

December 2020

## Thank you for a successful 2020 Annual Meeting!!

*Andrea Arias, Public Relations Officer, BNSF Railway*

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Despite the challenges brought by the global pandemic, we had a great 2020 annual meeting, and that wouldn't have been possible without the support of many people who put lots of time and energy to make it happen. Starting from INFORMS staff, cluster chairs, international committee members, student liaisons, conference speakers, roundtable's panelists, competitions' participants and judges, sponsors, and many others; we want to thank you from the heart and hope you enjoyed all activities organized by RAS during the conference.

We are already planning for INFORMS 2021 so if you are interested in getting involved please don't hesitate to reach out by email ([railwayapplicationssection@gmail.com](mailto:railwayapplicationssection@gmail.com)) or via social media ([facebook](#), [linkedIn](#)). Some of the volunteering opportunities are chairing one of our competitions, formulate a problem and provide data for the problem-solving competition, chair the RAS cluster at the annual meeting, organize the roundtable or the interactive session, among others.

Hope you stay safe and healthy during this holiday season.

Merry Christmas and Happy 2021!!

# Invited Article: Impacts of covid-19 on transport capacity in passenger railway networks

Nikola Bešinović, Digital Rail Traffic Lab, Delft University of Technology, Delft, The Netherlands, [n.besinovic@tudelft.nl](mailto:n.besinovic@tudelft.nl)

**Introduction.** Due to the covid-19 crisis, public transport (PT) systems are facing new challenges. Regarding restrictive measures such as physical distancing and the successive returning of passengers after the “intelligent lockdown”, significant lack of transport capacity can be expected. In fact, public transport at some point transported only 10% of the usual passengers and there is relatively more cycling and walking than ever. For example, some of the largest decrease in use of public transport, during the first wave, has been seen in San Francisco Bay Area - 95%, Lyon - 92%, Rome - 90%. In the Netherlands, decrease in use in peak hours has been about 90-95% as well<sup>1</sup>. After the pandemic passes and the “intelligent lockdown” is lifted, some restrictive measures are expected to stay much longer. In particular, we already observe that a physical distancing of 1.5m is becoming our new reality. We shall then accept that with returning of passengers to the PT system, transport capacity, i.e. maximum number of passengers travelling, may not be sufficient in peak hours.

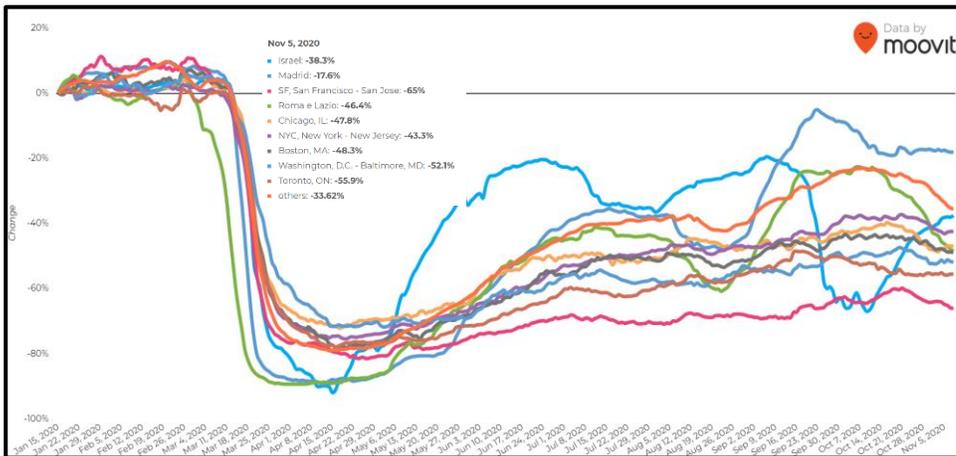


Figure 1. Transport reduction due to covid-19<sup>2</sup>

**Vehicle capacity.** Due to physical distancing, passengers would need to keep larger distances, which essentially means that not all seats in the vehicles can be occupied. In the beginning of the covid-19 pandemic, suggested vehicle capacity was fluctuating between 20% and 40% of the maximum vehicle capacity (Figure 2). More recently, public transport operators tend to be accepting 50% as a norm.



Figure 2. Seats marked during covid19 in Spring 2020: TriMet bus<sup>3</sup> (left), Netherlands Railways intercity train<sup>4</sup> (right)

**Transport capacity.** Bešinović and Szymula (2020) evaluated impacts of covid-19 on transport capacity in the Dutch railway network. The results showed that, assuming 25% of vehicle capacity available, **about 50% less passenger demand could be transported compared with the original (pre-covid-19) demand** (see Figure 3). At the same time, link utilization would be significantly higher over the whole network (more red links in Figure 4). This would eventually lead to about 70% of all trains being at least 90% full at some point of their journey.

<sup>1</sup> <https://www.dat.nl/nvp/>, accessed 5 November 2020.

<sup>2</sup> [https://moovitapp.com/insights/en/Moovit\\_Insights\\_Public\\_Transit\\_Index-countries](https://moovitapp.com/insights/en/Moovit_Insights_Public_Transit_Index-countries), accessed 5 November 2020.

<sup>3</sup> By Steve Morgan - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=89201193>

<sup>4</sup> <https://www.rtdvrenthe.nl/nieuws/159502/NS-test-aangepaste-treinen-op-traject-door-Drenthe>



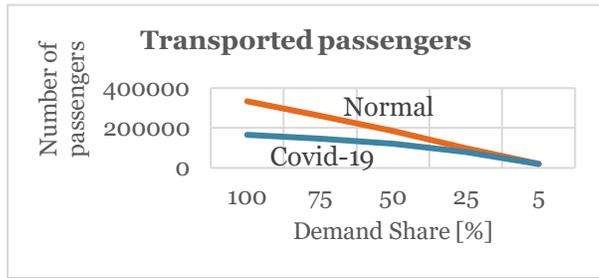


Figure 3. Transported passengers based on the actual given passenger demand during peak

**Passenger perception.** Netherlands Railways and Delft University of Technology jointly performed a longitudinal study over the last several months<sup>5</sup>, showing that passengers respond well on the proposed measures which makes it more comfortable using PT, although many passengers still stay away from travelling (Figure 5). It also showed that about 10% replaced train trips by mostly car or e-bike. It is remarkable that some positives of covid-19 have been recognized as well. First, people became more aware of sustainability and climate changes, and thus would prefer using PT and railways more. Second, due to more space on-board, passengers report increased comfort and safety in trains.

Finally, covid-19 rises the need for integrating railway systems with micromobility such as bikes, scooters, and car sharing that could support railways as feeder options as well as a way to mitigate congestions at stations, particularly in urban areas.

**Future.** In the recent report, UITP <sup>6</sup> confirms that **PT is covid-safe**, particularly when wearing a facemask. However, given an uncertain future ahead, it is evident that infrastructure managers and operators need to reorganize their services in response to these new societal conditions, particularly when passenger demand returns in greater portions.

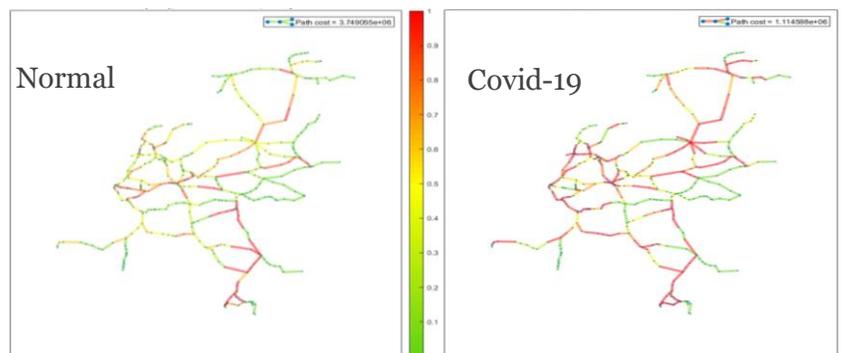


Figure 4: Link Utilization of 100% Demand Share in normal and covid-19 case

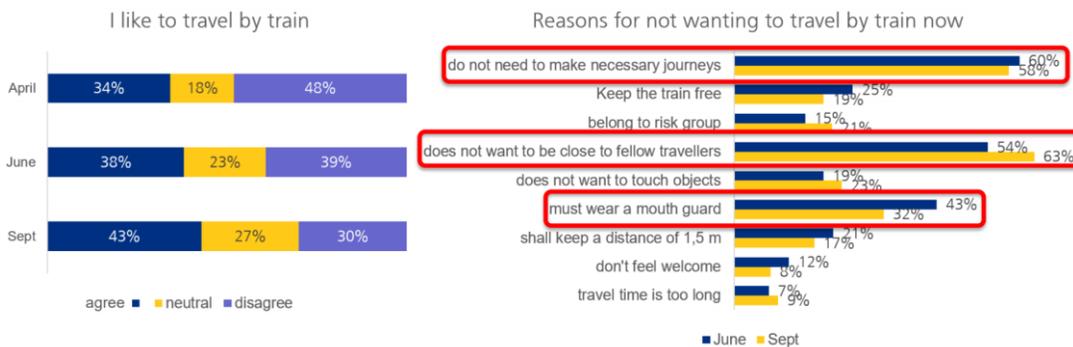


Figure 5. Passenger experience in the Netherlands during covid-19<sup>5</sup>

Some of the new challenges that arise with covid-19 are: **What is the transport capacity of the system under physical distancing? How to design lines and services with new more limiting conditions? How to operate and manage transport in such system? How to (re-)organize funding**

**frameworks to guarantee long-term survival of PT?** Tackling these questions would help us to build more resilient and sustainable transport systems capable of handling the novel disruptions such as pandemics.

