What’s new at the meeting?
Note that this year all RAS sponsored activities occur on Sunday, Monday, and Tuesday, and that Sunday activities does not start until 11 AM.
2018 Business Meeting Survey Results

Nathaniel Richmond, Vice Chair, Qing He, Public Relations officer, and Faeze Ghofrani, Student officer

At the 2018 RAS business meeting, we gave out a survey to those in attendance. The purpose of the survey was to gauge community interest in the services/activities we provided, especially the newer ones like the interactive session and the poster session. Below we have shared the results of the survey in two formats: tabular and graphical. The officers reviewed the survey results and attempted to cater to the preferences of our members in 2019.

Selected insights:

- The RAS Roundtable had the highest average score of any survey question.
- Free drinks, a formal dinner, and having an educational banquet received responses that indicate a lower perceived value.
- The Student Paper Competition, Interactive Session, Problem Solving Session, Poster Session, RAS Banquet, Roundtable, and socializing opportunity at the dinner were all given high marks.

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>Not at all Important</th>
<th>Not Beneficial</th>
<th>Neutral</th>
<th>Beneficial</th>
<th>Very Important</th>
<th>Not Familiar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poster session (posters on rail topics with prizes for students)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Interactive session (major rail carriers present on their OR groups and explore a project)</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>7</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Roundtable session (industry experts weigh in on a hot rail topic)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Student paper competition (students submit rail related work to a panel of judges)</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>8</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Problem solving competition (experts put forth a cutting edge problem for teams to solve)</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>RAS banquet itself (regardless of format)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>RAS banquet must be a formal sit down dinner (not buffet)</td>
<td>4</td>
<td>2</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Free drinks at the RAS banquet</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lots of time to socialize and chat at the RAS banquet</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>11</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>RAS banquet should be educational or have some presentation</td>
<td>0</td>
<td>4</td>
<td>10</td>
<td>7</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>RAS should cover the entire cost of the banquet as opposed to individuals paying some or all of the cost</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>9</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
RAS Survey for 2019

Qing He, Public Relations Officer

RAS members were invited by email to respond to a survey of their railway interests and their exciting news in 2019. Ten members responded. Nine of these are based in the United States, with one further from Denmark. Seven of these are employed in industry and three as research/teaching faculty in academia.

Many of the respondents offered a description of their interests in railway. Those texts have been assembled and processed into the “word cloud” shown here. It is interesting that “Optimization” and “Planning” are two of the most significant descriptive words.

All of the respondents briefly shared some of their exciting news in 2019. Selected are listed as follows:

- Kamesh Somani from CSX reported that one of the exciting things we did at CSX this year was to work on company’s strategy and how IT support it. We see a lots of opportunities to use Data Science & OR to help company achieve its strategy.
- Je Sang Sung and Marty Schlenker from BNSF reported that the OR team has been busy providing metrics supporting Movement Planner implementation, developing successful image analytics applications, and supporting updates to BNSF’s railcar distribution systems, trip planner, and intermodal planning systems. In Q3, after a sustained effort, a crew transportation application with significant OR input was placed into production. In operational news, BNSF continues to handle strong volumes in 2019. BNSF has increased train size since 2018 and is expanding the list of trains carrying traffic from multiple business units at once. Spring flooding on the Platte and Missouri Rivers and elsewhere caused outages of up to four months on BNSF. Hundreds of BNSF Engineering, Signal, and Transportation team members joined forces to restore service.
- Clark Cheng from Norfolk Southern reported that Norfolk Southern successfully launched its new TOP21 Precision Scheduled Railroading (PSR) operating plan in July 2019. A suite of OR tools have played an important role in developing the new operating plan to optimize transportation network, improve asset utilization, increase operating efficiency, and better serve customers. The OR tool suite includes network simulator, blocking optimizer, and train scheduler. As the railroad becomes leaner and more efficient, it’s imperative for NS to manage key assets such as locomotives and railcars and maintain proper crew staffing level to meet traffic demands and minimize disruptions to operations. The locomotive shop routing system routes all scheduled maintenance to the right shop at the right time. The car distribution system seamlessly incorporates new operating plan to optimally distribute empty railcars. The crew planning model right-sizes crew pools across the system. NS continues its journey in applying big data, artificial intelligence (AI) and machine learning to improve safety, operations and productivity. In addition to the predictive maintenance models for locomotive and rail, both presented in last year’s annual meeting, NS has developed a prediction model to identify potential failures of radio communications among base station, wayside signal, and locomotive in the Positive Train Control (PTC) system.
- Steven Harrod from Technical University of Denmark has just submitted a major grant application to the EU Horizon 2020 fund. He spent most of the year as co-coordinator on this application containing 19 members and a budget of nearly 7 million euro.
• Xuesong Zhou from Arizona State University worked with students to solve the very challenging cyclic train timetabling problem through model reformulation, and published the paper in Transportation Research Part B. He also assisted the RAS problem competition for the block planning problem and hope this benefits interested researchers and community.

