2.4 gigahertz (GHz) and in the bandwidth of 2.402 – 2.48 GHz. A common feature in electronic devices including mobile phones, laptops, tablets, roadside sensing devices, etc.	Already used on some tollways for the collection of travel time and speed data. Roadside readers detect unique Bluetooth IDs of equipped devices in vehicles.	Operational
	Wireless Fidelity (Wi-Fi)	An IEEE 802.11 communication standard for wireless local area network targeting high-speed data transmission for work and homes. Generally, operates on one of two frequencies – 2.4 GHz or 5 GHz ISM band. A common feature in electronic devices, including mobile phones, laptops, tablets, roadside sensing devices, etc.	May be used for vehicle detection and communications.	Operational
	Dedicated Short-Range Communications (DSRC)	A member of the Radio Frequency Identification (RFID) family of technologies corresponding to the 5.9 GHz band specifically designated for medium range (100–300 feet) wireless communications for automotive and transportation applications. Uses vehicle-mounted On-Board Units (OBUs) that communicate with roadside units and readers mounted on toll gantries to transmit information.	Primary (and defining) electronic toll technology in Europe and other international toll applications. Not generally used in U.S. toll applications. Being used in connected vehicle pilot projects around the world.	Operational
	5th Generation Cellular (5G)	Represents the next advancement in mobile technologies from the current 4G/3G network. Is anticipated to produce high throughput and connection density for mobile systems with fewer transmission delays and low latency rates.	May be used for high-speed data communications in lieu of 3G/4G. Could enable connected vehicle applications without the overhead/roadside equipment requirement.	System Tested

2. Sensing and Detection

Sensing & Detection Technologies	Technology/ Innovation	Description	Possible Toll Use Cases	Maturity
	Light Detection and Ranging (LiDAR)	Also known as laser scanning, utilizes a pulsated laser beam to measure the distance to a target object. The speed and wavelength of the laser beam and the return times are used to make three-dimensional (3D) representations of the object. The technology uses wavelengths in the range of ultraviolet, visible, or near-infrared spectrum to image objects, depending on the application and the nature of the objects.	Potential for higher-resolution vehicle detection and identification.	System Tested
	Infrared	Sensors that detect and convert energy from vehicles, roadways, and other objects into electrical signals that can be used for signal control, vehicle volume, speed, and classification detection.	Vehicle detection and identification.	Operational
	Microwave	Roadside-mounted sensors that emit electromagnetic waves to detect vehicle presence and measure vehicle speed.	Vehicle detection and identification.	Operational
	Optical	Converts light rays from the visible spectrum to electronic signals for various purposes, including non-intrusive detection and counting of objects.	Vehicle detection and identification.	Operational

3. Physical Infrastructure

Physical Infrastructure Technology	Technology/ Innovation	Description	Possible Toll Use Cases	Maturity
	Smart Pavement	Highly durable and unobtrusive sensors installed directly into pavement and other roadway surfaces.	Collection and transmission of real-time roadway and weather condition data.	Prototype
	Nanomaterials	Materials in which a single unit typically measures between 1 and 1,000 nanometers (a nanometer is one billionth of a meter, or 10^{-9}).	Strong and durable sign coverings and roadside structures.	Prototype
	Piezoelectric Pavement	Surfaces that convert the mechanical energy of a vehicle passing over the roadway into electrical energy.	Special lanes that support in-road charging of electric vehicles.	Experimental
	Shape Memory Metal	Materials (often nanomaterials) that are highly durable and capable of retaining their shape after impacts.	Highly durable signs and similar roadway structures that retain their shape and do not require replacement after being struck by a vehicle.	Prototype
	Self-healing Pavements	Special pavement mixtures that can be repaired through electrical induction.	Pavements that can be quickly repaired without the need for replacement.	Experimental
	Solar-Powered Photovoltaic Highways	Transparent concrete laid over electricity-generating solar panels.	Roadways that can generate and transmit electricity to the regional grid.	Prototype

4. Data and Analytics

Data and Analytic Technologies	Technology/ Innovation	Description	Possible Toll Use Cases	Maturity
	Big Data Analytics	Processes to analyze, synthesize, or otherwise work with data sets that are overly unmanageable in size or complexity for traditional data-processing applications.	Numerous business and transportation system management processes.	Operational
	Blockchain	Consists of an interconnected and growing list of records, known as blocks, which are linked and protected using cryptography. Each block includes a cryptographic hash that links to the previous block in the chain, a timestamp that establishes the creation or modification time of the block, and associated transaction data.	Possible platform for high-security, highly auditable interoperability processes.	Prototype
	Artificial Intelligence	The simulation of human intelligence processes by machines, especially computer systems, that include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions), and self-correction.	Possible applications in, and improvements to, automated image review processes. Applications to predictive modeling of transportation events and long-term scenario building and evaluation.	Conceptual
	Tokenization	Substitutes sensitive data elements associated with payment (like account details of the cardholder) with a non-sensitive equivalent, referred to as a token, that has no tangible meaning or value to external users (including merchants or hackers).	High-security customer data transmission.	Operational
	Geofencing	The creation of virtual geographic boundaries, often using information from Global Navigation Satellite Systems (GNSS), including Global Positioning Systems (GPS), to establish boundaries used in fleet vehicle management, construction site management, loss prevention, asset monitoring, and jurisdictional boundaries for work/patrol zones and route mapping, cities, counties, or states.	Enabling of satellite toll systems.	Operational

5. Automation and Connectivity

Automation and Connectivity Technology	Technology/ Innovation	Description	Possible Toll Use Cases	Maturity
	Automated Vehicles	Refers to a range of sensors, communications, and data processing systems that enable vehicles to be piloted with little-to-no interaction from a human driver.	Dedicated automated vehicle lanes as part of future managed-lanes networks.	System Tested
	Vehicle-to-Vehicle Communications (V2V)	Enable the transmission of data between vehicles on the roadway using advanced wireless communications, on-board processing systems, state-of-the-art vehicle sensors, GPS navigation, and other technologies.	Vehicle platooning in managed lanes.	System Tested
	Vehicle-to-Infrastructure Communications (V2I)	Enable the transmission of data between vehicles on the roadway and roadside units using advanced wireless communications, on-board processing systems, state-of-the-art vehicle sensors, and other technologies.	Wrong-way driving and crash notifications and warnings; inclement weather notifications sent through vehicle systems such as wipers; queued traffic notifications, and warnings; speeds/travel times.	System Tested
	Vehicle-to-pedestrian, bike, etc.	Enables the transmission of data related to potential roadside obstructions or impact threats such as bicyclists and pedestrians.	Roadside bicycle and pedestrian detection and warnings.	System Tested

6. Consumer Goods and Services

Consumer Goods and Services Technologies	Technology/ Innovation	Description	Possible Toll Use Cases	Maturity
	Smartphone Toll	The integration of required toll communications protocols and technologies within smartphones.	Smartphone apps linked to license plate toll accounts that preclude the need for a transponder.	System Tested
	Immersive Interfaces (heads-up displays)	Technologies that allow for the display of information on the interior windshield or other in-vehicle surfaces that eliminates the need to look away from the roadway.	Current toll rate and downstream congestion notifications broadcast in a heads-up display.	Experimental
	Integrated Toll Modules (ITM)	Integration of required toll communications protocols/technologies as a standard feature on newer model vehicles.	Toll technologies embedded as a standard feature in newer model vehicles, precluding the need for aftermarket tags.	System Tested
	Electronic License Plates	License plates that incorporate GPS and wireless (cellular and DSRC) communications technology within a digital display.	Current designs incorporate RFID equipment that may be detected in-lieu of tags. Potential for improved license plate image capture and recognition.	System Tested
	Shared Mobility	Smartphone-based and other personal device-based applications that allow users to access various modes of travel from a registered service provider.	Includes car sharing, ride sharing, and micro-mobility (shared bikes and scooters) applications.	Operational
	In-vehicle Telematics	Various sensor, telecommunications and data processing systems that are installed by the manufacturer as a standard feature on newer model year vehicles.	Calculation and communication of road usage information.	Operational
	Unmanned Aerial Vehicles (UAVs, or Drones)	Devices capable of flying by remote control; can be equipped with an array of cameras and sensing equipment.	Unmanned inspection of bridges and other infrastructure.	Operational
	Mobility as a Service/Mobility on Demand	Refers to a family of applications that allows transportation system users to access and pay for any number of alternative mobility services through an integrated platform.	Integration of toll accounts and toll payment in Mobility as a Service (MaaS) service suite.	System Tested

7. Travel Demand Management

Travel Demand Management Technologies	Technology/ Innovation	Description	Possible Toll Use Cases	Maturity
	Congestion Pricing	Changing the price for access to a facility in response to demand to increase price during periods of higher demand. Includes common roadway pricing techniques (such as managed lanes) as well as emerging pricing applications such as full roadway/network congestion pricing, cordon pricing, and area/zone pricing.	Increasing focus on the use of congestion pricing to address congestion outside of the typical freeway/corridor context (New York, Los Angeles).	Operational
	Road Usage Charging	Charging vehicles for each mile driven as a transportation funding source.	Road Usage Charging (RUC) systems could enable widespread freeway toll through satellite technology.	System Tested
	Active Traffic Management	Dynamically managing recurrent and non-recurrent congestion based on prevailing and predicted traffic conditions to improve trip reliability. Increases throughput and safety with integrated systems incorporating new technology, including automated dynamic deployment to quickly optimize performance.	Includes non-pricing strategies to improve system performance, such as Dynamic Lane Use/ Shoulder Control, Dynamic Lane Reversal, Speed Harmonization/ Dynamic Speed Limits, Dynamic Merge Control, Queue Warning, Signal Priority, Adaptive Ramp Metering/Managed Motorways, Dynamic Rerouting, Dynamic Junction Control, Adaptive Signal Control.	Operational
	Integrated Corridor Management	Bundling of Intelligent Transportation System (ITS) technologies and applications that improve transportation network performance in the efficient movement of people and goods through institutional collaboration and aggressive, proactive integration of existing infrastructure along major corridors.	Integrated Corridor Management (ICM) could be implemented as a means of better managing heavily used toll facilities in congested urban regions.	Operational

Appendix D: Case Studies

This appendix contains summary examples of organizations and initiatives that use strategies outlined in this paper (advancing regional integration and building organizational capacity). Observational analysis indicates that there is an emerging trend of an increasing number of organizations that are embracing these strategies and implementing pilot projects. There is ample opportunity for the toll industry to lead and support testing and pilot programs that advance regional collaboration and interoperability.

1. [ASFINAG – Innovation](#)

Austrian corporation ASFINAG established a central innovation hub and test region for automated cars and developed standards for vehicle-to-vehicle communication. An [Insight Outlook](#) report outlines the research, development, and innovation at ASFINAG.

2. [Catapult Transport Systems](#)

The United Kingdom (UK) established Catapult Transport Systems in 2013 to support a network of elite technology and innovation centers, each with their own specific sector focus to transform the UK's capability for innovation within the transportation sector and help drive future economic growth.

3. [Central Texas Regional Mobility Authority \(CTRMA\) – Innovation Team](#)

The CTRMA established an innovation team in 2018 to “explore and invest in transformative technology and adopt industry best practices.” Activities include conducting user behavior and technology research, assessing and deploying connected corridor technologies, deploying an organization data platform and data sharing hub, and advancing regional interoperability through the Transportation Systems Management and Operation (TSMO) process.

4. [FDOT District Five – Intelligent Transportation Systems Program](#)

The Florida Department of Transportation (FDOT) District 5 Intelligent Transportation Systems and TSMO Plan was created and organized around the six dimensions of a successful TSMO program: Business Process, Organization & Workforce, Culture, Collaboration, Systems & Technology, and Performance Measures.

5. [Greater Phoenix Region – Smart Region Consortium](#)

The Smart Region Consortium is a collaborative applied research and implementation partnership between public-sector, academia, industry, and civic institutions to drive the creation, advancement, and adoption of smart city technology to improve the quality of life for all citizens and businesses within Greater Phoenix communities. This team of partners was awarded a multi-million-dollar USDOT Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant.