## References

Bešinović N., Szymula C., (2020) Estimating impacts of covid19 on transport capacity in railway networks, <https://www.linkedin.com/pulse/estimating-impacts-covid19-transport-capacity-railway-be%25A1inovi%25C4%87/>

<sup>5</sup> <https://nielsvanoort weblog.tudelft.nl/how-do-dutch-train-passengers-expect-to-travel-during-and-after-covid/>, accessed 5 November 2020

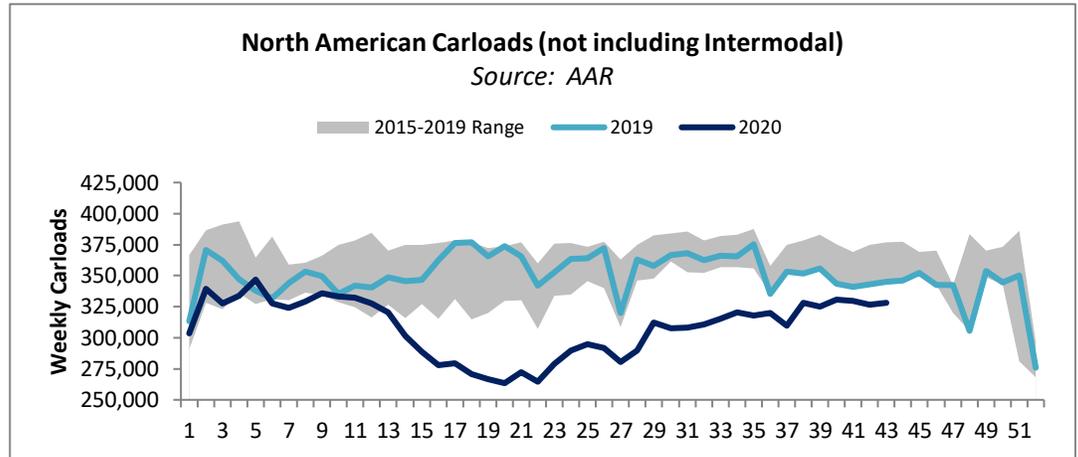
<sup>6</sup> <https://www.uitp.org/news/public-transport-is-covid-safe/>, accessed 5 November 2020.



# Invited Article: The Effects of COVID-19 on Freight Rail in North America

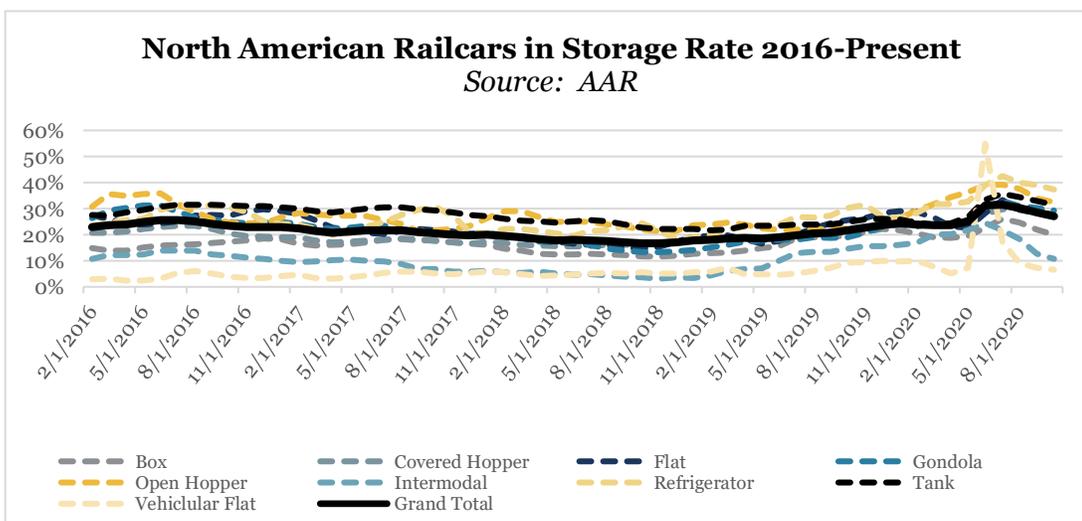
Daniel Windle, TrinityRail, [daniel.windle@trinityrail.com](mailto:daniel.windle@trinityrail.com)

The effects of the COVID-19 pandemic as well as an energy market crash during the spring led to significant challenges for the freight rail market in North America. This article will review how carloads, railcar storage, and industry railcar orders changed during the time period following lockdowns due to COVID-19.



According to the AAR, carloads (not including intermodal traffic) are down 12.9% compared to 2019 through the first 43 weeks of the year. When including intermodal, overall rail traffic is down 9% YTD. Coal, petroleum products, nonmetallic minerals (which includes frac sand), and motor vehicles/parts have been the largest headwinds based on the YTD figures with only agriculture related products showing growth YTD.

While the year-to-date numbers are well below last year, they do not tell the entire story. As we see in the chart above, the lowest carload counts occurred between Weeks 16-22 (mostly during the month of May, near the height of COVID-19-related lockdowns). The week ending May 16 saw the lowest carload count seen in recent history at 263,409. This total was down significantly, 29.2% for motor vehicles with parts down almost 88%. This was during the time many of the automotive manufacturing plants were either shut down or had converted capacity to build ventilators. There has been some level of recovery with grain and agriculture products up on the year and metallic ores/metals, motor vehicles/parts, and intermodal recently trending above last year's traffic pace. However, carloads have still not caught up to 2019 levels and are remaining below the 2015-2019 range.



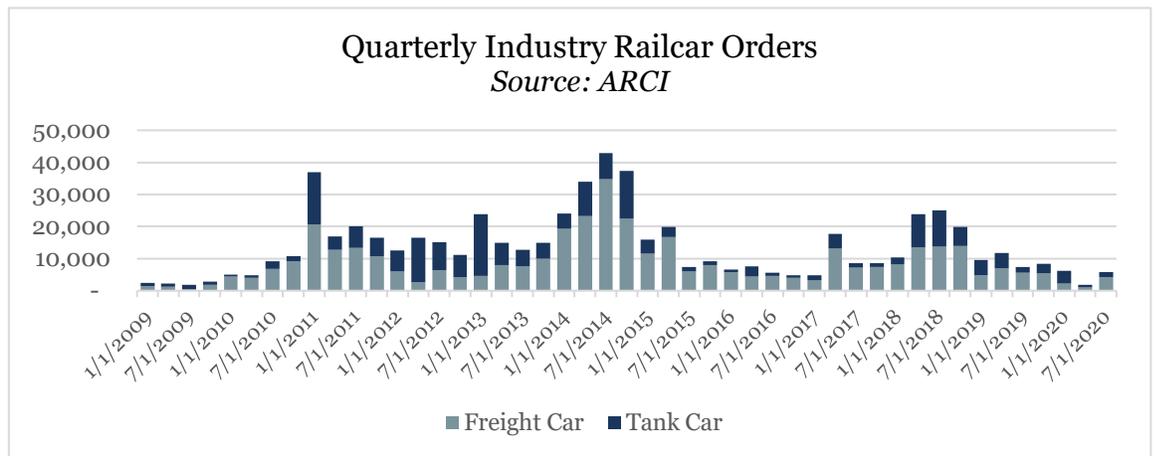
This reduction in carloads has led to a recent acceleration in railcar storage rates. The AAR provides a monthly overview of the storage rate of railcars that have not made a revenue move in the prior sixty days. From the beginning of 2016 through March 2020, the average percentage of railcars in storage has been 20.9% and there had not been a

storage rate greater than 25.7% (in June 2016.) In March 2020, the railcars in storage rate was 23.6% which is above the historical average, but not an extreme figure. As carloads dropped and the need for active railcars decreased, the storage rate increased to 31.5% in July 2020. This storage rate was driven in a large part by the



rapid increase in vehicular flats (which shortly thereafter quickly recovered), however, most railcar types had a more measured rate of increase into storage since the start of Q2, but have since only just begun a gradual recovery.