• Jeremiah Dirnberger from GE Transportation reported that GE Transportation merged with Wabtec in February 2019. It has created some exciting new collaborations as they move toward the Yard of the Future including using drones for gathering yard operational parameters. In addition, Yard Planner is going live using a comprehensive change management approach starting in mid-September. Stay tuned for the exciting updates as this cutting edge decision support tool takes flight.

Invited Article: Operations Research at CSX Survived, Thrived, and Created Value in the Changing Environment

Kamalesh Somani, Director Data Science & Operations Research, CSX

I have been at CSX for more than 14 years (all that time in Operations Research), and it has been an exciting career. Operations Research has always played a key role at CSX, and in the railroad industry in general. However, the past few years at CSX have been a time of exceptional change unlike any other time in my career. Operations Research was crucial during our company’s recent push to greater efficiency, and now together with Data Science plays a key role as the company continues to drive value by focusing on adding incremental value, and optimizing execution. I will give some description of our experience and my advice for others who find themselves in dynamic change environments.

During recent changes, the pace was fast and we found many ways to support our business partners. The business would have to make change with or without our help, and were grateful for the insights we brought. There was no time to find optimal solutions with complex models. We shadowed business partners to understand their processes and created heuristic solutions, which were equal to, or better than, their time consuming white board exercises. Once time allowed, we were able to go back and enhance the more critical models. This change from large, sophisticated models to fast, light models is a common theme we have seen in the past decade as the business demands agile practices, and increases its appetite for analytics and decision support. Advice: focus on rapid prototype small useful models; save the big models for entrenched processes.

Our substantial investments in fundamental tools like Network Based Classing (NBC) were a boon. Such core models allowed us to run many simulations a day without changing production classing tables, which would have been an enormous manual task. These powerful models allowed us to sandbox scenarios and make changes quickly in production. Similarly, our Line of Road Simulator (Stringline Planner) was used extensively when we moved away from 12 hour curfews for maintenance teams and needed to find natural track maintenance windows in the constantly changing plan. After extensive development with planners, data owners and maintenance teams, we continued to sit with the engineering team during weekly maintenance meetings to enhance the model and give insights. Advice: invest in your bread-and-butter core models.

NBC showed the impact of potential user changes but the exercises with it highlighted the need for incremental blocking and train models to suggest improvements automatically. We rewrote our blocking model from scratch during this time. We needed an incremental model and it had to mimic the existing base plan. Mimicking the base plan is not easy because traffic must be routed based on its various attributes as well as network attributes which involves many detailed constraints. Feasibility is
complex as well as changes cannot strand cars. This model required sophisticated OR skills as well as programming abilities to implement.

There was also an impact to the OR team composition at CSX at this time. Because of the rapid development cycles, we needed developers with project management skills who were thought leaders as well as technical leaders. All members needed to put on different hats and in turns be a business analyst, DBA, DA, scientist, architect, etc., and not just develop in a niche. Advice: help your people grow and develop new skills, especially front facing skills.

As always, we think the core of our success at CSX is based on the relationships, and the trust we have, with our business partners. By creating small wins that help free up some of their time, they came to trust us and were willing to invest the time with us that we needed to make larger initiatives successful. Learn the business, shadow them, be curious, ask tons of questions, and find pain points. Ideally team members should learn the business problems so well they could do the business job if needed. Advice: get your hands dirty and learn the business well.