6. [Integrated Corridor Mobility Project \(I-80 Smart Corridor\)](#)

The California Department of Transportation (Caltrans), Alameda County Transportation Commission (Alameda CTC), and Contra Costa County Transportation Authority (CCTA), in cooperation with nine cities and two transit agencies, will optimize the use of the existing infrastructure within the corridor by implementing strategies to reduce congestion and travel time, provide real-time information to drivers, and improve safety. The I-80 SMART Corridor Project (I-80 Integrated Corridor Mobility), activated in 2016, represents the most comprehensive Intelligent Transportation System in the state.

7. [I-95 Corridor Coalition](#)

The I-95 Corridor Coalition is an alliance of transportation organizations, toll authorities, and related organizations, including public safety, from Maine to Florida, with affiliate members in Canada. The Coalition provides a forum for key decision and policy makers to address transportation management and operations issues of common interest.

8. [Oregon Department of Transportation \(ODOT\) – Office of Innovation](#)

The Oregon Office of Innovation partners with internal and external organizations to identify, assess, and promote innovative services that advance our multimodal transportation system in this fast-changing transportation environment. It seeks out new developments and developers to create avenues for cooperation with private industry, develop policy and processes that can realize the value of these innovations, and collaborate with internal groups to ready the organization for long-term implementation.

9. [Pennsylvania Turnpike Commission \(PTC\) – Innovation Council](#)

The Pennsylvania Turnpike Commission (PTC) established an Innovation Council in 2014 to foster a collaborative, cross-disciplinary environment to explore and evaluate innovative approaches in delivering a high-quality transportation system. The PTC [Strategic Plan](#) includes innovation as a key value and [Policy Number 10.06](#) was adopted. Several significant innovative outcomes resulted from this initiative, including the use of Electric Vehicle Charging Stations, Unmanned Aerial Vehicle (UAV), Mobile Cashless Tolling, and the IBTTA award winning “Catch it Early, Act, Analyze and Review.”

10. [Smart Belt Coalition \(SBC\)](#)

The SBC was formed in 2016 and is a strategic transportation partnership comprising 12 organizations, including 5 transportation organizations and 7 research and academic institutions, located throughout Michigan, Ohio, and Pennsylvania. The [Smart Belt Coalition Strategic Plan](#) was adopted August 2018 with a vision to be a multi-jurisdictional innovation network that fosters the advancement of connected and automated vehicle technology. Its mission is to create a mechanism for transportation agencies, academic institutions, and others to collaborate on connected and automated vehicle initiatives.

11. [Smart North Florida](#)

The North Florida Transportation Planning Organization, through a partnership with 30 stakeholder organizations, facilitated the development of a Smart Region Plan to identify and implement new and emerging transportation technologies through an Integrated TSMO approach. Future deployment initiatives are grouped into four categories: 1) local intelligence, 2) electrification services, 3) data management services, and 4) feasibility demonstrations of automated vehicle technologies to connected vehicle corridor deployments.

12. [THEA – Connected Vehicle Pilot](#)

The Tampa Hillsborough Expressway Authority's (THEA) Connected Vehicle Pilot has employed innovative vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication technology to improve safety and traffic conditions in downtown Tampa. The Connected Vehicle Pilot Deployment Program is an initiative of the U.S. Department of Transportation (USDOT) that aims to spur the adoption of connected vehicle technologies.

13. [Traffic Management Finland – Aurora Intelligent Road Testing Ecosystem](#)

Aurora Intelligent Road offers the opportunity to test intelligent transport systems and proactive road condition management by providing the supporting physical infrastructure and data services. The 10-kilometer intelligent road section (Pahtonen–Puthaanranta) located on Main Road 21 in Muonio offers opportunities for testing automated vehicles and their related technologies in challenging road and weather conditions.

14. [Transurban North America Operations Division – Innovation Team](#)

The Innovation Team at Transurban North America was conceived out of the recognition across the business that a dedicated unit could optimize the identification of emerging technology opportunities, to both test and determine their value in advancing Transurban's mission to strengthen communities through transport. Internal resources are leveraged to explore technologies and processes that may yield quick, measurable value to the core business, and to advancing shared goals with external partners (i.e., Virginia Department of Transportation, USDOT/Federal Highway Administration, Virginia Tech Transportation Institute, and other public and private agencies).

15. [VDOT – Office of Innovation](#)


The Virginia Department of Transportation assigned a Chief of Innovation designation to Deputy Commissioner to bring innovation to every aspect of VDOT's business. This position works closely with the Department of Technology and Business Strategy/Office of Strategic Innovation, [Virginia Transportation Research Council](#), and Chief Financial Officer/[Office of Transportation Public-Private Partnerships](#). The VDOT Business Plan includes innovation as an organization goal (i.e., being innovative; transportation is changing, and we must take advantage of technological advances).

Appendix E: Useful References

- The National Cooperative Highway Research Program (NCHRP) recently issued a [“Guide to Creating and Sustaining a Culture of Innovation for Departments of Transportation.”](#) which discusses the overarching concept of innovative culture, its importance within an organization, and what innovation looks like at different levels of an organization. The report explores different types of innovation, offers methods to manage risk, and identifies the following key building blocks that a transportation organization can use to initiate or enhance its organization’s innovation.
- McKinsey & Company [“The Department of Transportation of the Future”](#), notes that transportation will be dramatically different in 10 years and agencies that prepare to proactively embrace change can shape the future of transportation along with urban, suburban, and rural development. Adjusting to rapid advances and providing effective, next-generation solutions requires agility and radical innovation. This kind of disruption can challenge the culture of transportation agencies, who may be required to focus on compliance and reducing risk as opposed to encouraging experimentation. To acquire the necessary skills and transform its practices, McKinsey recommends that agencies implement changes to five core capabilities: 1) strategy, 2) portfolio planning, 3) resources model, 4) project planning and delivery, and 5) performance measurement.

McKinsey further recommends a strategy that supports funding priorities that enable agility and innovation: partnering with metropolitan planning organizations, regional and local agencies, and other public and private organizations to develop and garner support for innovative ideas. Transportation agencies of the future will rely heavily on data scientists who analyze disparate information streams, developing solutions that incorporate autonomous vehicles and other emerging mobility trends. Those agencies may also create teams of programmers that develop applications to communicate live traffic information to drivers’ cars and mobile devices. The key will be for agencies to provide the right organizational structure to successfully blend new skills with the old to drive fruitful outcomes.

- Forbes (Glenn Llopis, [“5 Ways Leaders Enable Innovation in Their Teams”](#)) noted that it takes commitment to embrace an innovation mindset where everyone learns to apply the differences that exist in one another for their own success and that of the organization. Forbes notes that innovation must come from multiple sources, both internal and external. When people and their different points of view and experiences converge, they create the types of innovations that individuals could not have realized alone.



White Paper

Tolling and Customer Service Workgroup

A Roadmap for Engagement with Third-party Account Issuers

Abstract

Engaging third-party providers for toll charging and customer service can be challenging as Operators consider the impact to their brand, back office implications, and customer service handling. This white paper explores when to engage, why to engage, and suggestions for how to engage third-party providers, with a focus on considerations for Legal, Technical, and Customer Service requirements.

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Glossary of Terms

Where possible, terms and definitions follow the same definitions in Toll Miner.

Toll Operator	An entity that manages the functions of a tolled facility, parking lot, etc.
Third-Party Provider	A provider of technology and/or services outside of the Toll Operator or governing agency. May also be referred to as the Provider.
User	The User of the toll system. Also, the User of the third-party or Toll Operator's payment and account management solution. Also referred to as the consumer or customer.
Commercial Fleet	A fleet of vehicles managed by a third-party, typically involves a rental car fleet or commercial trucks
Consumer Fleet	A fleet of consumer, privately owned, not commercial vehicles managed by a third-party
Interface Control Document (ICD)	The document that describes the interface(s) to a system. The systems in this instance, include the Back Office System, and the third-party system. The ICD describes the technical means required for connecting the two systems.
Back Office	Database system that enables registration and maintenance of customer accounts; facilitates funds transfer between participating Authorities. See also Customer Service Center (CSC).
Customer Service Center	A facility used to service customers.

Engaging Third-party Providers for Tolling and Customer Service

The International Bridge, Tunnel & Turnpike Association (IBTTA) is the worldwide association for the owners and Operators of toll facilities and the businesses that serve them. Founded in 1932, IBTTA has members in 26 countries on six continents. Through advocacy, thought leadership and education, members are implementing state-of-the-art, innovative user-based transportation financing solutions to address the critical infrastructure challenges of the 21st Century.

To that end, the Emerging Technologies Committee - Tolling and Customer Service Workgroup, has developed this White Paper to provide a roadmap for engaging third-party providers that offer solutions for account issuance, management, payments, and customer service.

Introduction

Tolling has been an important transportation solution to building and maintaining infrastructure in the United States since the late 1700s when the Philadelphia and Lancaster Turnpike was established in Pennsylvania. Since then, Toll Operators have very successfully created systems and methods for toll collection, the distribution of transponders, and customer service center operations. Additionally, they have invested heavily in branding, building relationships and goodwill within the communities they serve, as well as with customers, and other stakeholders.

Tolling continues to be one of the most valuable options for creating and maintaining much needed roads and infrastructure. Once in operation, the revenue generated by tolled facilities goes toward maintaining the roads and repaying the bonds used to finance roadways. However, excess revenue can also be leveraged by Operators to fund other transportation corridors, alternative modes of transportation, and other valuable projects such as shared-use paths for the surrounding community.

As such, one of the most critical aspects of toll facility operation is undoubtedly the actual collection of toll revenue. Generally, the focus of Toll Operators is:

- Increasing collection rates of the toll from all types of customers
- Limiting collection risk from violators or post pay users
- Continuing to be seen as a positive solution in the press, to users, constituents, and stakeholders

Moreover, Toll Operators are continuously looking for innovative approaches and technologies, to accomplish all of the above, in a cost efficient and seamless manner for users. Toll Operators seek to minimize the cost of collections, improve operations, and to increase throughput and safety. So, why would a Toll Operator consider using a third-party to issue accounts and manage customer relations for those accounts?

Over the last decade or so, third-party account issuance has been reserved for commercial fleet accounts and temporary or rental vehicles. For Toll Operators, this particular group of Users was costly, and challenging to capture and manage. Commercial, trucking, and rental car fleet account management companies became a desirable option. As tolled facilities and consumer technologies have evolved, the opportunity to leverage third-party providers, who provide consumer solutions, has become a valuable option to capture revenue and decrease operational costs.

Goals and Intent of the White Paper

The goals of the white paper are focused on the following:

Goal 1. Evaluation Evaluate current third-party arrangements, evolving technologies and changing customer needs. Provide considerations and suggestions for why a Toll Operator would engage a third-party provider

Goal 2. Legal To provide guidance on engaging a third-party from a legal standpoint. Considerations include required legal language for User agreements between the third-party provider and the User. Additional considerations provided for the legal /contractual relationship between the third-party and the Toll Operator.

Goal 3. Technical Evaluate the technical requirements for connecting a third-party solution to an Operator's system including the evaluation of real-time versus batch interfaces, processing order, and other technical considerations.

Goal 4. Customer Service To explore customer service requirements between the Toll Operator and the third-party, in partnership. Customer service requirements outline the support tools needed for Users to pay for the road and manage their account, including inquiring about transactions or discrepancies.

The outlined goals are designed to provide the Toll Operator with assurances, that:

- The Toll Operator's goals and interests are being facilitated and protected
- Users are treated fair and equitably, in partnership with the Toll Operator and the third-party

The paper also provides considerations for Toll Operators to support third-parties and work cooperatively together, rather than independently. This includes giving third-parties access to, or making available, the information they require to adequately service and support the User.

In order to achieve these goals, the paper is broken down into the following sections:

- Considerations for When/Why to Engage a Third-Party

- Legal Requirements and Considerations
- Technical Considerations
- Customer Service Considerations

At the conclusion of the paper, recommendations for next steps are provided to further explore how the industry could continue to engage and leverage third-party providers and solutions.

Evolution of Third-Party Payment and Account Providers

In order to demonstrate why a Toll Operator might want to connect to a third-party provider, it is important to understand the history and evolution of third-parties and their role in the toll industry, both past and present. The following sections describe the historical and existing third-party relationships and how the relationships and technologies have evolved.