The surplus in railcars available (railcars in storage) has likely affected the level of railcar orders. High levels of available equipment and continued economic uncertainty have led to reduced orders industry-wide in recent quarters.



According to the American Railway Car Institute (“ARCI”), from 2010 through Q1 2020, the average quarterly railcar orders was 14,578 with no quarter having fewer than 4,814 orders. There were only 1,923 orders during Q2 2020, the lowest recorded since 2009. Unlike the previous recession, however, we did not see a prolonged drop in orders as Q3 rose back to 5,783.

This year, COVID-19 was the predominant factor in a recession spanning the first half of 2020. This recession hit the consumer market the steepest (which includes intermodal and vehicular flat carloads) during the spring, but those markets are recovering as demonstrated by their storage rates. Other than in grain and agriculture-related carloads (which were not hit as severely as other commodities) carload recovery for raw materials has lagged a little behind the consumer recovery, with only recent improvements in the metallic ores/metals and chemical carloads when compared to 2019 levels. These trends indicate there has been some level of recovery from the COVID-19 related lockdowns, but these carload figures remain relatively weak when compared to recent years. Especially during a downturn with an uneven economic recovery, our Data Analytics team at TrinityRail has found it useful to look at the railcar markets from a bottom up, rather than a top down, approach. While economic indicators such as GDP, industrial production, and retail sales are important macro level indicators, diving down deep into what drives each of the individual rail markets is vital in promoting a proactive approach for serving our rail customers. While we continue to see macro level headwinds to carloads and fleet utilization, it is important to view rail markets individually to better track carload and fleet recoveries.

## Thank you 2020 Gold Sponsors!



# NEW RAS International Webinars: A Big Hit in 2020!

*Shantih M. Spanton, Sr. Manager Operations Research, CSX*

At the end of 2019, the **RAS International Committee** was formed to increase member engagement and satisfaction. The International Committee had three goals at its inception:

1. Discover ways to add value to the rail community outside of the annual INFORMS meeting. Many of RAS's activities focus on the annual meeting. Due to changes in corporate climate, it has become increasingly difficult for corporate operations partners to attend. Due to political and economic changes, it has become increasingly difficult for non-US members to fund travel and gain Visas to attend the annual meeting. These individuals may not seek membership in RAS if they are unable to attend the meeting.
2. Discover ways to engage the international rail community. Due to the group's focus on the annual meeting, and the heavy involvement of US industry sponsors (which is a good thing!), US membership represents the largest percentage of members. RAS identifies as a global group, and as such we need to find ways to engage international members and provide ways to collaborate across continents.
3. Ensure that RAS activities meet the goals and expectation of members and sponsors. One of the greatest assets of RAS is its ability to bring together professionals across academia, industry, and consulting/vendor groups. We recognize these members have different desires/needs from RAS. We want to make sure that RAS is providing value to all these shareholders and seek their advice on the current, and future direction of the group.

The first activity championed by the group to reach these goals was the **RAS International Webinar Series**. This series presents a free, open to all, monthly online talk by a rail expert on a rail research topic. The series has been successful beyond the imagination its creating committee, and has filled a valuable niche during COVID as a way for us to feel connected professionally. Due to the popularity, sponsors have requested airtime for mini advertisements at the start of the webinars. Attendance at the webinars has increased steadily (see table below).

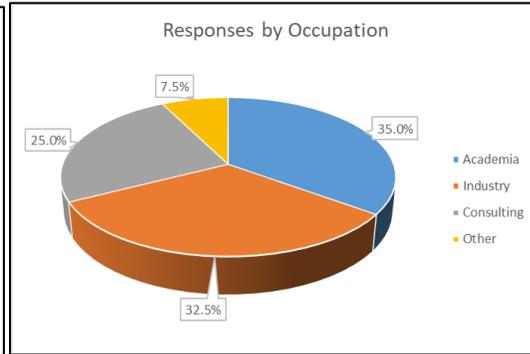
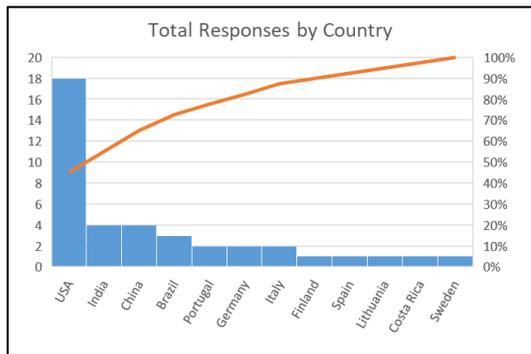
	July	Aug	Sept	Oct	Nov
Total attendees	69	88	89	94	100

Thanks to our first round of speakers who have given their expertise and contributed the making this global event a big success:

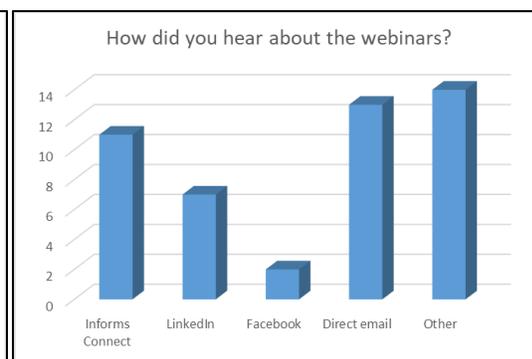
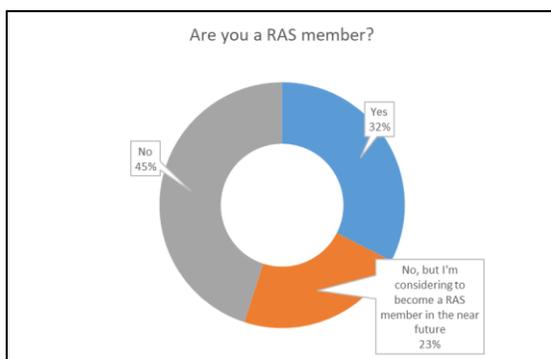
1. **Dasaradh Mallampati**, BNSF Railway, "Operations Research's Pivotal role at the Freight Railroad"
2. **Ken Kenjale** and **Dharma Acharya**, Wabtec Corp. "Optimizing the Network: Taking Precision Scheduled Railroading to the Next Level"
3. **Carl Van Dyke**, Industry expert and RAS distinguished member, "Freight Rail Operating Plan Systems – Past, Present, Future"
4. **C. Tyler Dick**, Rail Transportation and Engineering Center, University of Illinois at Urbana-Champaign, "Network Efficiency Cycle: Quantifying Yard and Mainline Railway Capacity and Performance Connections"
5. **Xingang Clark Cheng**, Norfolk Southern Corporation, "Managing Railroad Assets and Capacity for Sustainable Growth"

After the completion of the fourth webinar the RAS International Committee sent out a survey to attendees to solicit feedback. The results were overwhelmingly positive. Survey responses were received by 40 individuals from 12 countries, with the US representing the majority of respondents. Occupations of respondents were well mixed across academia, industry and consulting.

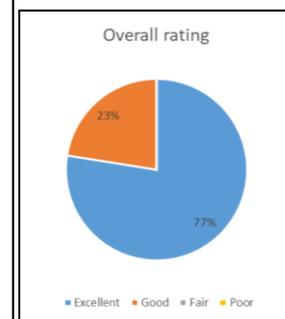
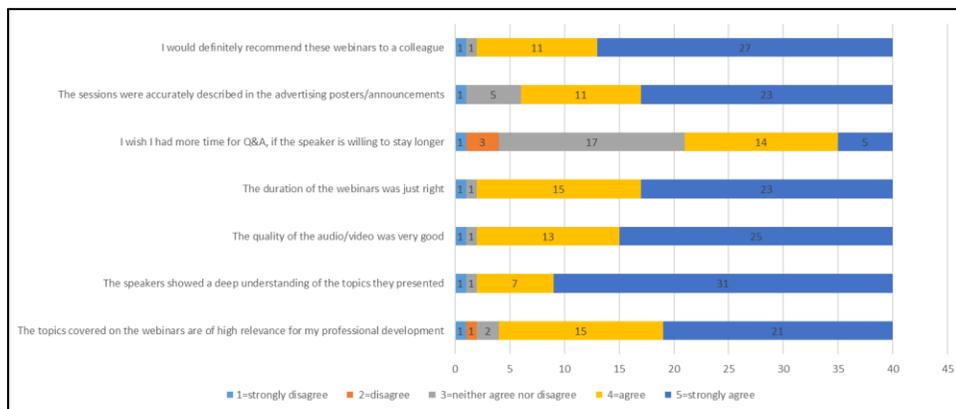




A large number of non-RAS members replied to the survey, and several identified that they were interested in joining RAS as members. Hopefully we will see an uptick in membership as a result. The team’s broad advertising across multiple platforms paid off, and attendees reported becoming aware of the webinar through numerous channels.