Going forward our focus is to use Data Science & Operations Research to predict asset health, create a safer environment, optimize the execution and grow the business. The management is very interested in knowing what will happen tomorrow so that they can plan better today. This real time planning requires understanding the near future, predicting conditions, and proactively resolving issues and/or taking advantage of favorable conditions. I’m excited to see where the new railroad culture takes us. As data quality and access continues to improve, we are ready to leverage this data explosion to drive value at the railroad.

**RAS Member Profile 2019**

*Qing He, Public Relations Officer*

The Railway Applications Section (RAS) held steady in membership in 2019. As of October 10, 2019, the paid membership totaled 123 members. 87 members are regular members, and 31 are student members. Out of all members, 90 are from US and the rest from other 10 countries and regions. One can see a statistically insignificant growth since 2016 when the total numbers is 101. And the total membership exceeds the total membership in 2013 (121). We strongly encourage students (will be free see below), academicians and business practitioners to become RAS members to enjoy and benefit from many perks of being a member. We are proposing new membership fees in coming year. Please refer the following table for the new rates.

<table>
<thead>
<tr>
<th>Membership Type</th>
<th>Current Dues ($)</th>
<th>Proposed New Dues ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
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<td>20</td>
</tr>
<tr>
<td>Student</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Retired</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Community-Only Regular</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Community-Only Student</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>
The number of total RAS members from 2013 to 2019

RAS Membership Trend

Thank you 2019 Gold Sponsors!

[Logos of various sponsors]

OLIVER WYMAN
Session Schedule

Railway Applications Section Sponsored Sessions
INFORMS Annual Meeting 2019, Seattle, WA

Kiran Chahar (Norfolk Southern), Hadi Karimi (BNSF), and Je Sang Sung (BNSF), Cluster Chairs

Sunday, October 20th

39-CC-Room 608. 11:00-12:30– RAS Problem Solving Competition (Chairs: Xuesong Zhou, Arizona State University; Andrea Leticia Arias, BNSF Railway)

This session is reserved for the finalists of the RAS Problem Solving Competition: “Integrated Train Blocking and Shipment Path Optimization (TBSP)”. The finalists have been selected by the Judging Committee. More information about the Competition is available at http://connect.informs.org/railway-applications/awards/problem-solving-competition.

- A New Mixed Integer Programming Model for the Integrated Train Blocking and Shipment Path Optimization Problem, Team 3: Mohammad Reisi-Nafchi, Pouria Asralani, Isfahan University of Technology; Vahid Famlidardashti, CIRRELT
- Integrated Train Blocking and Shipment Path Optimization (TBSP), Team 8: Tsung-Han Wang, Yen-Tzu Yueh, Yen-Wei Chen, National Cheng Kung University
- Integrated Train Blocking and Shipment Path Optimization, Team 30: Karen Angulo Díaz, Oscar Guaje Acosta, Daniel Suarez Bayona, Universidad de Los Andes

39-CC-Room 608. 13:30-15:00 – RAS Student Paper Award (Chairs: Nikola Besinovic, Delft University of Technology; Qing He, University at Buffalo, SUNY)

Awards for the 2019 Railway Applications Section Student Paper Competitions will be presented, along with presentations by the finalists. Winners are listed below:

- Solving Cyclic Train Timetabling Problem Through Model Reformulation: Extended Time Space Network Construct and Alternating Direction Method of Multipliers Methods, Author: Yongxiang Zhang, Southwest Jiaotong University
- Short-term Forecasting of Origin-Destination Matrix in Rail System Via a Deep Learning Approach, Author: Yuxin He, City University of Hong Kong
- Passenger-centered Vulnerability Assessment of Railway Networks, Author: Christopher Szymula, Delft University of Technology
- Strategic Passenger Railway Timetabling*, Author: Gert-Jaap Polinder, Erasmus University (*will be presented during Crew Management session on Tuesday, 10:30 – 12:00)

39-CC-Room 608. 16:30-18:00 – E-commerce and Intermodal Transportation (RAS Joint Session) (Chairs: Qing He, University at Buffalo, SUNY; Steven Jay Tyber, General Electric; Justin Goodson, Saint Louis University)