The History and Evolution of Commercial Fleets

Commercial Fleet Providers have long been a part of tolling. They were initially established to address specific challenges in the industry, namely rental cars and commercial trucks. Within the last few years however, the opportunity to service these groups of users has become easier to address and manage through advancements in technology, mobile phone innovations and the resulting changes in consumer behavior. In addition, the industry has seen commercial fleets evolve into consumer facing fleets. Many traditional commercial providers are beginning to incorporate a consumer facing component, leveraging their existing fleet connections.

Existing commercial fleet agreements are typically not appropriate for consumer facing fleet providers. Existing agreements do not incorporate the legal, customer service, and operational requirements and assurances needed to service consumers, and protect the Toll Operator.

The Evolution of Providers

In addition to the evolution occurring inside our industry, there are other factors that will most certainly affect the tolling landscape as it relates to service providers, Operators, and most importantly, consumers. ^{1,2}Auto OEMs and manufacturers are making vehicles “smarter” and are looking for ways to monetize User data, offer additional in-vehicle services and features, and potentially collect tolls. ³Ride-share app providers such as Uber and Lyft, are looking for ways to participate in tolling and congestion pricing, even going so far as to commission their own studies. Companies like Car to Go, Turo, Mobiliti, and other short-term lease and rental companies are changing the way consumers use and pay for transportation. These transportation providers are challenged in the existing toll environment to enable Users to pay for their tolls rather than the owner of the vehicle or fleet. These are just a few examples of new players that could be, and are currently, entering the market.

With established, robust, back office systems, and the enormous growth in electronic and mobile payments, there are many opportunities to partner to keep ahead of the quickly changing landscape.

¹<https://www.mckinsey.com/-/media/McKinsey/Industries/Automotive%20and%20Assembly/Our%20Insights/Monetizing%20car%20data/Monetizing-car-data.ashx>

² <https://tridenstechnology.com/the-connected-car-race-speeds-on/>

³ <https://mynorthwest.com/1453581/uber-congestion-tolling-push-seattle/>

Why Third-Party Providers?

Today, there are a number of reasons why third-party providers are becoming more prevalent. Toll Operators have well established systems and solutions for collecting, processing, and posting tolls, as well as issuing accounts, distributing transponders, and providing support to Users. However, there are many cases where a third-party can more readily support an agency that is going through an operational or programmatic change, for the benefit of the Toll Operator and its Users, alike.

There are benefits and challenges to engaging a third-party. Most benefits are based on specific events or changes to a toll agency's course of business and operations, as well as evolutions in technology and customer behaviors. Benefits are also based on groups of Users that are more challenging to capture or support. As the Cost of processing and collecting on certain transactions increases, there is becoming more opportunity for specialized Third-Parties to take over management (and in some cases risk) of those transactions, saving the Toll Operator time and money.

There are also challenges to engaging third-parties. Usually these challenges include messaging and customer confusion, as well as potential changes to an existing back office system.

Below are high level bullets related to benefits and challenges of engaging a third-party.

Benefits of using a Third-Party Partner

- Processing costs of Electronic Toll Collection or All-Electronic Toll (AET) transactions
- Offload Commercial Fleet Management
- Managing Infrequent Users, Cash-based, Underserved Users
- Lowering overall Operational costs
- Ability to utilize/implement new technology faster

Challenges

- Customer confusion around the third-party and the Toll Operator.
- Public Relations issues stemming from third-party issues or bad press.
- Technical challenges integrating or connecting a third-party solution to the back office system.
- The ability for a Toll Operator to make changes to their operations or back office systems. This can include technical and/or contractual challenges.

Throughout the paper are questions, answers, detailed information and use cases, to help evaluate the need, desire, and considerations for engaging a third-party provider.

Questions and Considerations for Engaging a Third-Party Provider

Q. Who is the User that a third-party is able to reach that is potentially challenging for the Operator?

A.1. *Example: Cash-based or underserved/un-banked User.*

Cash-based and under-served Users are typically Users that fall outside the traditional back office offerings for account establishment and management. Without an established payment method that can be auto-replenished, cash-based and underserved Users do not fit within this account model. Additionally, Users who lease a vehicle for a short timeframe. These examples include companies like Tura, Mobilti, and Silvercar.

A.2. *Example: Pay-by-Mail, post-pay applications, violations, or other type of post pay methods that involve collections.*

Perhaps the Toll Operator has a solution in place to handle these types of users however, it is a costly or in-efficient solution. While post pay programs service a particular group of Users, the burden of print and mail and collections are costly not only for the Operator but for the User. While these methods can provide a means for payment, they often charge those that are most challenged to pay, a premium for using the road. This is inefficient for all involved.

A.3. *Examples: Transient and infrequent Users. A visiting User that does not live in the area. A User that travels the road less than 4 times a year, or perhaps, 1 time per month, and, does not wish to maintain a tag account.*

Going All-Electronic can pose challenges for capturing the in-frequent or transient User. It is not easy, and in some cases not feasible for a transient User to establish a traditional account. For the infrequent User, they oftentimes do not see the value in establishing a traditional toll account when they use the road so infrequently, despite electronic discounts.

Q. In addition to establishing the account, why should I allow a third-party to handle customer service related to this account when I have a fully staffed, well established customer service and operations center? What is different about the User that requires a different approach to customer service?

A.1. *Example: Cash-based and underserved users often require more frequent communication than a monthly statement. They also require immediate access to their balance as well as the ability to fund the account and have those funds available, immediately.*

Third-party accounts are typically different from the traditional offering and as such, require different methods for managing the account. Often, the third-party issuer can provide

account management tools, different types of communication mediums, and incentives to the User to keep their account current or manage their account in a way that fits their needs.

Technologies Facilitating Third-Party Involvement

Below are descriptions of technologies that are facilitating third-party involvement.

Mobile Phones & Smart Phones

⁴The use of cell phones, smart phones, and app-based services has become an integral part of consumers' everyday life. Cell phone usage has reached across all demographics, socio-economic backgrounds, and age. As such, mobile phones create an ideal opportunity to reach untagged Users.

Electronic and Open Road Tolling

All-Electronic Tolling continues to expand across the country. Toll Operators are looking for ways to safely, efficiently, and cost effectively move vehicles. Cash-based and underserved users require solutions to continue to participate in using toll roads when cash is removed from the road. Additionally, ride share Users, short-term lease vehicles, and consumer to consumer rental applications have emerged which presents the complication of the registered vehicle owner being charged for tolls that the User of the vehicle or service should be responsible for.

Cars Are Getting Smarter

Auto OEMs & Manufacturers, Autonomous and Connected Vehicles

Tolling has become of great interest to auto manufacturers. The development of in-vehicle applications and other types of features related to safety, information/entertainment, and payments is extending into the vehicle's infotainment system. Previously known as the vehicle's navigation system, these in-vehicle infotainment systems have evolved into devices that offer, not only directions and maps, but connect to phones for calls, handsfree text messaging, food apps, gas rewards, and more. Auto manufacturers are now looking to provide tolling as part of this suite of applications.

Autonomous and connected vehicles pose new and interesting challenges as well. The User may not necessarily be the Owner of the vehicle, and in-vehicle technologies and external infrastructure required to facilitate these types of vehicles will likely play a huge role in how Users are charged.

⁴ <https://www.salesforce.com/blog/2018/02/consumer-smartphone-use.html>
12/13/19

Existing Commercial Fleet Agreements

Pros

Existing/legacy commercial fleet accounts provide an opportunity for third-parties to handle a historically, very challenging group of Users as ETC and AET emerged, in a cost effective, streamlined manner.

Cons

As technology has evolved, there are multiple ways to manage these Users and multiple types of third-party solutions that can be implemented to provide Users a choice for how they would like to pay for their tolls. ⁵Additionally, without the opportunity for competition, existing commercial fleet management companies are free to charge Users whatever they deem appropriate which, in some cases, can be many times higher than the toll charge.

Existing Legal and Contractual Arrangements

Existing legal and contractual arrangements are likely not sufficient to support the existing evolution of technology, and additional solution providers that have entered the market. In most cases existing contractual arrangements likely do not address the broad market that has emerged including:- Toll Operators and third-parties should work together to leverage the increase in mobile phone ownership, Electronic Toll and All-Electronic system conversions, and changing vehicle ownership. Engaging third-party providers will likely require adjustments to existing agreements and/or the development of new ones. Additionally, Toll Operators should begin to explore procurement processes that will facilitate the engagement of new technologies and the evolving User ownership and usage.

Dispute Handling

Most legacy legal and contractual arrangements for fleet providers do not address dispute handling as it occurs from User to third-party to Toll Operator. Previously, a major reason for engaging a third-party provider was to handle or reduce the number of disputes the Toll Operator was receiving from a particular group of Users. Typically, the contractual arrangement only covered legal disputes between the third-party and the Operator. As systems evolve and we rely more on innovative technologies, dispute handling can become more challenging. There are benefits to the evolution of both toll systems including video tolling, and consumer facing technologies such as the evolving capabilities of smart phones.

Dispute handling should be defined in the contractual arrangement and should include language to support not only the Toll Operator, but clearly define for the third-party how disputes should be initiated and resolved with the User.

⁵ <https://onemileatatime.com/rental-car-toll-rules/>
12/13/19

Consumer Facing Fleets

Pros

Consumer facing fleets provide competition and choice for the User. Consumer facing fleet providers can often help consumers establish and maintain an electronic toll collection account in a manner consistent with their usage, financial needs, or other need that is not currently addressed under the existing Toll Operator customer program.

Cons

Fleets in general, and especially consumer facing fleets, require more support from the Toll Operator for dispute resolution. Toll Operators have largely expected fleet providers to solve all problems related to the vehicles they represent. Unfortunately, disputes are costly for all involved and can be a public relations issue. There is often a perceived risk on the part of the Toll Operator that the third-party may not handle the customer service needs of the User, however, third parties need support and a process for handling customer needs that involve the Toll Operator and its system.

Legal and Contractual Considerations

Existing/legacy fleet contracts do not provide for a third-party to represent a consumer to inquire about transactions. Legacy fleet contracts tend to be focused on commercial fleets and as such are structured to provide information only to commercial fleet management companies. Standard fleet contracts for consumer facing solutions should be developed with the consumer in mind as the end-User versus the fleet account manager or third-party provider. In addition, the agreement should provide for a partnership approach to servicing Users and should not include a prescriptive approach. At the end of the day, the User is a customer of both the Toll Operator as well as the third-party provider.

Implementation of Common Privacy Approach

Privacy laws and agreements will vary by Operator and provider. The approach used must:

- Have reasonably similar privacy agreements between parties
- Use necessary tools to make the User aware of the privacy agreement
- Implement business rules requiring all participants to adhere to the privacy requirements.

Dispute Handling

Suggestions for dispute handling within the contract include:

- Provide a single point of contact for communication. This can be a dedicated email

address or a person(s) assigned to handle disputes.

- Develop a sound process including the information required for a dispute, response times, etc. All should be documented in the legal agreement including assigned responsibilities.

Terms of Service

Third-parties should have a Terms of Service (TOS) agreement between their organization and their Users. Often, Toll Operators require that the TOS include specific language between the third-party and the User, in order to legally protect the Toll Operator from any impropriety or malfeasance on behalf of the third-party. Some Toll Operators require specific language that calls out their agency. Rather than change the TOS each time the third-party connects to a new Operator, it would be helpful to analyze existing TOS and evaluate whether or not there is language sufficient enough to indemnify and protect the Toll Operator. This approach provides consistency with the User especially with solutions that are interoperable across multiple Toll Operators.

The TOS should also have the required legal language that allows the third-party the right to represent the User and inquire, dispute, and generally interact with the Toll Operator on behalf of the User.

Suggested Legal Requirements

Third-Party to Consumer Requirements

Terms of Service (TOS)

Toll Operators, at a minimum, should require language in a third-party's TOS that includes the following:

- Clearly identifies for the consumer who to contact when there is a dispute or problem with the account
- Clearly identifies that using the third-party toll account does not absolve them of any Toll Operator or state rules, laws, or regulations.
- Clearly defines that by using the third-party the User is authorizing the Toll Operator to exchange information with the third-party as it relates to a customer's account, as well as allowing the third-party to act on the consumer's behalf to inquire and resolve toll transaction issues.

Toll Operator to Third-Party

Base contractual legal language that provides the Toll Operator the ability to share transaction information with the third-party vendor, and for the third-party vendor to share account information with the Toll Operator for consumers participating in a third-party account management program.