The response to sentiment questions was very positive. One respondent did rate the webinars very low, reporting “1- strongly disagree” to all questions. However, when looking at the raw data, this particular respondent rated the overall quality of the webinar as “Excellent,” so hopefully the negative responses were due to a confusion in the quiz instrument, and less likely caused by true negative feeling about the event. :) The only question that had a variety of responses was whether the webinar Q&A should continue past the cut off time if the speaker is able to continue taking questions. In the first webinars, the cut off time was firm, but the committee received requests to continue the dialogue if speakers are able. This was attempted in later webinars with mixed feedback. No respondents rated the webinar overall as fair or poor, with all ranking it as good or excellent.



Free response questions can be categorized into negative and positive points, as well as neutral suggestions. These have been rephrased to ensure anonymity of responses:



**Positive:**

- Format was seen as good
- Desired replay/on demand viewing,
- Good and relevant to individuals' careers/interests
- Positive valuable addition to rail

**Negative:**

- Audience members interjecting commentary and audience monologues were not muted,
- If Q&A will be extended past the cutoff time, advertise ahead of time this so that audience members can make arrangements
- Ending of session was not clear when Q&A session extended past cut off time

**Suggestions:**

- Chinese rail topics
- Focus on risk/profit/cost aspects of problems
- speakers could give references for audience members who are interested in looking further into topics
- simulation and ML topics
- wide variety of all topics in the area

The Committee is excited to address the given points and create new content next year. We look forward to adding exciting new broader content by international speakers next year.

If available, completed talks are posted on the \*new\* [RAS YouTube channel](#), and the [RAS website](#) for your viewing enjoyment.

To join the organizing team, or to suggest topics or speakers, reach out to Nikola Besinovic at [N.Besinovic@tudelft.nl](mailto:N.Besinovic@tudelft.nl).

Many thanks to the RAS 2020 inaugural International Committee!

**Chair:** Nikola Bešinović, TU DELFT

Andrea Arias, BNSF

Hadi Karimi, BNSF

Shantih Spanton, CSX

Yihui Wang, BJTU

**Thank you 2020 Silver Sponsors!**



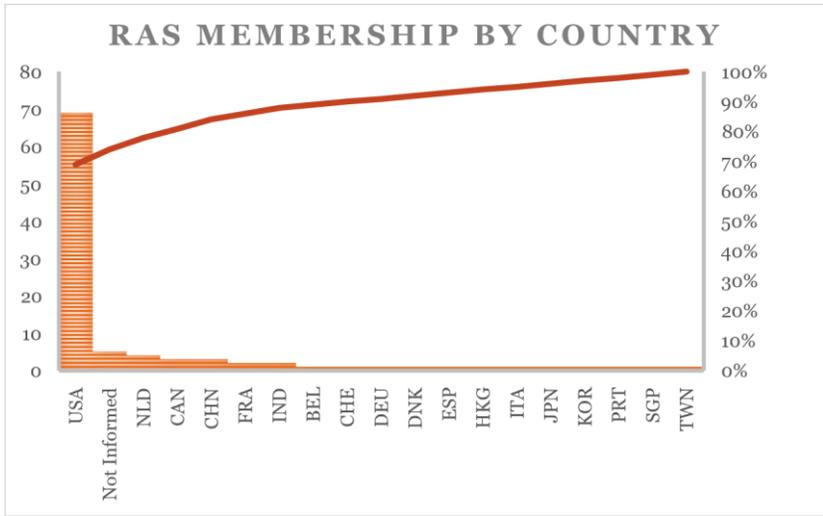
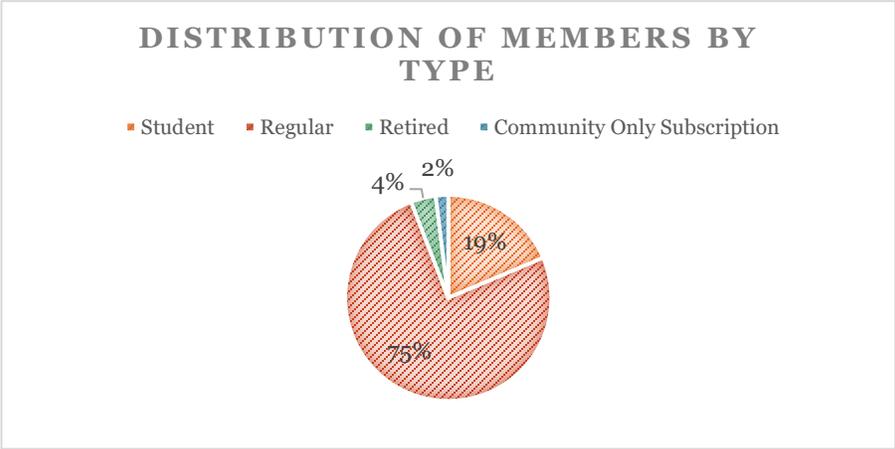
**CEDAR**



# RAS Member Profile 2020

Andrea Arias, Public Relations Officer

As of November 8, 2020, the total number of RAS member was 100, which represents a 19% reduction compared to 2019. 75% of the members are regular, 19% are students, 4% are retired and 2% are community-only members. Out of all members, 69 are from the USA, and the rest from at least 17 countries including: The Netherlands, Canada, China, France, India, among others.



Despite the challenges we faced this year, we had a successful INFORMS 2020 Virtual meeting, which wouldn't have been possible without your support, so we deeply thank you for all your commitment and engagement to this wonderful community. We'd love to see you around next year so if you have not renewed your RAS membership, you can do it [here](#), and please also help us spreading the word among your friends and colleagues so we can welcome more people to RAS. Good news is the dues have not changed (see table below) and are FREE for students and retired!!

	Regular	Student/Retired	Community-Only Regular	Community-Only Student
<b>Dues (\$)</b>	20	0	30	15



# RAS Sponsored Sessions – INFORMS 2020 Virtual

Alexander Lovett (UP), Kiran Chahar (Norfolk Southern), Nikola Bešinović (TU DELFT), and Daniel Windle (TrinityRail), Cluster Chairs

Check out the presentations and recordings available in the [RAS website!!](#)

## Sunday, November 8<sup>th</sup>

**RAS Problem Solving Competition** (Chair: Jay Baillargeon, Federal Railroad Administration)

- **An Optimization Method for Train Rescheduling and Travel Time Estimation Problem**, Bisheng He, Hongxiang Zhang, Peng Hui, Southwest Jiaotong University, Chengdu, China
- **A Multi-Objective Railway Freight Timetable Reschedule Approach with Extensive and Stochastic Delay**, Hui Wang<sup>1</sup>, Zhuotong Bai<sup>2</sup>, Lin Yang<sup>3</sup>, <sup>1</sup>Tongji University, Shanghai, China; <sup>2</sup>Tsinghua University, Beijing, China; <sup>3</sup>Beijing Jiaotong University, Beijing, China
- **A Mixed Integer Programming Model for Freight Train Travel-Time Estimation by Minimizing Delay of Trains**, Bijan Taslimi, Farnaz Babaie Sarijalo, Hongcheng Liu, University of Florida, Gainesville, FL

## Monday, November 9<sup>th</sup>

**RAS Roundtable** (Chair/Moderator: Daniel Windle, TrinityRail)

- **Regulatory and Market Landscape for Rail**, David Hunt, Director, Oliver Wyman's Transportation Practice
- **Regulatory and Market Landscape for Railroads**, Lee Clair, Managing Partner for Transportation and Logistics Advisors, LLC; member of the Business Advisory Council for the Northwestern University Transportation Center
- **Market and Regulatory Environment from the Perspective of an Equipment Builder/Lessor**, Dan Anderson, Vice President of Strategic Marketing and Product Development, TrinityRail
- **Regulatory and Market Landscape for Rail**, Todd Tranausky, Vice President of Rail and Intermodal, FTR

**Yards and Terminals** (Chair: Tyler Dick, University of Illinois at Urbana-Champaign)

- **Hump Yard Performance Simulation with Anylogic**, Jiaxi Zhao, Geordie Roscoe, University of Illinois at Urbana-Champaign, Urbana, IL
- **Influence of Mainline Schedule Flexibility and Volume Variability On Railway Classification Yard Performance**, Tyler Dick, University of Illinois at Urbana-Champaign, Urbana, IL
- **Automation and Integration of Rail Yard Planning and Execution**, Jeremiah Dirnberger, Wabtec Freight, Jacksonville, FL
- **Freight Railroad Terminal Clock Optimizer**, Gunnar Feldmann, Xingang Clark Cheng, Peiheng Li, Behzad Zahiri, Norfolk Southern Corporation, Atlanta, GA