- Quantifying the Effect of Different Intermodal Terminal Facility Layouts Via Simulation, Team: Tyler Dick, University of Illinois at Urbana-Champaign
- Testing Intermodal Terminal Optimization Models with Simulation, Team: Patricia Randall, Princeton Consultants
- Air-high Speed Rail Intermodal Transport Network Design Problem of China, Team: Mi Gan, Mingfei Wang, Dandan Li, Southwest Jiaotong University
- System-wide Delay Optimizer for Train Schedules at Intermodal Facilities, Team: Di Hoai Nguyen, Amirali Ghahari, BNSF Railway

39-CC-Room 608.18:30-19:30 PM – RAS Business Meeting

19:30-22:00– RAS Dinner, Blueacre Seafood; 1700 7th Ave, Seattle, WA 98101

Monday, October 21st

39-CC-Room 608. 8:00-9:30 – Precision Scheduled Railroading (RAS General Session) (Chair: Carl D. Van Dyke – TransNetOpt)

- Principles of Precision Scheduled Railroading, Team: David T. Hunt, Oliver Wyman
• Precision Scheduled Railroading at Norfolk Southern: Overall Process and Optimization Tools, Team: Clark Cheng, Yudi Pranoto, Norfolk Southern Corporation
• Precision Scheduled Railroading at CSX, Team: Michael Swain, CSX Transportation
• Role of OR, Modeling and Analytics in Precision Scheduled Railroading, Team: Carl D. Van Dyke, TransNetOpt

39-CC-Room 608. 11:00:12:30 – Positive Train Control (PTC) (RAS Panel Session) (Chair: Jeremiah Dirnberger, GE Transportation, Moderator: Jeremiah Dirnberger, GE Transportation, Panelist: Larry Chalmers, Wabtec Corporation)

39-CC-Room 608. 12:30:13:30 – RAS Round Table Luncheon, (Sponsor: Wabtec Corporation)

39-CC-Room 608. 13:30:15:00- Round Table – PTC Discussion (RAS Panel Session) (Chair: Jeremiah Dirnberger, GE Transportation, Moderator: Jeremiah Dirnberger, GE Transportation, Panelist: Larry Chalmers, Wabtec Corporation)

39-CC-Room 608. 16:30:18:00- RAS Interactive Session- (Chair: Clark Cheng, Norfolk Southern Corporation)

Join us for an interactive look at the substantial use of advanced OR techniques in the railroad industry. Four major North American rail carriers (BNSF, CSX, NS, Wabtec Corporation and Amtrak) will be onsite to give in-depth practical demonstrations of OR tools. Join us to learn how railroads implement robust solutions to complex business problems. The demonstrations will focus on the practical implementation of advanced OR models within companywide systems including the core software and technologies used, large scale data constraints, production level deployment, and business alignment

• Schedule, Crew and Trainset Optimization, Team: Mamadou Seck, AMTRAK
• Tool Suite for Intermodal Hubs and Crew Decision Assist, Team: Marty Schlenker, Amirali Ghahari, Dasaradh Mallampati, Je Sang Sung, Seyed Nourbakhsh, BNSF Railway
• Tie Deterioration Prediction, Team: Kamalesh Somani, Shantilih Spanton, Masoumeh Taslimi, CSX Transportation
• Car Routing Tool, Team: Clark Cheng, Andy Yoon, Yudi Pranoto, Gunnar Feldmann, Norfolk Southern Corporation
• Service Design Tool, Team: Dharma Acharya, Ken Kenjale, Wabtec Corporation
• Port Optimizer and Container Visibility, Team: Kunwar Walia, Wabtec Corporation

Tuesday, October 22nd

39-CC-Room 608. 7:30-9:00 - OR/OM Impact on Freight Railway Services (RAS General Session) (Steven Harrod, Technical University of Denmark)

• Efficiency and Effectiveness Analysis of the EU TEN-T Freight Railway Network, Team: Steven Harrod, Technical University of Denmark; Shengdong Li, Southwest Jiaotong University
• Retrospective Impact of Operations Research & Operations Management on Freight Railway Operations, Team: Marc Meketon, David T. Hunt, Oliver Wyman
• Service Network Design for China Railway Express Under the Belt and Road Initiative Considering Market Competition, Team: Yingzi Peng, Lefei Li, Tsinghua University

39-CC-Room 608. 10:30-12:00 – Crew Management in Railway (RAS General Session) (Chair: Seyed Mohammad Nourbakhsh, BNSF Railway)