Base contractual language that provides Toll Operators the indemnifications and legal language they require to absolve them concerning issues arising between the third-party provider and the User. Language should be generic in nature and broad enough to cover most if not all Operators.

Technical Considerations

This section will break down the pros and cons of existing technologies. Evaluations include:

- Real-Time versus Batch ICDs and considerations or best practices for engaging third parties using each type of interface.
- Processing order and ways to honor the User's choice for account management.

Real-time vs Batch Interfaces

Realtime processing consists of a webservice interface (or similar) between two systems that have a set protocol for sending inquiries or data and receiving back responses or acknowledgements. The advantage of a real-time interface is that both systems can communicate between each other in a near real-time manner, therefore, eliminating any delays in posting of transactions. A primary disadvantage of this type of interface is if the system is down or the communications link is offline, the two systems are unable to communicate until service is reestablished, and thus information about the account is not updated. In addition, real-time systems typically require higher bandwidth networks and higher operating and maintenance costs.

Batch processing is the packaging of data in electronic file format (CSV, XML, etc) and sending this data to another system for processing. After receipt, the receiving system sends back an acknowledgement of receipt and after processing, the receiving system normally sends back a reconciliation file. The advantages of Batch processing are that the systems can send and receive files even when the primary system is offline. Once back online the system can process the files without any interruption to the Batch service. The disadvantage of this type of interface is that it may take several days to post transactional data and receive confirmation. Thus, account information is not, in general, up to date since recent transactions and payments are not included.

Processing Order

Processing orders should be structured to honor the consumer's choice for account management. Historically, in most cases, Toll Operators process tags first and foremost. After tags, the processing order can vary from Operator to Operator. This can be problematic if a User wants to assign a license plate based or iToll account to a rental or temporary vehicle, especially if a toll tag is already on the vehicle. If a User also has a tag account that they would like assigned to the vehicle, the same issue occurs.

Technical Service-Level Agreements (SLAs)

This section discusses suggested minimum SLAs required for third-party providers.

Service-Level Agreements (SLAs)

Service-level agreements (SLAs) should be required for the third-party to ensure that Users do not experience significant down times related to a third-party solution, or that any technical issues are dealt with in a timely manner.

While the exact SLAs will be developed over the course of introduction of a third-party CSC, there are some primary SLAs that can be applied generically with a focus on system availability for a third-party provider.

It is important that transactions are processed and posted in a timely manner in order for the true account status to be updated to other systems. This will further drive toward a Guaranteed Toll model (more on this below). Once a system updates the external parties of an account status, the reporting system will have guaranteed that any tolls that are sent will be accepted and posted to the account as long as the account is reported in good standing.

Processing order becomes increasingly important as the transactions for a given customer will have to post to the correct account. For example, as in the case of rental cars or short term lease vehicles (Car-To-Go), there could be multiple Users in one day. A Real-time interface becomes more important as these technologies and User behaviors change.

Another significant area to consider is Customer Service, the question of “who” owns the customer specifically during a complaint or dispute situation is important as the customers should not be passed around from party to party. To keep the customer’s interests as the focal point, each party will be required to have an escalation tree and appropriate contact details so that a customer can quickly be evaluated and directed to the appropriate party for questions and/or resolution.

Guaranteed Tolls

While most third-parties guarantee the toll, this becomes a risk for third-parties in the absence of a real-time interface. In the case of a misclassified or invalid toll posted to a third-party User’s account, without sufficient details from the Toll Operator (a picture of the vehicle, or transactional information), the third-party that guarantees the toll is at risk for not collecting from the User and must absorb the cost which can be significant)

Exceptions may occur: For example, tolls over “X” days old may not be guaranteed; or tolls lacking backup, no image for an image toll, or no transactional information when there is a dispute over classification, could be rejected.

Processing Order

Processing order is a major factor in today’s tolling environment and will become increasingly more important as autonomous, shared-use, and short-term rentals become more prevalent.

Transaction processing order ultimately affects the customer and should reflect the customer's choice for payment.

In some cases, vehicles or the responsible-party, may be on two or more third-party fleet accounts. The determination of which account should receive a given transaction, should be based on 1) The interest of the User, 2) The interest of the Toll Operator, for example using real-time account status to determine financial responsibility; This approach promotes competition and honors the User's choice for account management and toll payment. Implementing a real-time interface for registration and account status updates, combined with posting transactions to the account based on real-time reporting ensures that the User has a choice. Competition for the User includes customer service options and lower cost tolls and account management. Real-time updates and honoring the User's choice decreases customer service issues and ultimately, lowers costs for the Toll Operator

Customer Service

Customer service considerations include system outages and technical issues that affect all customers. System messaging and monitoring that includes notifications to third-parties is a helpful tool as third-parties providing customer service to account holders can help message Users and alert them of system issues. This helps with public relations and should be considered when engaging a third-party.

Suggested Technical Requirements

The following are suggested technical considerations.

Hub / Portal Functionality

Ideally, third parties would connect through a single interface to provide services to all Operators. Likewise, Operators should have a single source to access third-party solutions. This functionality would be provided by a portal or hub, which would aggregate all third-party services via common interfaces.

For example, the third-party business rules, would be transparent to each Operator because all accounts come through a common interface using standard business rules. Likewise, with services like ALPR, which may be provided by multiple third-parties, using a common interface. Each Operator would be able to select and change ALPR providers without the need to change interfaces.

Real-Time Interface

Ideally, the goal would be for all interfaces to function in real-time or near real-time. However; at this time many systems do not support real-time interfaces. Where that is the case, legacy batch interfaces will continue to be used until it is possible to upgrade the system to real-time.

Support for Legacy Hub interfaces

In some cases, the system may be interfaced directly to legacy interoperability hubs or indirectly to hubs via a Toll Operator. While legacy hub interfaces may not be ideal, this may be required in order to provide access to some Toll Operators. Issuers should be made aware of any latency incurred as a result of hub “hops”. Two “hop” interfaces may introduce delays up to 24 hours per hop, making it more difficult if not impossible to determine when account statuses have been updated at a Toll Operator. Acknowledgement of account status, with a time-stamp, should be pushed back to the original third-party provider.

Consumer Expectations

Users want to travel the Operator's facilities and experience a seamless way to pay. Toll Operators want Users to pay for using the facility and experience a safe, expedient trip. Their goals are usually aligned.

However, the evolution of tolling practices and technology has brought about many challenges for various groups of Users, to establish and maintain an account.

For some Users, the removal of cash collection from the roadside, also removes the ability to conveniently pay for the road. These Users are most commonly:

- Untagged/Infrequent Users
- Cash-based & Underserved Users
- Rental Vehicles

Third-party providers can offer a User an opportunity to establish and maintain a toll account when they are challenged by participating within the constructs of the Toll Operator's existing back office, customer service program(s), and/or business rules.

When engaging a third-party, typically, Toll Operators often have specific concerns about the relationship between the third-party and the User including:

- Customer Service – how will my customers be treated?
- User Terms and Conditions or Terms of Service – are the correct TOS in place that provide the third-party the ability to work with the Toll Operator on the User's behalf.
- Customer Service SLAs
- Marketing and Customer Messaging

It is important to note that often these items cannot mirror a traditional back office/operations offering, but rather take on the requirements and needs of the solution the third-party is offering to the type of customer they are serving. For example, app providers may provide all their support through the app and not require a call center. Therefore, when possible, minimum requirements should be established without providing a prescriptive approach to customer service requirements.

Below is a breakdown of these critical elements and suggestions for base or minimum requirements.

Customer Service

Toll Operators often have concerns about the support needed to manage an account. At a minimum, Operators who implement third-party systems are often concerned that, while the third-party may handle customer service, what are the potential implications to their programs including:

Q. Will users understand who they need to contact if there is an issue with their account? (third-party versus Operator)

Q. Will the customer clearly, understand that the third-party is handling customer service for the account?

A. Messaging is critical to the User. The User should understand that the Toll Operator is providing the toll road service, while the third-party, as the account issuer, is responsible for any issues or questions related to their account. A good example of the delineation of Service, Account Issuer, and Customer is the retail model. Messaging should focus on the responsibilities of each party.

- The **Toll Operator's responsibility** is to provide a quality product/service.
- The **User's responsibility** is to pay for the product/service using an acceptable form of payment.
- The **Account Issuer's (third-party) responsibility** is to ensure that payments are remitted to the Toll Operator on behalf of the User, as well as to provide support to the User for any account issues.



Q. What does account management look like?

A. Account management should, at a minimum, provide the User with tools to establish, update, and change the account information. The level and type of account management is dependent on the type of User the third-party is servicing. However, account establishment and management should include all necessary information required to:

- Identify the User
- Identify the vehicle being used
- Any other information critical to driving the road

Q. How do fees play a factor in third-party account management?

A. Fees can be a complex component as there are many factors to consider. As with a retail model, the more ways to pay provides the User more choices to manage their accounts. To that end, the element of competition becomes a distinct factor and the market will drive pricing and customer service. Just as some credit cards offer different interest rates, annual fees, special rewards and promotions, and some do not. Users get to choose if the benefits and fees are appropriate to their needs thus, driving competition.

In the case where there is more than one provider of the same type of service, Users can choose the best type of account management that fits their needs and wants. If a provider is offering a service with associated high fees, the User has the option to determine if that service is acceptable and the fees justified.

For example, grocery and food delivery has become extremely popular. Users can order food, and have it delivered for a fee. Arguably the cheapest way to get said food is to go to the store or restaurant and purchase the food yourself. However, delivery is more convenient in some cases. The ability to simply make a purchase online and have it delivered is, to some, worth the associated fees and cost.

Consider banking services as yet another example. Banks all offer the same base services related to account management. When choosing a bank, Users tend to look past the base services and focus on additional offerings as well as associated fees. Does the bank offer an app for account management? Do they provide paper or electronic statements? Do they provide additional services? There are usually bells and whistles that are attractive to that particular User, which factors into their choice.

Another factor for consideration is legal. For some Toll Operators, fees are regulated at a maximum. For example, some Operators do not allow more than a \$2 fee to be imposed for services outside of the cost of the toll. In such cases, the third-party model must fit within the financial confines of the legislated requirements or the governing body that oversees tolling. This should be a consideration for Toll Operators when engaging a third-party.

Finally, much attention should be paid to third-parties where there is a lack of competition. While the third-party may provide a solution to a group of Users who are challenging for a Toll Operator to capture, for example the rental car industry, services associated with high fees and a lack of competition can be difficult for Toll Operators to manage under public scrutiny.

Q. How are disputes handled?

A. Third-parties can be valuable in vetting and handling disputes for Users. In the case of a third-party representing a User, the third-party should have the ability to submit a dispute and help work to resolve the dispute. As in the retail model, if a User experiences a charge that they deem inappropriate, the User will call their credit card issuer or bank. The bank will submit a request for proof of purchase in order to resolve the dispute.

In the case of tolling disputes, there should be a process for the third-party to request proof of the transaction in question such as an image of the vehicle or other supporting transaction information.

In addition to advocating for and managing the User, third-parties can also provide a valuable first line of customer service and “buffer” for Toll Operators. The third-party should be able to perform initial research of the User’s account to determine such things as: the vehicle’s license plate registered correctly to the account, correct axel count, confirm the account was properly funded at the time of the transaction in dispute. This initial evaluation of a dispute saves the Toll Operator resources and time by ensuring that a dispute is deemed reasonably valid prior to involving the Toll Operator. The third-party should also collect the proper information prior to involving the Toll Operator such as a copy of the violation, bill, or notice from the Toll Operator. The third-party should also collect all the pertinent account information such as tag ID, license plate number, and any other required vehicle information.

Suggested Standard Terms of Service

Customer service also encompasses clearly defined contractual obligations between the account holder (User) and the account issuer (third-party). The following sections provide considerations for standard Terms of Service elements that should be included in a consumer facing agreement.

Each third-party should have a Terms of Service (TOS), Terms and Conditions, or some sort of contractual relationship with the User. The agreement should define requirements, roles and responsibilities of all parties involved, particulars related to the management of the account, and the goods or services provided. Suggested inclusions in TOS agreement are:

- Definitions – as terms vary, it is helpful to define the components of the product and/or service. There are many terms to define, examples include:
 - Video Tolls. A Video Toll (“V-Toll”)
 - Dispute
 - Violation
 - Transponder, Toll Tag, Sticker Tag

There are many other terms to define, these are just examples.