## Tuesday, November 10<sup>th</sup>

**Railway Resource Management and Optimization** (Chair: Dharma Acharya, Wabtec Corp.)

- **Resource Planning and Management for Efficient Railway Operation**, Dharma Acharya, Ken Kenjale, GE Transportation, a Wabtec Corporation, Ponte Vedra, FL
- **Deadlock Avoidance Dispatching Algorithm for Generalized Track and Train Configurations**, Geordie S. Roscoe, University of Illinois, Urbana, IL
- **Optiyard: An Optimised Management of Freight Yards Operations**, Pierre Hosteins<sup>1</sup>, Samuel Deleplanque<sup>2</sup>, Paola Pellegrini<sup>1</sup>, Joaquín Rodríguez<sup>1</sup>, Norbert Adamko<sup>3</sup>, Milos Zlatko<sup>3</sup>, <sup>1</sup>Univ. Gustave Eiffel, Villeneuve d'Ascq, France; <sup>2</sup>Yncrea, Lille, France; <sup>3</sup>SIMCON, Zilina, Slovakia
- **Designing Unit Train Service for Freight Railroad Asset and Capacity Planning**, Andy Yoon, Clark Cheng, Norfolk Southern Corporation, Atlanta, GA



## **Machine Learning in Railroad Transportation** (Chair: Nikola Bešinović, TU DELFT)

- **Applications on AI in Rail Industry**, Sethuraman Janardhanan
- **ML in Departure Prediction of Freight Trains**, Niloofar Minbashi, Markus Bohlin, Behzad Kordnejad, KTH Royal Institute of Technology, Stockholm, Sweden
- **Dynamic Origin-destination Prediction in Urban Rail Systems: A Multi-resolution Spatio-temporal Deep Learning Approach**, Peyman Noursalehi<sup>1</sup>, Jinhua Zhao<sup>1</sup>, Haris N. Koutsopoulos<sup>2</sup>, <sup>1</sup>MIT, Cambridge, MA, <sup>2</sup>Northeastern University, Boston, MA
- **Passenger Rail Demand Uncertainty Analysis Based On Automated Data: Case of Tehran**, Nima Aminpour<sup>1</sup>, Mohammad Amir Ahmadian<sup>1</sup>, Faraz Zargari<sup>1</sup>, Amir Samimi<sup>1</sup>, Saeid Saidi<sup>2</sup>, <sup>1</sup>Sharif University of Technology, Tehran, Iran, Islamic Republic of; <sup>2</sup>University of Calgary, Calgary, AB, Canada
- **Real-time Delay Prediction in Railway Transportation: An Application of a Recurrent Neural Network Approach with Spatial Features**, Veerle Hennebel<sup>1</sup>, Bart Roets<sup>2</sup>, Léon Sobrie<sup>3</sup>, Marijn Vershelde<sup>4</sup>, <sup>1</sup>KU Leuven, Kortrijk, Belgium; <sup>2</sup>Infrabel, Brussels, Belgium; <sup>3</sup>Ghent University, Ghent, Belgium; <sup>4</sup>IESEG School of Management, Lille, France

## **Real-Time Rescheduling in Metro and Railways** (Chair: Shuai Su, BJTU)

- **Modern Approaches for Real-time Rescheduling in Metro and Mainline Railway Systems**, Jin Liu, University of Birmingham, Birmingham, United Kingdom
- **Energy-efficient Train Scheduling and Rollingstock Circulation Planning in A Metro Line: A Linear Programming Approach**, Pengli Mo, Eindhoven University of Technology, Eindhoven, Netherlands
- **Passenger-oriented Traffic Control for Railway Networks Under Disruptions**, Xiaojie Luan, Francesco Corman, ETH Zürich, Zurich, Switzerland
- **Integration of The Train and Rolling Stock Rescheduling for Metro System**, Shuai Su, Boyi Su, Beijing Jiaotong University, Beijing, China
- **Validating Operational Traffic Management Systems, Before and After Deployment**, Michael Vere, Graffica Ltd, Malvern, United Kingdom

## Wednesday, November 11th

### **Planning and management in urban transit** (Chair: Yihui Wang, Beijing Jiaotong University)

- **Train Rescheduling for Urban Rail Transit Systems Under Disruptions**, Yihui Wang, Beijing Jiaotong University, Beijing, China
- **Real-time Rolling Stock and Timetable Rescheduling in Urban Rail Networks**, Jiateng Yin<sup>1</sup>, Andrea D'Ariano<sup>2</sup>, <sup>1</sup>Beijing Jiaotong University, Beijing, China; <sup>2</sup>Roma Tre University, Roma, Italy
- **Increasing Reliability of the Vehicle Scheduling Problem with Stochastic Travel Time**, Lea Ricard<sup>1</sup>, Guy Desaulniers<sup>2</sup>, Andrea Lodi<sup>2</sup>, Louis-Martin Rousseau<sup>3</sup>, <sup>1</sup>Université de Montréal, Montréal, QC, Canada; <sup>2</sup>Polytechnique de Montréal, Montréal, QC, Canada; <sup>3</sup>Ecole Polytechnique de Montreal, Montreal, QC, Canada
- **Machine-learning-based Column Selection in Exact Branch-and-price Algorithms**, Mouad Morabit, Guy Desaulniers, Andrea Lodi, Polytechnique de Montréal, Montréal, QC, Canada
- **Mathematical Modelling for Tackling Covid19 in Public Transport Networks**, Nikola Besinovic, Delft University of Technology, Delft, Netherlands

### **RAS Student Paper Competition** (Chairs: Qing He, University at Buffalo, and Clark Cheng, NS Corp.)

- **The Role of Incomplete Information to Passengers in Railway Delays**, Nuannuan Leng, Francesco Corman, ETH Zürich, Zurich, Switzerland
- **Integrated Rolling Stock and Shunting Driver Rescheduling**, Rowan Hoogervorst, Dennis Huisman, Twan Dollevoet, Erasmus University Rotterdam, Rotterdam, Netherlands
- **An Exact Method for Integrated Optimization of Subway Operation Strategy with Asymmetric Passenger Demands and Operating Costs**, Pengli Mo<sup>1,2</sup>, Andrea D'Ariano<sup>3</sup>, Lixing Yang<sup>1</sup>, Lucas P. Veelenturf<sup>4</sup>, <sup>1</sup>Beijing Jiaotong University, Beijing, China; <sup>2</sup>Eindhoven University of Technology, Eindhoven, Netherlands; <sup>3</sup>Roma Tre University, Rome, Italy; <sup>4</sup>Rotterdam School of Management, Rotterdam, Netherlands



# Takeaways from the 2020 RAS Roundtable

*Daniel Windle, TrinityRail*

This year's roundtable was on the market and regulatory landscape for rail. While COVID-19 was naturally among the largest points of discussion, other topics discussed included Precision Scheduled Railroading, structural changes in the rail market, the growth of intermodal movements, and the role of analytics and technology. The speakers for this roundtable were:

- Todd Tranausky, VP of Rail and Intermodal with FTR Transportation Intelligence
- Dan Anderson, VP of Strategic Marketing and Product Development with TrinityRail
- Lee Clair, Managing Partner with Transportation and Logistics Advisors, LLC
- David Hunt, Director in Oliver Wyman's Transportation Practice

Todd Tranausky discussed many different ways COVID-19 has affected the rail equipment market. Due to the pandemic, FTR is forecasting a lower overall GDP through 2023 which is likely to affect overall freight volumes and railcar orders. In reference to the long-term economic effects of COVID-19, Todd stated, "We took not just a one-time hit, but a hit that will be present through all of the outer year periods...freight demand, equipment demand is going to be at a lower level because the underlying economic demand that supports it will be at a lower level." Todd also mentioned how production and trade indicators are showing month over month improvement, but are mostly lagging well behind February's totals which are representative of the pre-pandemic stage. In an effort to determine which areas were recovering quicker, Todd noted that intermodal traffic has surged in recent months while carloads have made a slower, but steady recovery in recent months. The level of recovery and future expectations will be dependent on the specific commodity being shipped. You can download Todd Tranausky's presentation and find out more about FTR Transportation Intelligence by visiting <https://www.ftrintel.com/INFORMS>.

Dan Anderson looked at the high level market overview comparing how the rail market looked entering the lockdown stages of COVID, and how large the effects of COVID were on the market. While Dan demonstrated the importance of looking at the larger macroeconomic factors, he emphasized an approach to market intelligence that breaks the problem into smaller parts. Dan mentioned in his presentation, "It is important to understand that there is no such thing as a "railcar market," simply markets for multiple railcars because railcars move a diverse set of commodities and the COVID-19 shocks impacted each of those markets differently. With our tools we could identify the areas of relative strength and the likely customer segments that would see some interest in new or existing railcar equipment that helped us guide our sales team, so they use their time most effectively and efficiently." Dan also spoke of the interplay between data and intuition as well as how new technologies will allow rail to become more competitive at combining analytics and expertise. "The implementation of sensors and further data aggregation in the rail industry can make the mode more competitive allowing the industry to unlock the true potential of expertise and the sustainable nature of rail transportation." You can learn more about TrinityRail's analytics based solutions in rail by visiting <https://www.trinityrail.com/contact>.