• Robust Tactical Crew Scheduling Under Fluctuating Demand, Team: Christian Raehlimann, Felix Wagener, Ulrich Thonemann, University of Cologne
• A Heuristic-based Tactical Crew Sizing Model for Freight Railroad, Team: Kiran Chahar, Clark Cheng, Norfolk Southern Corporation
• Scheduling and Routing Roaming Conductors to Support Single-person Crew Operations On North American Freight Railways, Team: Tyler Dick, University of Illinois at Urbana-Champaign
• Railway Crew Rescheduling with Flexible Starting Times, Team: Felix Wagener, Ulrich Thonemann, University of Cologne
• Strategic Passenger Railway Timetabling (Student Paper Contest Awardee), Team: Gert-Jaap Polinder, Erasmus University

39a-CC-Room 608 Hall. 12:05-13:35- RAS Poster Session (Chair: Kiran Chahar, Norfolk Southern Corporation)

The RAS poster session provides an interactive way to share knowledge and state-of-the-art research in railroad applications. Poster presenters will have the opportunity to show case research or projects that are at early stages of development, and
benefit from the interactive critique, suggestions, and encouragement from colleagues working in the area of railroad business analytics and optimization.

39-CC-Room 608. 14:00-15:30 – Railroad Maintenance (RAS General Session) (Chair: Qing He, University at Buffalo, SUNY)

- **Rail Service Failure Analysis: A Data-driven Approach**, Team: Faeze Ghofrani, Seyedsina Yousefianmoghadam, Qing He, Andreas Stavridis, University at Buffalo, SUNY
- **Joint Optimization of Track Maintenance and Renewal Planning**, Team: Reza Mohammadi, Qing He, University at Buffalo, SUNY
- **Using Smartphones to Assess Vehicle Running Quality and Track Conditions of Urban Rail Transit**, Team: Jianli Cong, Southwest Jiaotong University; Qing He, University at Buffalo, SUNY
- **Machine Learning for Predictive Maintenance of Positive Train Control (PTC) System**, Team: Clark Cheng, Mabby Amouie, Ilya Lavrik, Norfolk Southern Corporation
- **Optimizing Conditioned-based Maintenance and Investment in Shared Freight and Passenger Corridors**, Team: John F. Betak, Collaborative Solutions LLC; Trefor P. Williams, The State University of New Jersey

![Somani is Director of Data Science and Operations Research at CSX Railway. He has been a RAS member since its inception in 2003.](image)

### 2019 Distinguished member

*Michael F. Gorman, Distinguished Award Member Committee Chair, Professor, University of Dayton*

It is my sincere pleasure to announce that Kamalesh Somani is the 2019 RAS Distinguished member. Kamalesh has a M.S. in Industrial and Systems Engineering from the University of Florida. He has been a member of RAS since 2003. His academic and professional accomplishments, as well as his contributions to RAS are truly impressive.

In his current role as Director of Data Science and Operations Research at CSX Railway, and in previous roles there, he has been integral in developing CSX Data Science & Operations Research team, leading and participating in numerous challenging projects. These projects range from curfew/gang scheduling, rail inspection vehicle routing, caller district partitioning, rail grinding scheduling, to locomotive service facility planning. Many of the optimization solutions developed under his leadership are still being used heavily by CSX on a day to day basis.

He has authored/co-authored several papers and presentations in numerous areas. His special skills in developing and implementing solution algorithms has enabled him to solve a wide variety of railway problems including block optimization and train scheduling, crew and locomotive planning and distribution, and railway track component inspections and renewal scheduling. His special interests in solving real world railway problems has been astounding.

Most importantly, he has been an ever-present tour de force as a member of RAS. Of course, he is a regular, well known and enthusiastic attendee. More importantly, he has contributed his time and talents to RAS leadership and volunteer positions on a regular basis. He has been the Chair and Vice Chair twice (2010/2011, 2017/2018) and Treasurer twice (2008, 2009). He also has been a regular volunteer in the Rail Problem Competition (2011- 2015) and Student Paper Contest (2011- 2015).

Truly, Kamalesh exemplifies everything we would like to emulate as a RAS member, and is truly deserving of this award.
Congratulations, Kamalesh!