- Privacy and personal information handling – the agreement should include a section that clearly identifies how a User’s information is handled as well as disclosures if a User’s information will be shared or sold to additional parties for purposes outside of the intended service. For example: use for general marketing,

the marketing and sale of addition services, or other.

- Responsibility to the Toll Operator – language that lets the User know that each Toll Operator has various rules and laws for using their system. Signing up for a third-party service does not in any way absolve the User from their responsibility to operate within the conditions and requirements of the Toll Operator. For example, if a User has previous violations or outstanding debts that have been unpaid/uncollected, using the services of the third-party does not absolve the User from their previous debts. In addition, some Toll Operators do not allow a User to drive their road until all debts are paid. The language should remind users of their obligation to understand the rules and requirements of driving the respective roads, as well as the conditions in which the Toll Operator will consider them a valid User.

This also could apply to fleets as Users continue to use the road through a fleet provider. Toll Operators and third-parties should work together to resolve outstanding debts incurred by a User in order to prevent the User from changing accounts merely to avoid fees and fines by one or more providers.

Suggested legal language is included in the Legal section of this paper.

Customer Service SLAs

Customer service is an important aspect of each third-party offering. The type of customer service offered is often directly related to the type of solution it supports. While it's important to allow third-parties the flexibility to architect their own customer service solution, Toll Operators require some assurances that:

- Users are not taken advantage of or charged unnecessary or exorbitant fees.
- Users will have the necessary tools to manage their account.
- Users are being charged within the guidelines and legal statutes of the Toll Operator and governing body.
- The third-party's offering will not generate bad publicity

Account Establishment

In order for the third-party to provide account service, key information needs to be captured and made available to the Toll Operator. Third-party Service Providers should establish a method or process to on-board a User that obtains the required, pertinent information. This information may vary depending on the solution (tag versus license plate, etc.). Suggested components of information include:

- Tag ID
- License Plate
- A way to identify the account holder - account number or other
- A way to contact the account holder
 - Email
 - Phone
 - Mobile Phone
 - Address

Customer Service Support

Customer service support is defined in this section as the tools required for a User to reach the third-party when they are establishing an account, have questions, or have a dispute. The customer service tools will vary from third-party to third-party however, should be substantial enough that the customer understands that they should contact the third-party provider for any issues rather than the Toll Operator. Tools will likely vary with one, two or any combination of methods listed below.

Minimum channel requirements should include any combination of the below:

- IVR
- Customer Service Call Center
- Phone Application
- Website for Account Management
- Text Message Support
- Email Support
- Walk-In Customer Service Center

Dispute Handling

When addressing a dispute, the Toll Operator and third-party provider must work together to determine if the dispute is valid or not. As previously mentioned, when a User disputes a

transaction, third-party providers can be an excellent first line of defense. In the case of an issued violation, pay-by-mail bill, or mistaken transaction, the third-party provider should be able to determine if the dispute is reasonably valid and should be submitted to the Toll Operator. A few factors in the initial determination of a valid dispute include:

- Was the User's account funded at the time?
- Was the correct vehicle information associated with the account?
- License Plate
- Make/Model of the Vehicle
- Number of vehicle axels or vehicle class
- Does the violation or pay-by-mail notice match the User's account information?

All of these elements should be reviewed and confirmed prior to contacting the issuing Operator or the third-party's home Operator. Once the account elements of the dispute have been confirmed, the dispute process should be pursued.

User's expect the same level of customer support from a Toll Operator as other customers who have direct accounts with the Operator. The User expects that the dispute will be investigated in a timely manner, and that the transactional details and images are provided as proof that the User was charged correctly or incorrectly. In order to achieve this, the Toll Operator and the third-party must work together. Suggestions for dispute handling are described in detail below.

Initiating A Dispute

It is critical to clearly define within the Toll Operator and Third-Party agreement a process for dispute handling. The following should be included as part of the process.

Contact

The third-party provider should clearly understand who their initial contact is to initiate the dispute. Should the third-party reach out to the Toll Operator in question or to their Host Operator in order to initiate the dispute? This can differ depending on interoperable agreements and the rules or policies for governing disputes

- There should be a designated person or contact email assigned to the third-party, specifically for disputes.

Submission & Response Time

There should be a defined process associated with the submission of the dispute as it relates to the required information, To and From, the Toll Operator and third-party provider. Timing is an important element in the process as the User will want a quick response and speedy resolution to any issues. Response times should be defined for the following:

- How long after a transaction is posted can the User issue a dispute? This is likely dependent on how long the Operator keeps transactional information, e.g. Images, transaction data including axle count, date, time, and location of the transaction, etc.
- If a User is issued a violation or pay-by-mail notice and the notice ages into collections, can the User still dispute the transaction through the third-party and the Operator, or will they have to address the notice with a collections firm since the dispute was not made in a timely manner? These are important to define for the third-party and for the third-party to communicate to its Users.
- How long does the Toll Operator have to investigate and address the dispute? It is important to set expectations with the User for a timely response. This could be dependent on the type of the dispute and should be defined.

Required Information: Third-Party Provider

Clearly defining the information required from a third-party provider in support of the dispute is important as the Toll Operator will need evidence that the dispute is considered valid. Suggested required information includes:

- A copy of the violation or pay-by-mail notice if the dispute involves an invalid notice
- A copy of the User's account information including:
 - License Plate
 - Tag ID
- Proof that the account was in good standing/funded at the time of the transaction(s) in question.
- Any other information the Toll Operator deems appropriate in order to conduct their investigation into the dispute.
- A brief narrative or description of the reason for the dispute.

Required Information: Toll Operator

Toll Operators should provide the same type of information that they would provide to an existing User who has an account directly with the Toll Operator. Depending on the dispute a Toll Operator should be able to provide the following information:

- Image of the vehicle and transaction – this information is undisputed proof that the vehicle in-question is or is not the correct vehicle. The license plate should be clearly visible and match that of the User's. The image of the vehicle will also provide valuable axle count information.
- If the image does not match the tag registered, the transaction should be further investigated to determine if the tag was moved to an unregistered vehicle.
- Transaction information – date, time, location of the transaction, vehicle classification.

See a sample overview of suggested information to initiate and resolve a dispute.

Third-Party Initiates Dispute

From: Disputes@ThirdParty.com
Date: Monday, September 30, 2019 at 2:10 PM
To: Support@TollOperatorUSA.com
Subject: Violation Dispute

Hello,

The below User received a violation notice (copy attached). According to our records, the User's account was funded and in good standing when the violation notice was issued. Please research the dispute and provide the results of your findings.

Tag ID: USA123 456 789

Vehicle License Plate: ABC 999

Account Balance (date of transaction dispute): \$50.00 (*attach pdf of account overview with funds noted*)

Regards,

Third-Party Supervisor
888-888-8888

Toll Operator Dispute Response

From: Support@TollOperatorUSA.com
Date: Monday, September 30, 2019 at 2:14 PM
To: Disputes@ThirdParty.com

Subject: Re: Violation Dispute

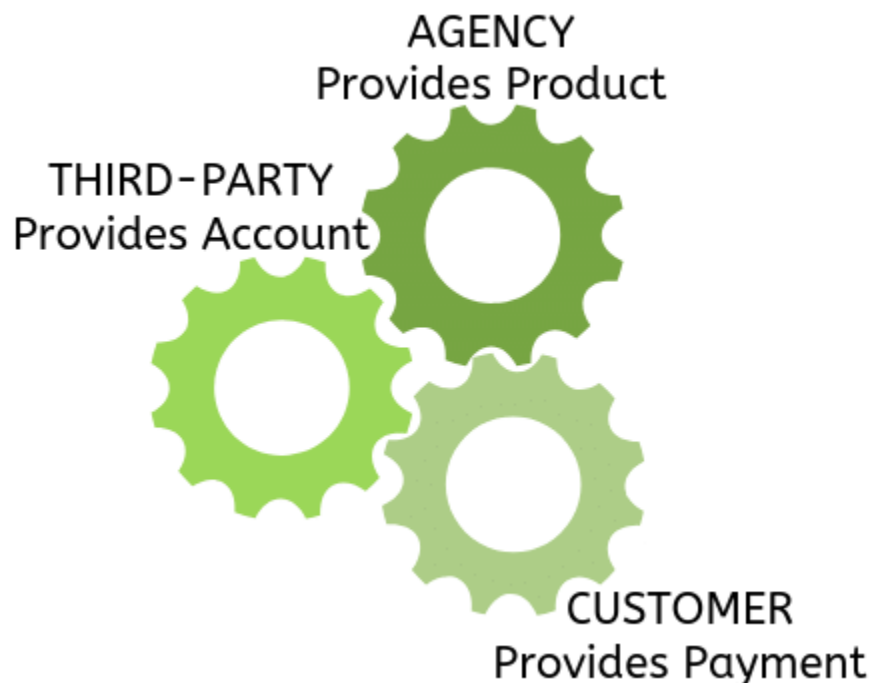
Good afternoon,
The User received a violation notice in error. The vehicle image does not match the User's vehicle.
OR
The violation is valid as the Tag ID associated with the vehicle in question does not match the license plate given.

Regards,
Toll Operator Supervisor

Dispute processes will likely evolve as technology evolves and processes become more efficient, and perhaps, even automated.

Marketing and Customer Messaging

Marketing and customer messaging are important and sometimes complicated elements based on the User, Toll Operator, and third-party provider relationship dynamics. The basic relationships between the three can be complicated as they are not one-to-one relationships.



Customer messaging should take on the appropriate roles and responsibilities of the User, third-party, and Toll Operator as described below.

- The User is responsible for keeping their account in good-standing with the third-party.
- The User is responsible for paying for the usage of the Toll Operator's road.
- The third-party is responsible for providing account information to the Toll Operator. The third-party is also responsible for providing the User tools to manage their account.
- The Toll Operator is responsible for providing a sound product (the toll road). A Toll Operator is also responsible for providing dispute tools and transactional information to third-party providers to support the end User.

Suggestions for creating successful messaging to consumers are described below.

New Solution Launch: Press, Media, and Marketing Considerations

Leveraging media and press for the launch of a new solution can provide a big boost to a Toll Operator's reputation and to the third-party's ability to gain new customers. As the third-party is usually a completely separate operating entity, the Toll Operator and third-party should create a sandbox environment of agreed upon messaging, logo use, and other elements that are important to each respective party. See below, examples of a sandbox environment:

- Approved logo usage – this can be as broad as a branding guide or as specific as how the logo is used in conjunction with the third-party offering, including placement on their website or in marketing ads
- Defined audiences – clearly define who the third-party product is targeted to, in order to define the proper and not competing or conflicting messaging. Messaging suggestions include:
 - Toll Operator's reason for engaging the third-party
 - List the differences between the Toll Operator's offering and the third-party's offering so the User can make an informed choice for account management
 - Talk about how to engage or contact the third-party provider so the Toll Operator is not overwhelmed by Users looking to sign up for or ask questions about, the third-party solution
 - Define any required approvals for marketing or creative

Presenting a partnership approach can be incredibly beneficial not only for the Toll Operator and the third-party, but the User as well.

System Maintenance, Outages, Toll Operator Issue Considerations

As with Toll Operator managed User accounts, third-parties should also be considered when communicating to Users about toll system issues. Third-parties often experience increased customer service calls and interactions with their Users when there is an issue with the Toll Operator's operations or system. This can be a road closure, system maintenance downtime, system outage, delays in transaction posting, or other issues. Clearly communicating this to third-party providers in a timely manner can create an opportunity for the third-party to proactively address Users in order to avoid any negative press or customer issues.

Providing appropriate and approved system issue messaging for the third-party to release or share with their Users can be extremely helpful. As with most Toll Operators, third-parties also participate in social media and can help reach a large number of Users for communication purposes which is a valuable tool as well.

Suggested Next Steps for Customer Service

- Create a clearly defined, standard process for dispute handling
- Create standard SLAs for customer service handling
- Create a suggested Sandbox for messaging and marketing

Summary & Suggested Next Steps

In summary, engaging third-parties can be extremely valuable to Operators. The key to success is based on clearly defining roles, developing the proper contracts and legal. Agreements, the implementation of a solution that is technically sound, and creating a program where the User engages for the benefit of capturing payments. While this paper focuses on various types of third-party providers that we are currently seeing in the industry (app based, third-party tag issuers, license plate based), the need to continue to expand on this topic becomes more relevant as Connected and Autonomous/Connected Autonomous Shared and Electric (CAV/CASE) vehicles emerge.