Lee Clair presented on how Precision Schedule Railroading has affected railcar demand. His analysis went on what the changes were and what the effects are on how shippers need to plan for their fleet. Lee stated, "The initial impact of PSR is that the average velocity improves and improves a lot. You can see CSX improvement running about 15% from where it had been." However, improvement on a local move (within the same railroad) does not necessarily mean that the demand for railcars will go down by that same amount. "On interline moves, the situation changes quite a bit for the private cars where there is little improvement...and in some circumstances the cycle times actually deteriorated." Overall, the PSR implementations seem to show cycle times and reliability have improved within a railroad, but there is the potential for greater inconsistency for interline moves. Based on Lee's analysis, the need for some railcar types may actually increase due to PSR while others



will see a decrease. You can read some other case studies from Transportation and Logistics Advisors, LLC by visiting <http://www.tandla.net>.

David Hunt used a median polish technique to help evaluate trends in US carload data. What was unique about David's approach is that it emphasizes the importance of the noise and not just the trend of the data. "Noise can tell us specific events and can help us to understand the impacts of different events that occurred." Using the median polish technique, David was able to demonstrate some of the similarities in intermodal traffic between the 2008-2010 recession and the COVID-19-caused recession through this analysis by looking at the traffic declines compared to seasonal expectations. David used this analysis on other AAR listed commodities to determine which commodities were the most volatile and which ones were the least volatile. David's analysis demonstrated grain as among the least volatile commodities in the rail industry, "Grain is the most stable of the commodities – it only had two outliers in the data. One was during the Great Recession (on the downside) and another in 2013 when there was a record grain harvest...COVID-19 has had very little impact on grain shipments." To learn more about Oliver Wyman's Transportation Practice, visit <https://www.oliverwyman.com/our-expertise/industries/transportation.html>.

Overall, it was clear through the presentations, Q&A, and discussion afterwards that market and regulatory issues need to go beyond sales and business development in their applications. Market forecasting and outlooks allow railroads to be proactive in making decisions that affect the operations side of the business significantly. Utilizing data and analytics will allow new products and services to be offered in the market, aid in determining staffing levels, and can be used in conjunction with subject matter expertise to serve rail customers.

## 2020 RAS Problem Solving Competition

### ***Freight Train Travel-Time Estimation***

*Jay Baillargeon, Federal Railroad Administration, Competition Chair*

*Krishna Jha, Optym, Problem Owner*

In this competition, participants were asked to determine the travel time of freight trains within a given time window and minimize delays from the given timetable, considering all important characteristics of the network and important resources required for freight train operations. Rail transportation is one of the most efficient and the most environmentally friendly modes of transportation on a per ton-mile basis because of the dedicated track for train movements. However, this characteristic also creates inherent cascading impact of each train's movements on the movement of other trains in the network. Combining this complex interdependency with other resource-specific restrictions makes the train travel-time estimation problem an algorithmically challenging problem.

A total of 18 teams registered this year, despite the challenges presented by the pandemic. Congratulations to the finalists for their hard work! And a BIG thank you to all the judges and problem owners for their important contribution to the success of this year's competition.

The slides and recordings of the finalists' presentations at INFORMS Virtual 2020 can be found in the [RAS Website](#).



The winners of the 2019 Railway Applications Section Student Paper Award are:

**First Prize:** “A Multi-Objective Railway Freight Timetable Reschedule Approach with Extensive and Stochastic Delay” by Hui Wang, Tongji University; Zhuotong Bai, Tsinghua University; and Lin Yang, Beijing Jiaotong University.



**Second Prize:** “A Mixed Integer Programming Model For Freight Train Travel-Time Estimation By Minimizing Delay of Trains” by Bijan Taslimi, Farnaz Babaie Sarijaloo, and Hongcheng Liu; University of Florida

**Third Prize:** “An Optimization Method for Train Rescheduling and Travel-Time Estimation Problem” by Bisheng He, Hongxiang Zhang, and Hui Peng; Southwest Jiaotong University



Congratulations to the winners and many thanks for your contributions!!!



# 2020 Student Paper Competition

*Qing He and Xingang Clark Cheng, Competition Chairs*

After a careful two-month assessment process, we finally selected four outstanding winning papers of this year's Student Paper Contest. The final decisions have been made together with the RAS Chair Nathaniel Richmond. Seven papers were submitted to the contest. Papers were evaluated on 6 criteria: the problem novelty, methodology, results and conclusions, scientific contribution, contribution to practice and composition. All papers received double-blind reviews by multiple reviewers. Overall, judges were quite positive about the solid quality and diverse research topics of all submitted papers. The Railway Applications Section is grateful for the great commitment of the judges: Rob Goverde, Paola Pellegrini, Busby Attoh-Okine, C. Tyler Dick, Lingyun Meng, Steve Tyber, Jianqiu Huang, Qing He and Clark Cheng. The winners of the 2020 Railway Applications Section Student Paper Award are:

**First Prize:** Pengli Mo, Beijing Jiaotong University. "An Exact Method for Integrated Optimization of Subway Operation Strategy with Asymmetric Passenger Demands and Operating Costs"

*Pengli Mo received the B.S. degree from Harbin Institute of Technology, Harbin, China, in 2016. He is currently working toward the Ph.D. degree under the joint supervision of Prof. L. Yang and Prof. Z. Gao at the State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, Beijing. In 2019, he was one-year guest researcher at Eindhoven University of Technology, where he reinforced the collaboration with Dr. L.P. Veelenturf, Prof. T. Van Woensel and Prof. A. D'Ariano (Roma Tre University). His current research interests include intelligent transportation systems, mathematical programming, and their application to railway operations research.*



**Second Prize:** Rowan Hoogervorst, Erasmus University Rotterdam. "Integrated Rolling Stock and Shunting Driver Rescheduling"

*Rowan Hoogervorst is currently a PhD candidate at the Econometric Institute, Erasmus University Rotterdam. He holds a MSc degree in Econometrics and Management Science, with a specialization in Operations Research and Quantitative Logistics, from this same university. His research interests lie within the field of applied optimization, in particular public transport optimization. In his PhD project, Rowan focuses on rolling stock rescheduling for passenger railway operators, where he specifically looks at improving the rescheduling of rolling stock within the real-time rescheduling context.*



**Third Prize:** Nuannuan Leng, ETH Zürich. "The role of incomplete information to passengers in railway delays"

*Nuannuan Leng is currently a doctoral student at the Institute for Transport Planning and Systems (IVT) at ETH Zurich, Switzerland. Her PhD project is "The role of information to passengers in public transport disruptions", under the supervision of Prof. Francesco Corman and Prof. Ulrich Weidmann. She obtained her MSc in Transport management from Beijing Jiaotong University. Her research interests include disruption management, information availability, passenger heterogeneity, multi-layer approaches, public transport, large-scale multi-modal network, agent-based simulation, railway operations.*



Congratulations to the winners!! Each recipient will receive a cash award of \$1,000, first place, \$500, second place, and \$250, third place. The slides and recordings from their presentations at INFORMS Virtual 2020 can be found in the [RAS Website](#).



## RAS Celebrates Success!!

Congratulations to **Shantih Spanton** for being one of the awardees of the 2020 INFORMS Volunteer Service Award for her contributions to INFORMS RAS, the INFORMS Professional Recognition Committee (PRC), and the community. The Volunteer Service Award was first awarded in 2016. Its purpose is to recognize exceptional volunteer service to INFORMS. The award winners will be publicized on the INFORMS website, a dedicated Volunteer Service Award page, OR/MS Today, Enews, Social Media and other media vehicles.



**Faeze Ghofrani**, graduated with her PhD in Civil Engineering from State University of New York at Buffalo (UB) in February 2020. Her graduate research with UB involved data-driven railway track deterioration modeling for predictive maintenance under supervision of Dr. Qing He. Faeze has been a member of INFORMS Railway Application Session (RAS) since 2018. She served as INFORMS RAS student officer in 2019. She also won RAS student poster competition third and second places in 2018 and 2019, respectively.

Beginning Fall 2020, Faeze started her academic career as an Assistant Teaching Professor of Rail Transportation Engineering (RTE) at Pennsylvania State University-Altoona (PSU). Her research vision as a faculty member is to incorporate recent data analytics advances and technologies into a broad range of railroad engineering problems. Her most recent research direction at PSU focuses on the emerging track inspection technologies.