2019 Rail Problem Solving Competition Finalists:

**Integrated train blocking and shipment path optimization**

*Andrea Arias, Competition Chair*

*Boliang Lin and Xuesong Zhou, Problem Owners*

This year, over 50 teams from all over the world participated in the RAS Problem Solving Competition, which seeks to optimize the integrated train blocking and shipment path problem. Each submission was thoroughly evaluated by a committee of judges based on solution quality, methodology, quality of presentation, scalability, and applicability in the railroad industry.

Proposed solution approaches included innovative reformulations to the problem and interesting decomposition heuristics. The three finalists will be presenting their work at INFORMS 2019 annual meeting in Seattle, WA, on Sunday October 20, at 11:00 am (RAS session SB39), to compete for the first, second and third place.

Congratulations to the finalists for their hard work! And a huge thank you to all the people that have contributed to the success of this competition (problem owners, participants, judges, sponsors, etc.).

Looking forward to seeing you all at INFORMS 2019 Annual Meeting!

**Finalists:**

“A New Mixed Integer Programming Model for the Integrated Train Blocking and Shipment Path Optimization Problem”

*Authors*: Mohammad Reisi-Nafchi, Pouria Arsalani, Department of Industrial & Systems Engineering, Isfahan University of Technology, Isfahan, Iran; and Vahid Famildardashti, CIRRELT, Montreal, Canada.

*Abstract*: An arc-based Mix Integer Programming (MIP) model is presented to solve the Integrated Train Blocking and Shipment Path optimization problem. No linear MIP model has been presented for this problem in the literature. We developed a linear MIP model for this problem and reported and analyzed the computational results. Three different problem instances provided by RAS2019 for this problem were solved using GUROBI optimizer.

“Integrated train blocking and shipment path optimization (TBSP)”

*Authors*: TSUNG-HAN WANG, YEN-TZU YUEH, and YEN-WEI CHEN, National Cheng Kung University, Taiwan.

*Abstract*: Viewing each OD shipment as a commodity, this problem becomes a special min-cost OD multicommodity network design problem, where the bundle constraints consider two more types of node capacities. Starting with good initial multicommodity flows, our two integer programs cover all constraints with good efficiency and effectiveness. The innovative inverse shortest path heuristic helps good estimation on the dual variables of bundle constraints. A column generation scheme is also proposed.
"Integrated train blocking and shipment path optimization"

Authors: Karen Angulo Díaz, Oscar Guaje Acosta, and Daniel Suarez Bayona, Universidad de Los Andes, Colombia.

Abstract: We propose a methodology that solves the TBSPP based on three stages. First, we propose a novel formulation based on a multi-commodity network flow problem to generate an initial set of routes. Second, we greedily augment the set of routes seeking diversity in the available routes. Finally, we solve an MIP that enforces feasibility using the set of available routes. We achieve good solutions in acceptable computational time.

2019 Student Paper Competition

Nikola Bešinović and Qing He, 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 Shantih Spanton. 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: C. Tyler Dick, Carlo Mannino, Dennis Huisman, Jianqiu Huang, Lingyun Meng, Paola Pellegrini, Pavle Kecman, Qing He and Rex Lai.

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

First Prize: Christopher Szymula, Delft University of Technology, Technische Universität Dresden, Passenger-centered vulnerability assessment of railway networks

Christopher studies Traffic and Transportation Engineering at Technische Universität Dresden. Following the track Engineering of Transportation Systems and Logistics, he is specialised in public- and railway transportation as well as mathematical modelling and optimisation. During an exchange year at Technische Universität Delft, he made his first steps in academic research and also gained air transportation insights. Next to his studies, he has been working for the chair of traffic flow science in Dresden and is actively working as a tram driver and in the transport planning department for the public transport company of the city of Leipzig.

Second Prize: Yuxin He, City University of Hong Kong, Short-term forecasting of Origin-Destination matrix in rail system via a deep learning approach

Yuxin received her B.S. and M.S. degree in transportation planning and management from Central South University, Changsha, China, in 2014 and 2017 respectively. She is pursuing the Ph.D. degree with the School of Data Science, City University of Hong Kong, Hong Kong,
12

518000, China. Her research interests include network analysis, traffic flow theory and data mining.