IBTTA Board – Suggested Next Steps

Below are suggestions for continuing the work related to Operators who choose to implement third-party solutions.

Legal/Contractual Next Steps

- Develop Standardized Agreements for Commercial Fleet Accounts
 - Commercial fleet accounts operate differently than consumers. As such, the agreement should reflect the needs and requirements of these particular Users, the organizations they represent and the types of vehicles that use the roads.
- Develop Standardized Agreements for Consumer Fleet Accounts
 - Consumer facing accounts should ensure that all parties involved are protected, have a fair and equitable approach, as well as defined User support roles.
- Base contractual legal language that provides the Toll Operator the ability to share transaction information with the third-party vendor, and for the third-party vendor to share account information with the Toll Operator for consumers participating in a third-party account management program.
- Base contractual language that provides Toll Operators the indemnifications and legal language they require to absolve them concerning issues arising between the third-party provider and the User. Language should be generic in nature and broad enough to cover most if not all Operators.
- Develop Recommended Procurement Processes for Third-Party Providers

- While procurements for fleet providers have typically not been required, at a minimum, fleet providers or third-party providers should meet minimum standards and requirements. This may not require a full-blown procurement however, a standardized “application” that requires all relevant information could be valuable.
- Procurement
 - An important aspect of this process is to explore the procurement process. Third-party offerings are often not appropriate for a competitive process against other third-party providers. Their systems and solutions differ and therefore, an open procurement with benchmarks, such as those listed in this document, should be the measure.
 - Standardized interfaces will vastly help facilitate the procurement process as a standardized interface will provide a baseline for adhering to business rules, audit, and reconciliation requirements.

Technical Next Steps

- Develop a Standardized ICD for Commercial and Consumer Fleet Accounts
 - Suggest the development of a Standardized ICD(s) in conjunction with the interoperability committee members.
- Develop the ICD using standard, transparent Business Rules for Adoption
- Baseline business rules should be included in the ICD.
- Create minimum, required SLAs for Third-Parties
- Standardized SLAs related to third-party solutions: e.g. downtime and technical issues

Customer Service Next Steps

- Develop Minimum Required SLAs for Third-Parties
- While customer service varies by solution, standardized SLAs related to response time and capability to service and support the User for account management, issues, or disputes should be developed.
- Develop standard guidelines, considerations, and best practices or use cases for

media & messaging to Consumers

- This is important as the industry continues to embrace third-parties. Standard guidelines for messaging protects the Operator, facilitates support for third-party solutions, and lends credibility to the overall third-party program. In addition, there are opportunities to capture positive PR and reinforce the Operator's commitment to its customers. There are emerging use cases and lessons learned that the industry should begin to record and refine.
- Service-level agreements (SLAs) should be required for the third-party Customer Service Centers as this gives assurance to each party that transactions will be sent and posted to accounts in a timely manner, and that account information be current in accordance with the agreed to SLAs.

Resolution to Elect New Members
To be adopted by the IBTTA Board January 10, 2020

Whereas Article II Section 2 of the IBTTA Bylaws stipulates that all members “shall be elected to the Association by resolution of the Board of Directors.”

Whereas the organizations listed below have expressed the desire to become members of IBTTA and have paid their dues;

Now, Therefore, Be it Resolved, that the IBTTA Board of Directors elects these organizations to be members in the Association in the membership categories designated.

Agency/Organization	Member Type	City	State	Country
Cepton Technologies, Inc.	Associate Member	San Jose	CA	United States
Compass Transportation and Technology	DBE/WBE/MBE/SBE Member	Potomac	MD	United States
Ford Motor Company	Associate Member	Dearborn	MI	United States
Gentex Corporation	Associate Member	Zeeland	MI	United States
IBM	Sustaining Member	Cambridge	MA	United States
Innovative Products LLC	Associate Member	Cherry Hill	NJ	United States
Peracchio & Company, LLC	Associate Member	Grosse Pointe Shores	MI	United States
Proponisi	Associate Member	Colleyville	TX	United States
RevSpring	Associate Member	Livonia	MI	United States
RRD	Associate Member	Croton on Hudson	NY	United States
SAP Public Services, Inc.	Associate Member	Washington	DC	United States
Valerann	DBE/WBE/MBE/SBE Member	London		United Kingdom

Resolution to Elect Directors to the IBTTA Foundation Board of Directors
To be adopted by the IBTTA Board of Directors
January 10, 2020

Whereas the IBTTA Foundation is organized to pursue education, research, charitable good works and other efforts in accordance with its Articles of Incorporation and Bylaws;

Whereas the following individuals have expressed interest in serving on the IBTTA Foundation Board of Directors and are deemed to be qualified to serve;

Whereas the Foundation bylaws specify that the “IBTTA Foundation Board of Directors shall be composed of at least six (6) members and not more than fifteen (15) members, who shall be appointed upon election by the IBTTA Board of Directors.”

Now, therefore, be it resolved that the IBTTA Board of directors elects the following individuals to serve as directors of the IBTTA Foundation for the terms so indicated:

- Federico Di Genarro, AISCAT (term ending 12/31/2022)
- Greg Le Frois, HNTB (term ending 12/31/2021)
- Tyler Milligan, Milligan Partners (term ending 12/31/2021)
- Jim Wilson, Transcore (term ending 12/31/2022)

**IBTTA AUDIT COMMITTEE
2020 GOALS**

Goal #1 – Work jointly with IBTTA Management to procure, through a competitive process, independent auditors for a multi-year contract.

Goal #2 – Oversee management’s progress in addressing the auditors’ Internal Control Assessment findings. This will include creating a tracking schedule that identifies the finding, management’s actions, person responsible, estimated completion date, and current status. Collectively, we’d update the schedule quarterly or prior to the Spring and Fall board/committee meetings.

Goal #3 – Work jointly with the Finance Committee to oversee management’s progress in implementing the action plan to address the Quadrant II risks identified by the Enterprise Risk Assessment.

Goal #4 – Review the Audit Charter to determine if the Committee has any recommended changes. Additionally develop an action plan to fulfill the responsibilities.



Bill Cramer
Communications Director, IBTTA

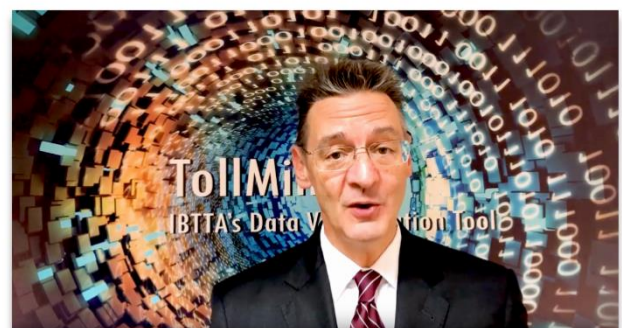
**YEAR END - 2019 METRICS FOR
IBTTA'S MOVING AMERICA
FORWARD CAMPAIGN**



traffic
TECHNOLOGY INTERNATIONAL



THIRD-PARTY VALIDATORS



Letter to the Board of Directors

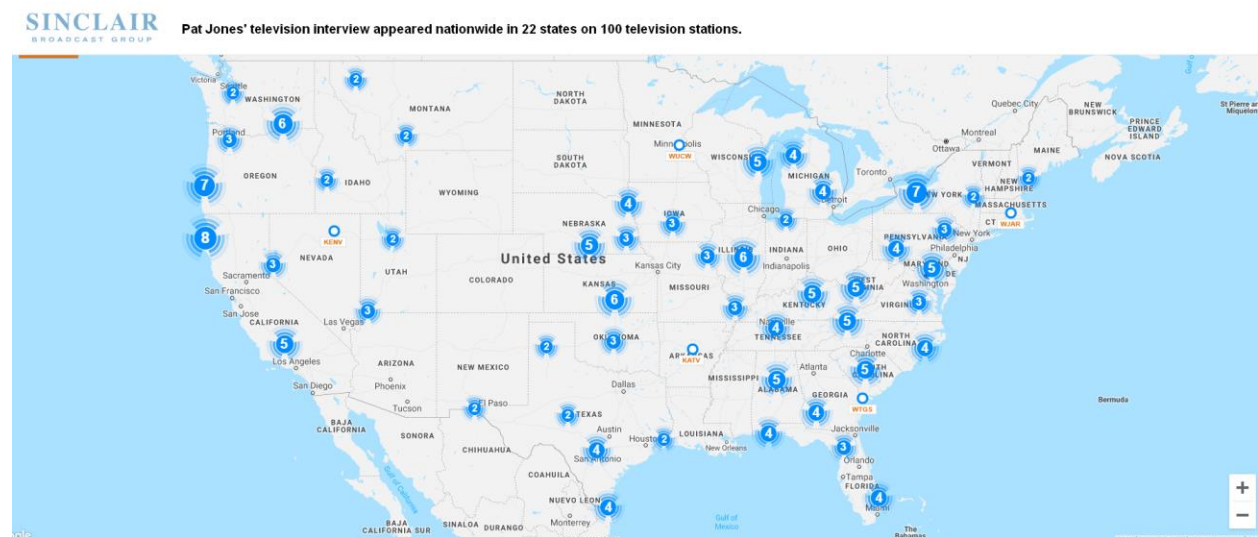
Dear Board of Directors:

When IBTTA's *Moving America Forward* public awareness campaign launched in 2013, we set an audacious goal for ourselves to elevate IBTTA's brand to a level where top-tier media would regularly seek us out as a trusted source. As the campaign enters its seventh year, the metrics included in this report demonstrate clearly the stellar reputation IBTTA has built over the last several years as a "go to" source for leading reporters, media outlets and opinion leaders throughout the transportation industry.

Let me share with you one quick example illustrating this trajectory. On July 23rd, IBTTA Executive Director and CEO Patrick Jones was quoted in an article in *The New York Times* on the advancement of all-electronic tolling. IBTTA's data, pulled from TollMiner, helped shape the story and show the advancement of cashless tolling. **The profile story on our industry not only ran in the hard copy of the newspaper, but also online and shared through *The New York Times'* social media account reaching 43 million readers.**

However, the July 23rd, 2019 story didn't happen in a vacuum. In fact, the story marks the **fifth straight year** IBTTA has been quoted in *The New York Times*.

In addition to *The New York Times*, a diverse range of leading media outlets continue to turn to IBTTA to help shape coverage as leading experts in the tolling industry and the broader transportation sphere. In 2019 alone, we have responded to media requests and been included in coverage with outlets ranging from *The Washington Post*, *The Boston Globe*, *The Seattle Times*, *Cincinnati Enquirer*, National Public Radio and Sinclair Broadcasting (the largest local TV broadcasting company in the country). The recent [Sinclair Broadcasting network story featuring Pat Jones discussing nationwide interoperability was picked up by 50 local TV stations in 22 states.](#)



Through the *Moving America Forward* public awareness campaign, we continue to build a robust, multi-tiered communications effort reaching audiences in a number of ways. Although top-tier, national media outlets are essential, we also understand that in this era of hyper-connectivity we can't simply rely on one communications channel to effectively carry our message. We continue to utilize effective tools in the communications' toolbox to amplify tolling as a proven, reliable and effective transportation funding option:

Social Media: Developed original content for more than 70 blog posts which are now being delivered into the email inboxes of nearly 4,000 individuals. In addition, IBTTA has a continuous presence to thousands of followers on Facebook, Twitter, Instagram, and LinkedIn where our message is carried to thought leaders and other influencers in our industry and the media.

IBTTA SmartBrief: In 2016, we created our own media distribution source, aggregating the top news of the day and promoting stories of interest to our industry. In 2019, we have grown our distribution of IBTTA SmartBrief by 32 percent helping to disseminate stories of interest, including IBTTA original content highlighting TollMiner, meetings, webinars and reports. IBTTA SmartBrief also brings in a modest amount of non-dues revenue.

Third-Party Validators: It's one thing for IBTTA to communicate a pro-tolling message, but it's another to have independent, third-party validators amplifying our message. Since the launch of the *Moving America Forward* public awareness campaign, we have seen a steady rise in validators communicating our message of support for tolling. This year we began capturing and cataloging those who have spoken out in support of tolling through studies, reports and in the media.