On December 18 at 9:30 (CET), **Gert-Jaap Polinder** will defend his PhD-thesis entitled '*New models and applications for railway timetabling*'. The thesis covers various periodic timetabling problems. First, it studies a strategic timetabling problem: how to compute an ideal timetable for passengers without infrastructural limitations, to support strategic decision making. Secondly, an algorithm is developed to modify this timetable as little as possible to make it fit on infrastructure. Thirdly, an algorithm is proposed that modifies PESP constraints as little as possible, to resolve the issue of infeasible timetabling instances. Finally, a robust timetabling problem is studied, to develop a timetable that is robust against periodically reoccurring disturbances. The defence will be broadcasted online, a link can be found in due time at <https://www.erim.eur.nl/research/events/>.

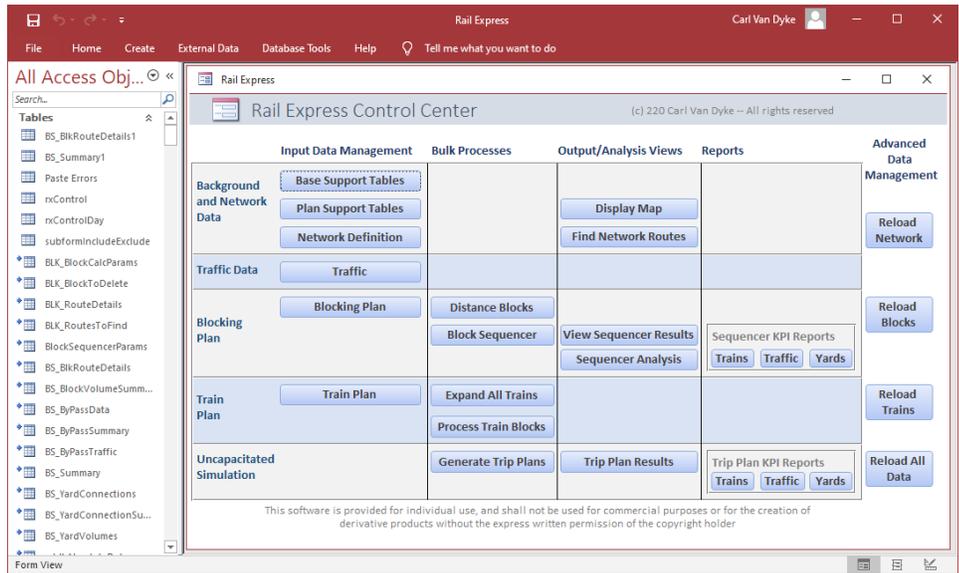


# New Access-Based Railway Analysis Tools

Carl Van Dyke & Roger Baugher, contact: [rwbaugher@aol.com](mailto:rwbaugher@aol.com)

When asked what we have been doing since the onset of the pandemic, our answer is that we have been working on the development of a pair of railway analysis tools! The first is a freight rail operating plan design and evaluation tool we are calling Rail Express, and the second (yet unnamed) is an Access-based Train Performance Simulator (TPS).

Rail Express is a fairly complete (but not fully tested!) network model that includes many features including:



- A graphic and non-graphic representation of a railway network
- A detailed traffic database
- A complete blocking plan, including the ability to algorithmically assign the traffic to the blocks
- A detailed train design tool, including the ability to estimate detailed train routes based on a skeletal routing plan, manage block-to-train assignments, and estimate train sizes
- An uncapacitated, deterministic trip planner or simulation
- Numerous diagnostics identifying plan errors/gaps and improvement opportunities
- Volumetric analysis of train sizes, block sizes, and yard volumes
- Statistics or KPIs related to the blocking plan and overall trip plan results

Plus many other features. There are several aspects of this tool that are of particular note:

- It is built to recognize three different types of operations: general carload, unit train, and intermodal. It has separate logic for each so that they can each be modelled in a manner that is consistent with the way they are operated and “bleed through” of traffic between the three is eliminated
- Local blocking has the ability to include local zones, eliminating the need to enumerate blocks to and from each and every local station
- The blocking tools are strictly algorithmic. That being said, we introduce the notion of an “exclusive” rule to support cases where the user wants absolute control over the routing of traffic. This is done in such a way as to eliminate the need for “drop through logic tables” within the blocking specifications

Due to it being created in Access, the tool is inherently single user/single scenario. It is also limited as to problem size, but likely able to handle fairly large networks. It may also be a bit slow on larger problems. On the plus side, having been created in Access using standard forms, reports, data tables, and VBA code, it is easy to modify and extend.

While Carl has been the primary coder, Roger has been hard at work creating a sample database for use with the tool. Using “ancient” data on the operation of the Grand Trunk Western Railroad circa 1989, the year for which we have a comprehensive data source, we have created a complete operating plan to accompany the tool.



Our plan is to release this tool for individual use and evaluation on a no-cost basis, including academic use. We hope to have the first version out by around January 1. Might be a bit buggy – but given the price, who can complain? While commercial use and creation of derivative products is only by express permission from us, we are open to exploring partnerships related to the technology embodied in the tool.

Swapping hats, Roger has taken the lead in creating an Access-based Train Performance Simulator, while I play a more supporting role. Like Rail Express, this tool will rely solely on Access tables, forms, reports, and VBA code. Our goal is to create an easy to modify tool that will support basic running time and energy consumption estimations for the movement of freight trains. Fingers crossed, this tool may be extended in the future to support more sophisticated energy usage analysis for alternative locomotive types such as electric or hybrid, including modeling of energy recapture efficiency from regenerative (dynamic) braking. Hopefully it will include a library of publicly sourced equipment performance metrics and a number of sample rail lines.

When not working with Carl on our mutual projects, Roger has continued development of flat-yard switching models using AnyLogic. The current version simulates a real switching sequence captured by a video camera at the yard throat. The model accepts a list of switch moves, simulating both shove to rest and kicking operations. It is presently limited to a single locomotive switching from one end of the yard. The intent is to enable replay of a yard's operations to support process improvement, ability to create a what-if environment and a method to estimate the time consumed by a planned switching sequence. Anyone interested in learning more should contact Roger.

## Katie Farmer Named President and CEO of BNSF

### *BNSF Railway*

On September 12<sup>th</sup>, 2020, BNSF announced that Executive Vice President Operations, Kathryn M. Farmer, will become President and Chief Executive Officer on Jan. 1, 2021. She will continue her role on and assume leadership of BNSF's Board of Directors. Carl R. Ice, current President and Chief Executive Officer, will retire at the end of 2020 and remain on BNSF's Board of Directors as well.



Farmer has been with BNSF for 28 years, most recently serving as Executive Vice President, Operations since September 2018. In 1992, Farmer joined Burlington Northern as a management trainee and has held leadership positions in every major function of the company including operations, marketing and finance. Prior to her operations role, Farmer led BNSF's largest business unit as Group Vice President, Consumer Products.

Ice has been with BNSF for 42 years. In 1995, he led a team that orchestrated the merger and subsequent integration of Burlington Northern Railroad and Santa Fe Railway. Since then, he has helped lead the company and culture into what has become the largest Class I railroad in North America. Ice has been integral to the development of the company's operating and marketing plans.

"I want to thank all of the men and women of BNSF. I am proud of having worked with you and all of things that we have accomplished together. One of the most important roles of a CEO is to ensure a strong succession plan is in place," said Ice. "Katie and I have been working toward this plan for a long time. Katie has held many different roles at BNSF with an ever-increasing impact with each new role as she has built trust and confidence throughout BNSF. I am pleased for Katie and the organization knowing BNSF's future is in good hands. Katie is a shining example of BNSF's leadership model and BNSF will continue to build upon its legacy."



As a long-time member of BNSF’s leadership team, Farmer said, “I am humbled and honored to be asked to lead this incredible company and its dedicated employees—men and women that I have worked alongside for almost 30 years. We are well-positioned in our approach to safety and meeting our customers’ expectations while having the necessary capacity to grow with our customers. BNSF has long been a cost leader and we will ensure that continues into the future. I look forward to continuing BNSF’s success.”

“Carl has had a huge impact on this company and this industry having served on BNSF’s leadership team for the entire 25 years of the company’s existence. I have great respect for him and he leaves BNSF well-prepared for the next 25 years,” said Greg Abel, Vice Chairman, Non-Insurance Operations, Berkshire Hathaway. “Katie has had a long career with multiple roles at BNSF which fits well with our efforts to develop our people. Katie’s proven leadership and passion and commitment make her perfect for the role. We’re thrilled that Katie is taking over the role and have the utmost confidence in both her and BNSF’s future success.”

Berkshire Hathaway Chairman and CEO Warren Buffett said, “BNSF is an iconic company and this is a historic day. Carl has been critical to BNSF’s success for a very long time. I thank him for his leadership and his accomplishments. We look forward to Katie’s leadership and more success. She possesses all of the qualities that make us excited about the future.”