Network of Industry Communications Professionals: We continue to find ways to connect and engage a network of communications professionals throughout our industry to share best practices and ideas to more effectively communicate our message and benefits. We created specialized distribution lists, where top professionals receive critical information in real-time that is simultaneously being pushed to the media.

One of the proudest accomplishments of this year's *Moving America Forward* public awareness campaign has been our ability to amplify the incredible work of our members. On frontlines around the globe, IBTTA members continue to exemplify the power of toll-financed infrastructure. From the launch of cutting-edge, new transportation technologies to system integrations delivering better customer results, IBTTA members have an important story to tell and we're helping share it with the world.

Through customized press releases and personalized pitching to local media outlets throughout the world, this year's Toll Excellence Award winners reached record levels of media coverage. Over 20 stories in publications around the U.S. and internationally, [including a seven-page spread in *Traffic Technology International* featuring all six of the 2019 Toll Excellence Award winners.](#)

It's not only the work of our member agencies we are helping to promote, but also individual professionals in our industry. This year's 2019 Leadership Academy class were supported through individualized press releases to local markets helping to provide graduates with positive news stories about their careers. And future leaders, such as the five IBTTA scholarship winners, were promoted to their local and college publications garnering over a dozen media stories about the IBTTA scholarship – the most news coverage in the three-year history of the program.

We welcome your review of the following report, providing you with overall metrics, including detailed figures, data and statistics, serving as a measurement of the steady progress of IBTTA's communications efforts. These metrics, an important measurement necessary to effectively chart our course forward, outlines the growth and success we have accomplished together. Thank you for your continued support, both financially and through your personal efforts.

Sincerely,

Bill Cramer, Communications Director
International Bridge, Tunnel and Turnpike Association

U.S. and International Media Attention in 2019

Media

of press releases - 31 (34 in 2018, 24 in 2017, 39 in 2016, 21 in 2015, 45 in 2014, and 35 in 2013)

of press advisories - 4 (6 in 2018, 8 in 2017, 9 in 2016, 7 in 2015, 10 in 2014 and 10 in 2013)

of one-on-one media interviews - 32 (50 in 2018, 49 in 2017, 56 in 2016, 50 in 2015, 85 in 2014 and 47 in 2013)

Please see a list of interviews in the Attachments Section of this report.

of media hits mentioning IBTTA and tolling – 3,739, plus 2,960 social media posts --
Meltwater Tracking
(2,500 in 2018, 1,235 in 2017, 1,140 in 2016, 1,050 in 2015 and 1,200 in 2014 using Bloomberg tracking, 1,374 in 2013 using Meltwater tracking)

High-value media relationships maintained with:

Winnie Hu, *The New York Times*
Scott Horsley, NPR
Luz Lazo, *The Washington Post*
Joan Lowy, Associated Press
Mark Niquette, Bloomberg News
Max Smith, WTOP
Brianna Gurciullo and Sam Mintz, *Politico Morning Transportation*
Kellie Mejdrich, *CQRoll Call*
Melanie Zanona, *The Hill*
Sean Sloan, Council of State Governments
Daniel Vock, *Governing*
Jason Ruiter, *Orlando Sentinel*
John Chesto, *The Boston Globe*
Sarah Wynn, *The Bond Buyer*
Mark Willis, Sirius XM Radio - Mad Dog Truckers Show
Elaine Povich, *Stateline* – The Pew Charitable Trusts
Adam Hill, *ITS International*
Tom Stone, *Traffic Technology International*
Jack Roper, *Traffic Technology International*

Major media placements:

Associated Press
NPR – All Things Considered
The New York Times
The Washington Post
Washington Times
USA Today
Atlanta Journal-Constitution
Los Angeles Times
Orlando Sun Sentinel
The Boston Globe
Forbes
Economist
Bloomberg News
The Bond Buyer
Politico
Politico Morning Transportation
Governing Magazine
CQRollCall
The Hill
Traffic Technology International
Transport Topics
ITS International

Internationally featured articles placed in:

ITS International (4)
Traffic Technology International (1)

Top five countries mentioning IBTTA in the media:

- USA
- Brazil
- Italy
- United Kingdom
- South Africa

Top trade publications with the highest number of IBTTA mentions:

IBTTA SmartBrief
ITS International
AASHTO Update
Traffic Technology International
Construction Equipment Guide
OverDrive

of Op Eds - 1 (3 in 2018, 3 in 2017, 6 in 2016, 7 in 2015, 7 in 2014, 6 in 2013)

The Hartford Courant

Social Media

Seven years ago, IBTTA began following conversations on social media, then creating and developing our own content. IBTTA's social media presence now provides an opportunity to engage with members, interact and share information with reporters, and introduce tolling to others outside the transportation community. For the past several years, we have been attracting followers such as congressional leaders and staff, a wide selection of transportation specialists and reporters covering Capitol Hill, and international, national and state media.

Tolling Points - Blog Posts

IBTTA published 70 original content blog posts on *Tolling Points* from January 1 to December 17, 2019. In June, we moved from posting two per week to one a week, and we send that one post directly to our members inbox via email. **(100 in 2018, 92 in 2017, 94 in 2016, 75 in 2015, 70 in 2014, 50 in 2013).**

IBTTA's blog traffic grew by 80% in 2019, with an average of 1,932 monthly page views in 2019. **(1,068 monthly page views in 2018, 961 monthly page views in 2017, 812 monthly page views in 2016, 609 monthly page views in 2015, 522 monthly page views in 2014, and 460 monthly page views in 2013.)**

The main objectives of IBTTA's blog are to:

- Continue to use the blog as a tool to position IBTTA as a thought and opinion leader, by delivering substantive, analytical content that advances the dialogue on transportation infrastructure finance, while making the case for tolling as a key tool in the funding toolbox;
- Provide a consistent cornerstone for social media activity that will steadily build IBTTA's online community;
- Deliver a sustained promotional push and buzz for IBTTA conferences;
- Highlight state-level opportunities and initiatives that could lead to increased reliance on tolling or mileage-based usage fees across U.S. jurisdictions; and
- Profile tolling milestones and achievements outside the United States.

Top 10 *Tolling Points* Blog Posts in 2019

- 1 – Regan Wins Top Honors for Future of Mobility Video
- 2 – Pennsylvania Court Case Sheds Light on Long Running Toll Revenue Saga
- 3 – Florida's New Secretary of Transportation Shines
- 4 – 122 Billion More Miles Driven in 2018
- 5 – Milligan Partners Introduces Blockchain for Toll Interoperability
- 6 – Long Game Wins the Day: Tolling Projects Bloom Across U.S. States
- 7 – America's First Worst Road Trip Celebrates 100 Years
- 8 – Get to Know IBTTA's 2019 President Christopher Tomlinson
- 9 – At 80 Years, Thousand Islands Bridge System is a 'Living, Breathing Thing'
- 10 – 95 Express Lanes in Virginia Host Successful Cooperative Automation Trials

Twitter

The number of Twitter followers increased 6% in 2019 to 5,234. (4,929 in 2018, 4,494 in 2017, 3,640 in 2016, 2,600 in 2015, 1,654 in 2014 and 901 in 2013.)

Twitter followers' profiles:

Gender: 57% men, 43% women

40% completed high school; 40% completed college; 20% completed graduate school

23,028 Clicks (Clicks increased by 2%, from 22,417 in 2018)

618 Retweets (Retweets decreased by 28% from 863 in 2018)

Facebook

We placed 302 posts on our Facebook page in 2019. "Likes" on the page increased 5% in 2019 to 771. (732 in 2018, 650 in 2017, from 599 in 2016, from 471 in 2015, 403 in 2014 and 202 in 2013.)

Facebook followers' profiles:

Gender: 72% men, 27% women

Top three countries: United States, Nigeria and Italy.

Clicks: 2,189 clicks for a 13% increase in 2019. (1,932 clicks in 2018)

Actions: 732 actions for a 23% increase in 2019. (594 actions taken in 2018)

LinkedIn – Two Sites

On IBTTA's LinkedIn Association/Company page, there were 259 postings. Followers increased by 59% to 1,317 in 2019. (828 in 2018, 577 in 2017, and 476 in 2016, 329 in 2015 and 201 in November 2014.)

1,574 clicks in 2019, a 12% increase. (1,400 in 2018)

1,239 actions taken (liked, shared, commented, a 59% increase in 2019. (779 in 2018)

On IBTTA's Campaign for the Tolling Industry LinkedIn page, there were 154 postings.

Followers grew 17%, to 694. (591 in 2018, 507 in 2017, and 446 in 2016, 416 in 2015, 348 in November 2014 and 246 in November 2013. This site continues to grow slowly, with industry professionals from around the world reading and posting discussions.

Instagram

There were 168 posts, with a 59% increase in followers, to 267 in 2019. (176 followers in 2018, 102 followers in 2017 and 58 followers in 2016.)

Website

One of IBTTA's major communications goals is to serve as the credible source for the tolling industry by providing comprehensive information and data easily accessible to members, media, elected officials, policymakers and the general public.

Throughout 2019, we continually updated the [Moving America Forward Page](#) with revised statistics, data, maps, media kit, informational fact sheets and reports. We also posted press releases and more than 250 news articles on the [News and Media](#) section of the website to inform and educate.

Monthly Google Analytics for IBTTA Website -- Snapshot for 2019

	January	February	March	April	May	June
Page views	30,485	28,305	34,506	30,531	27,695	25,645
Sessions	15,012	15,705	17,691	16,430	14,001	12,822
Users	10,046	9,943	11,524	11,800	9,792	8,988
Average Time on Site	0:01:52	0:01:37	0:01:57	0:01:40	0:01:43	0:01:47
Bounce Rate	57%	60%	53%	61%	58%	57%
	July	August	September	October	November	
Page views	27,404	24,300	25,162	21,863	17,663	
Sessions	14,515	12,281	12,679	10,960	9,343	
Users	10,305	8,442	8,556	7,667	6,993	
Average Time on Site	0:01:41	0:01:50	0:01:48	0:01:45	0:01:43	
Bounce Rate	59%	57%	54%	60%	64%	

By Year

	2019	2018	2017	2016	2015	2014	2013
Page Views	293,559	312,594	284,947	234,691	212,644	231,376	249,196
Sessions	151,439	133,360	127,162	98,627	88,424	-	-
Users	92,646	83,872	78,607	57,987	44,047	39,654	49,215
Bounce Rate	58.11	55%	47.27%	42.20%	42.59%	41.33%	55.97%
Average Time on Site	1:46	2:17	2:23	2:42	2:36	3:27	2:56

Other Communications Initiatives This Year

IBTTA SmartBrief – The daily e-newsletter is sent to 3,987 individuals. It provides headlines, short descriptions and links to news of the day from around the globe. It has been very well received and provides members an opportunity to publicize and share their own news, efforts and successes.

Subscribers: 5,353 (3,987 in 2018, 3,863 in 2017)

2019 Unique Open Rate: 29%, 4 points above average (30% in 2018 and 25% in 2017)

2019 Click Rate: 9%, 6 points above average (10% in 2018, 10% in 2017)

(SmartBrief Average Open Rate: 25%)

(SmartBrief Average Click Rate: 3%)

Communication and Change Management Summit

This year, IBTTA offered a **Communication and Change Management Summit** in Seattle, in July. We had 183 attendees, a nice bump from the 150 attendees two years ago. We achieved our goal of attracting a more diverse (people of color, gender, age and experience) group of attendees. The Secretary of WSDOT and Mark Hallenbeck, Director of Washington State Transportation Center, Univ. of Washington served as luncheon speakers. There were four sponsors -- AECOM, Jacobs, Stantec and PRR -- exceeding our sponsorship budget by \$7,500. I worked closely with the Patty Rubstello and Kim Jackson, CMOs, Wanda Klayman and Ancilla Brady on companies to approach and companies that wanted to be involved. Most importantly, there was a high level of energy, engagement and excitement at the Summit. This also came across in a follow up survey where 71% said they were extremely satisfied with the Summit meeting their expectations. Some attendees are asking for this Summit to be held annually.

Communications Network for Communications Professionals in the Industry

I maintain and strengthen relations and communications with PIO, communications and marketing staff with toll agencies and vendors. The informal network provides a valuable resource for all of us to share information, challenges and solutions. A few examples include sharing information with one another on; Google ads, best practices on incentives to open toll accounts, record retention policies, cooperation with mapping companies, toll collector performance, etc.