### **About BNSF**

BNSF is one of North America’s leading freight transportation companies. BNSF operates approximately 32,500 route miles of track in 28 states and also operates in three Canadian provinces. BNSF is one of the top transporters of consumer goods, grain and agricultural products, low-sulfur coal, and industrial goods such as petroleum, chemicals, housing materials, food and beverages. BNSF’s shipments help feed, clothe, supply, and power American homes and businesses every day. BNSF and its employees have developed one of the most technologically advanced, and efficient railroads in the industry. We work continuously to improve the value of the safety, service, energy, and environmental benefits we provide to our customers and the communities we serve. You can learn more about BNSF at [www.BNSF.com](http://www.BNSF.com)

## *Did you know?*

That RAS has multiple contact points on social media?



# Letter from Incoming Chair Steve Tyber

Steve Tyber, 2021 INFORMS RAS Chair, [steve.tyber@gmail.com](mailto:steve.tyber@gmail.com)

Dear RAS members and friends,



First and foremost, I would like to thank the RAS sponsors and volunteers. RAS is what it is thanks to the financial support of our sponsors and our committed volunteers. Behind each and every great RAS event are great volunteers.

I would like to thank the outgoing officers and student liaisons: Nathaniel Richmond (Keurig Doctor Pepper), Andrea Arias (BNSF), Hadi Karimi (BNSF), Jianqiu Huang (Wabtec), Jiayi Zhao (UIUC), Zhoutong Jiang (UIUC), and Marko Kapetanović (TU Delft). I would also like to thank our cluster chairs: Alexander Lovett (UP), Daniel Windle (Trinity Industries), Nikola Bešinović (TU Delft), and Kiran Chahar (NS). Thanks to their dedication and resourcefulness, we were able to quickly adapt to a virtual setting and preserve the spirit of many of our community's activities.

Despite this year's challenges, we continued to host our annual competitions and executive roundtable. I would like to thank Clark Cheng (NS) and Qing He (SUNY Buffalo) for leading the student paper competition. I would also like to thank Jay Baillargeon (FRA) and Krishna Jha (Optym) for organizing the problem-solving competition for freight train travel-time estimation. Lastly, I would like to thank Daniel Windle (Trinity Industries) for organizing this year's executive roundtable on the timely and highly relevant topic of regulation and market changes in rail.

The most exciting development of 2020 was the newly formed RAS International Committee. The mission of this committee is to foster broader international involvement in RAS, which it has achieved through the RAS International Webinar Series. To date, we have hosted 5 webinars, each with roughly 90 attendees spread across 4 continents. This is off to a great start and I can't wait for an exciting continuation in 2021. I would especially like to recognize the International Committee: Andrea Arias (BNSF), Hadi Karimi (BNSF), Shantih Spanton (CSX), Yihui Wang (Beijing Jiaotong), and Nikola Bešinović (TU Delft).

Once again, thank you to all of our volunteers!

## Looking ahead

We anticipate many of the same challenges in 2021 as we faced in 2020. These challenges led us to cancel the popular Interactive and Poster sessions and indefinitely postpone the mid-year Rail Planning Conference. Going into the new year, we must continue to reimagine existing events and identify new ways to provide value to our members and our sponsors throughout the year. I am greatly encouraged by the success of the International Webinar Series. I firmly believe that this and other activities that engage our community outside the INFORMS Annual Meeting will succeed and will become part of what makes RAS an amazing community.

With that said, I would love your feedback and ideas for how to best serve the community. I can't wait to serve as your chair in 2021!



# Meet the 2020 RAS Officers!

*Andrea Arias, Public Relations Officer*

Join us in welcoming the RAS leadership team that will support our incoming chair Steve Tyber on continuing the great job that previous leaders have done in the past for RAS. We want to thank all the people who participated in this year's election, we appreciate your commitment and willingness for making RAS a better community. Please remember that there are many volunteer opportunities within RAS aside from being an officer, for example chairing one of our competitions or our cluster at the INFORMS Annual Meeting.

Aside from incoming Chair Steve Tyber, who offers his own introduction here in the newsletter, there are two new officers and one "trading up".

**Vice Chair: Andrea Arias, BNSF Railway**

Andrea is moving up from her position last year as Public Relations Officer.

**Bio/Position Statement:** Andrea holds a Ph.D. in Industrial Engineering with a minor in Business Statistics from Texas Tech University, and a Doctoral degree in Industrial Engineering from Pontificia Universidad Católica de Valparaiso, Chile. Her main areas of interest include Mathematical Programming, Optimization, Statistics and Simulation. She started her career in the rail industry at BNSF Railway in 2018 as Senior Operations Research Specialist. Andrea has been an INFORMS member since 2015, and a RAS member since 2019. In 2018 she organized a session in OR applied to drone delivery systems at the INFORMS Annual Meeting, in 2019 she served as chair for the 2019 RAS Problem Solving Competition, and currently she is the Public Relations Officer of the Section and is part of the RAS International Committee.



As Vice Chair, Andrea plans to keep supporting the Section in all its events and activities, as well as to provide new ideas to keep both members and sponsors engaged, while exploring ways to attract new ones, not only within the U.S. but internationally. She will work closely with the Section Chair to make sure everyone in the RAS leadership team has everything they need to be successful in their duties; and to encourage not only continuity but also growth for this amazing community of motivated rail professionals.

**Secretary: Jay Baillargeon, Federal Railroad Administration**

Jay is new to RAS administration.



**Bio/Position Statement:** Mr. Jay Baillargeon is a Program Manager for the Federal Railroad Administration's Office of Research, Development, and Technology and is based at the FRA's Transportation Technology Center in Pueblo, Colorado. He leads a relatively new research program focused on the enhancement of railroad safety through innovative analytical strategies, including artificial intelligence applications for track-related datasets. Jay currently serves on multiple inter-agency task forces related to data management and artificial intelligence at the U.S. Department of Transportation (DOT), including the DOT's AI Task Force in response to the Presidential Executive Order on AI. He has nearly ten years of experience working in the railway industry and holds a Bachelor of Science in Mathematics and a Master of Science in Industrial and Systems Engineering. He is been a member of the INFORMS

Railway Applications Section for the last two years and, during the 2020 organizational year, served as the Problem-Solving Competition Chair. In addition to INFORMS, he is also a member of the American Railway Engineering and Maintenance-of-Way Association (AREMA) and the American Society of Mechanical Engineers (ASME). Regarding his experience directly related to the position of Secretary, Jay has served on similar positions both in and outside of the industry, including coordination, planning, and documentation of activities for Association of American Railroads' (AAR) Strategic Research Initiatives steering committees, such as the Railway Technical Working Committee (RTWC),



during his time with the Transportation Technology Center, Inc., or TTCI. Furthermore, his experiences in secretarial matters extends to similar positions outside of the work environment as Recorder for the Knight of Columbus Council 557 and Assembly 90, a position that is responsible for maintaining accurate documentation of meeting proceedings and action items as well as communication of these to the membership on a regular basis.

**Treasurer: Hadi Karimi, BNSF Railway**

Hadi continues his service as Treasurer.

**Bio/Position Statement:** I received my Ph.D. degree from Clemson University in Spring 2018. Main domains of research and industry experience include Operations Research, Mathematical Optimization, and AI with applications in supply chain optimization, transportation and logistics, and renewable energy management. I have served as Vice President (2016) and President (2017) of INFORMS Student Chapter at Clemson University.



In May 2018, I joined BNSF Railway as a Senior Operations Research Specialist I. In 2019, I served as the Cluster co-chair for Railway Applications Section (RAS) of INFORMS. In 2020 I served in the Treasurer role. This year, I would like to continue my service as a Treasurer. As a Treasurer for RAS in 2020-2021, I intend to provide a good quality administration of Section funds as directed by Section Chair. Prepare accurate and clear financial reports for the Section. Effectively communicate with INFORMS regarding the annual budget and Section spending.

**Public Relations Officer: Kiran Chahar, Norfolk Southern**

Kiran is new to RAS administration.

**Bio/Position Statement:** Kiran Chahar is a Senior Manager Operations Research at Norfolk Southern, a Class I freight railroad. She holds a PhD in Industrial Engineering with a minor in Operations Research from Clemson University. She has over 13 years of experience in railroad and optimization. Her interests in Operations Research include Mathematical Programming, Simulation and Data and Statistical analysis.



Kiran has been RAS member since 2018. She has served as a cluster chair in 2019 and 2020 and has organized the RAS Poster session in 2019 and 2020. As Public Relations officer, she plans to strengthen the RAS community by reaching out to new student researchers from across the world. She plans to maintain the communication going with the RAS community by improving RAS website, distributing quality content in the newsletter amongst other initiatives.

## Thank You 2021 Sponsors!