Third-Party Validators

Created a list in both Word and Excel of third-party individuals that have spoken up via studies, reports and in the media about the benefits of tolling. We can build relationships with these individuals, quote them as non-traditional transportation advocates and call upon them as needed. Please see the list of non-traditional transportation advocates in the Appendix section.

Weekly Update Video

[Pat Jones released a weekly video](#) detailing the weeks' current happenings in the news and within IBTTA.

International Tolling Newsletter

The Communications Team assisted International Vice President Malika Seddi with the production and editing of [three international newsletters](#) that captured developments in the tolling industry around the world.

Conclusion

As demonstrated by the preceding information and data, IBTTA continues to make significant progress in raising national and international awareness about the work of our association, as well as the benefits of tolling and our valued role in the larger transportation industry. It is clear that IBTTA continues to serve as a leading and credible resource and thought-leader for the industry, elected officials, media and the general public. In 2020, as the Trump Administration and Congress tackle a Surface Transportation Reauthorization Bill and states continue their efforts to look for alternative funding options to deliver safe, reliable mobility, IBTTA is prepared and able to continue to expand our public awareness campaign.

My sincere thanks to a tremendous Communications Team

The success and progress of this public awareness campaign is made possible by the support and leadership from you, the Board of Directors, member input, our IBTTA colleagues and the communications team of consultants. My sincere thanks and appreciation to a great team of individuals who are creative and assertive in daily raising IBTTA's and the tolling industry's visibility and voice.

LUNA + EISENLA media – Brad Luna and Kristofer Eisenla
Smarter Shift Inc. – Mitchell Beer and Jenise Fryatt

Attachments for the Moving America Forward Report:

2019 Media Interviews and Inquiries and Capitol Hill Meetings and Testimony

January 8

Ed Blazina, *Pittsburgh Post-Gazette*

Imara Bright-Johnson, APCO Worldwide Cooper Tires

February 1

James Jaillet, *Overdrive Magazine*

February 7

Hannah Sparling, *Cincinnati Enquirer*

February 18

Nicole Fierro, NBC News 15, Mobile, AL

March 1

Zach Gorchow, Editor, Gongwer News Service/Michigan Report

March 27

Racquel Asa, WFTV, ABC affiliate Orlando

April 3

Marc Fitch, *Yankee Institute*

April 8

Sarah Wynn, The Bond Buyer

Scott Horsley, National Public Radio

April 18

Emilie Munson, *Greenwich Time*, Hearst Connecticut Media

April 30

Winnie Hu, *The New York Times*

May 7

Jon Chesto, *The Boston Globe*

May 8

Susan Haigh, Connecticut Statehouse/Political Writer, Associated Press

Mary Childs, Barrons

May 13

Marc Fitch, *Yankee Institute*

Mary Childs, Barrons

May 20

Noah Pransky, Florida Politics

June 10

Elaine Povich, Stateline – Pew Trusts

June 12

Daniel Steinberger, Full Measure TV

2019 Media Interviews and Inquiries Continued

June 14

Sarah Wynn, *The Bond Buyer*

July 19

Winnie Hu, *New York Times*

July 17

John Sharp, Alabama Media Group

July 22

Emilie Munson, *Hearst Connecticut Media*

August 1

Joe LeCompte, WNTV Landsdale, PA

September 16

Sheldon MacLeod, The Sheldon MacLeod Show on 95.7 News, Halifax

October 16

Angelica Alvarez-Ibarra, Sinclair Broadcast Group

October 29

Mike Lindblom, *Seattle Times*

November 4

Paul Muschica, *The Morning Call*

November 11

Marcus Green WDRB Media

November 26

Lauren Gibbons, MLive – Michigan

December 2

Eleanor Lamb, Transport Topics

Capitol Hill Meetings and Testimony

January 29

Pat Jones, Neil Gray and IBTTA's Executive Officers met with Chairman DeFazio

January 30

Pat Jones and Buddy Croft met with Senator Sheldon Whitehouse and Rep. Langevin offices

February 27 and 28

IBTTA Fly-In

AASHTO Washington Briefing

Capitol Hill Briefings with House T&I and Senate EPW Committee Staff

Cindy Essenmacher, Tolling Program Manager, FHWA Center for Innovative Finance

Alexander Herrgott, Exec. Director, Federal Permitting Improvement Steering Council

Capitol Hill Meetings and Testimony Continued

March 3

Pat Jones, Neil Gray and Kathy Ruffalo met with Senator Carper's staff.

March 6

Pat traveled to Hartford, Connecticut to testify before the Transportation Committee of the Connecticut General Assembly. [Pat's testimony is here.](#)

Pat also met with Governor Ned Lamont.

June 10

Pat Jones spoke at ASCE's International Conference on Transportation and Development

July 9

Mark Compton, Second Vice President, IBTTA, attends a meeting at the National Governors Association with Maryland Governor Hogan, to discuss NGA's focus for the year on infrastructure.

August 26

Bill Cramer traveled to Boston to participate in a National Governors Association Meeting with Governors Baker of Massachusetts, Sununu of New Hampshire, Raimondo of Rhode Island and Hogan of Maryland. The small meeting focused on Infrastructure: Foundation for Success. [IBTTA provided material on Priced Managed Lanes.](#)

September 11

IBTTA submitted a [Statement for the Record regarding Pricing and Technology Strategies To Address Congestion On And Financing Of America's Roads Before The House Transportation And Infrastructure Committee Subcommittee On Highways And Transit](#)

September 30

Pat Jones met with Jonathan Gulliver, Massachusetts Highway Administrator, in Boston, about joining IBTTA.

October 1

Pat Jones' spoke to the Maine "Blue Ribbon Commission To Study and Recommend Funding Solutions for the State's Transportation Systems." [Pat's testimony is here.](#) IBTTA Board Member Bruce Van Note, Commissioner of Maine DOT, formerly of the Maine turnpike, invited Pat to come and talk to the group.

Pat also met with Peter Mills, executive director of the Maine turnpike, and Peter Merfeld, chief operations officer.

November 6

1:30 pm – Meet with Alexandra Menardy – Legislative Assistant – Congressman Rick Larsen (D-WA) – 2113 Rayburn

2:00 pm – Meet with Maggie Ayrea – Legislative Assistant - Congressman Garret Graves (R-LA) – 2402 Rayburn

2:30 pm – Meet with Jhostyn Duval – Legislative Assistant - Congressman Albio Sires (D-NJ) – 2268 Rayburn

3:00 pm – Meet with Sharon Wagener – Legislative Assistant – Congressman Julia Brownley (D-CA) – 2262 Rayburn

4:00 pm – Ken Nealy – Legislative Director – Congressman Eddie Bernice Johnson (D-TX) – 2306 Rayburn

Capitol Hill Meetings and Testimony Continued

November 7

1:30 pm – Meet with Logan Ferree – Legislative Assistant – Congressman Jared Huffman (D-CA) - 1527 Longworth

2:30 pm - Meet with Chris Gorud – Legislative Assistant – Congressman Alan Lowenthal (D-CA) – 108 Cannon

3:00 pm –Meet with Tori Bice – Legislative Assistant – Congressman Greg Pence (R-IN) – 222 Cannon

3:30 pm – Meet with Steve Schultz – Legislative Assistant – Congressman Donald Payne (D-NJ) – 103 Cannon

November 8

11:30 am - Meet with Natalie Martinez – Legislative Assistant – Congressman Angie Craig (D-MN) - 1523 Longworth

1:00 pm – Meet with Johanna Montiel – Legislative Assistant – Congressman Salud Carbajal (D-CA) - 1431 Longworth

2:00 pm – Meet with Gus Ashton – Legislative Assistant - Congressman Ross Spano (R-FL) – 224 Cannon

2:30 pm – Meet with Chris Eddowes – Legislative Assistant – Congressman Lloyd Smucker (R-PA) – 127 Cannon

3:00 pm – Meet with Tracee Sutton – Deputy Chief of Staff – Congressman Greg Stanton (D-AZ) – 128 Cannon

December 3

2:30 pm – Meet with Alex Bechmann – Legislative Assistant – Congressman Dan Lipinski (D-IL) – 2346 Rayburn

3:00 pm – Meet with Zac Commins - Legislative Director – Congressman Harley Rouda (D-CA) – 2300 Rayburn

3:30 pm – Meet with Ben Rosenbaum – Deputy Chief of Staff and Legislative Director – Congressman Dina Titus (D-NV) - 2464 Rayburn

4:30 pm – Meet with Lauren Ziegler – Legislative Assistant – Congressman Brian Babin (R-TX) – 2236 Rayburn

December 4

2:00 pm - Meet with Perry Chappell – Legislative Assistant – Congressman David Rouzer (R-NC) – 2439 Rayburn

2:30 pm - Meet with Iain Hart – Legislative Assistant – Congressman John Garamendi (D-CA) 2368 Rayburn

3:00 pm - Meet with James Longley - Legislative Assistant – Congressman Brian Fitzpatrick (R-PA) - 1722 Longworth

3:30 pm - Meet with Jimmy Ballard – Legislative Director – Congressman Rodney Davis (R-IL) – 1740 Longworth

Capitol Hill Meetings and Testimony Continued

December 4 Continued

3:50 pm - Meet with Laney Copeland – Legislative Assistant – Congressman Rob Woodall (R-GA) - 1724 Longworth

4:30 pm - Meet with Ross Dietrich – Legislative Director – Congressman Jennifer Gonzalez Colon (R-PR) – 1609 Longworth

December 5

2:15 pm – Meet outside of 1230 Longworth

2:30 pm – Meet with Will Smethers – Legislative Assistant – Congressman Mike Gallagher (R-WI) – 1230 Longworth

3:00 pm – Meet with Mark Ratto – Legislative Assistant – Congressman Mike Bost (R-IL) - 1440 Longworth

3:30 pm – Meet with Ben Jackson – Legislative Director – Congressman Lizzie Fletcher (R-TX) -1429 Longworth

4:00 pm – Meet with James DeAtley (Legislative Director) and Hannah Cooper (Legislative Assistant) – Congressman Anthony Brown (D-MD) – 1323 Longworth

4:30 pm – Meet with Heather Painter – Legislative Assistant – Congressman Conor Lamb (D-PA) - 1224 Longworth

5:00 pm – Meet with Patrick Schilling – Legislative Assistant – Congressman Scott Perry (R-PA) -1207 Longworth

December 11

1:30 pm - Meet with Chelsea Gray – Legislative Assistant – Congressman Hank Johnson (D-GA) – 2240 Rayburn

2:00 pm – Meet with Don Andres – Deputy Chief of Staff/Legislative Director – Congressman Jesus “Chuy” Garcia (D-IL) – 530 Cannon

2:30 pm – Meet with Brian Duckworth – Legislative Assistant – Congressman Colin Allred (D-TX) – 328 Cannon

MINUTES

IBTTA Board of Directors

September 25, 2019

By Conference Call

Board Members Present: Chris Tomlinson, Samuel Johnson, Malika Seddi, Tim Stewart, Diane Gutierrez-Scaccetti, James Hofmann, Julia Monso, Maria Moreno, Mark Muriello, Kathryn O'Connor, Patty Rubstello, Gary Trietsch. **Board members elect (taking office January 1, 2020):** Jessica Carson, Jeff Dailey, Joi Dean, Andrew Fremier, Laura Kelley, Rene Moser. **Staff:** Ancilla Brady, Bill Cramer, Neil Gray, Pat Jones, Wanda Klayman, Cindy Norcross, Cathy Pennington.

IBTTA President Chris Tomlinson called the meeting to order at 11:15am EDT immediately following the adjournment of the meeting of the Finance Standing Committee of the Board on the same conference call. He asked if there were any questions about the proposed 2020 budget which the Finance Committee had just approved. Mark Muriello said we should look at the level of dues for international members to ensure that we don't make it too expensive for them to join and participate. Chris acknowledged the comment and said we would keep it in mind as we work on recruiting international members.

There being no other questions, **there was a MOTION and a SECOND to approve the 2020 Budget. The motion PASSED.**

The meeting was adjourned at 11:20am EDT.

Respectfully submitted,
Patrick D. Jones
Executive Director & CEO