Third prize: Yongxiang Zhang, Southwest Jiaotong University, Solving cyclic train timetabling problem through model reformulation: extended time-space network construct and Alternating Direction Method of Multipliers methods

I am a Ph.D. candidate at Southwest Jiaotong University under the supervision of Qiyuan Peng. I received a bachelor degree in 2014 from Southwest Jiaotong University majoring in Railroad Transportation Engineering. From December 2017 to June 2019, I was also a visiting Ph.D. student at Arizona State University. My research focuses on optimizing real-life railway train scheduling problems with effective and efficient problem decomposition techniques, especially when the railway transportation is facing with increasing travel demand and high-quality service requirements. I appreciate the valuable chance of applying optimization methods to improve the social and economic benefits of railway transportation.

Third prize: Gert-Jaap Polinder, Erasmus University Rotterdam, Strategic Passenger Railway Timetabling

I am a last year PhD student from the Erasmus University in Rotterdam, The Netherlands. Before this, I studied Applied Mathematics at Delft University of Technology. In my master thesis about infeasibilities in timetabling, I worked with Leo Kroon, who offered me a PhD position, which I now fulfill under the supervision of Marie Schmidt and Dennis Huisman. In my project, I focus on the development of algorithms for long term strategic timetabling. I really like the challenge of finding methods to solve the very challenging problems that exist in complicated railway networks.

Each recipient will receive a cash award of $1,000, first place, $500, second place, and $250, third place (to be split between two recipients). The winners will present their research at the INFORMS Annual Meeting, Sunday, October 20th 2019, in Seattle, WA.

BNSF OR Team Organizational Changes

The BNSF Operations Research and Advanced Analytics (OR&AA) team had organizational changes in the first quarter this year. After more than 20 years of distinguished services to BNSF and the Railroad community, Dr. Pooja Dewan left her role as the leader of BNSF OR&AA team. Marty Schlenker, previously the AVP of Merchandise Service Design at BNSF, accepted the role of OR&AA leader upon Pooja’s moving.

Pooja holds a PhD in Industrial Engineering from Penn State University, and joined BNSF in 1998. With her contributions and leadership, the BNSF OR&AA team grew into a well renowned team with solid technical expertise in Optimization, Simulation, Machine Learning and Statistical Analytics. The team helped drive millions of dollars savings annually from the multiple decision support tools and systems they developed. Pooja is a recognized member of INFORMS and has served in various official positions in the INFORMS and RAS organizations. Under her leadership, the BNSF OR&AA received the INFORMS Prize in 2018 for effective integration of OR/MS principles in the organization. After

Marty Schlenker  Pooja Dewan
leaving BNSF, Dr. Devan has joined the Otis Elevator Company as the VP of Data and Analytics. Along with all her colleagues, including the RAS members, we wish her well on her new adventures!
The new leader of the OR&AA team at BNSF, Marty Schlenker, is a seasoned BNSF veteran. Marty holds a BA in Economics from University of Chicago and an MSc in Transportation from MIT. Before joining BNSF, Marty served as a Managing Director at CSX Transportation for 2 years. Marty began his BNSF career in 1999 as a trainmaster progressing to positions in Network Strategy. In 2004, he moved to the Service Design and Performance department where he served in various roles with increasing responsibility. He was promoted to the role of AVP of Merchandise Service Design in 2012. He has had significant impact on company’s strategic decisions to provide a reliable and effective service to the clients. Marty has a deep knowledge and experience in both operations and analytical areas at BNSF. He brings a unique perspective of how OR&AA team can closely align itself with business, operations and technology services. We wish him luck in his new role as the leader of BNSF OR&AA team!

**Letter from Incoming Chair Nathaniel Richmond**

Nathaniel Richmond, 2020 INFORMS RAS Chair, Principal Data Scientist, Keurig Dr Pepper

nathaniel.richmond@kdrp.com

Dear RAS members and friends,

First, thank you for your continued support and involvement in the Railway Applications Section of INFORMS. RAS operates due to the generosity of our great financial sponsors and outstanding volunteer leaders. A huge amount of effort goes into coordinating all of the events that occur before, during, and after the INFORMS Annual Meeting, and I’d like to thank everyone that was involved in the planning.

I would like to especially thank the outgoing 2019 RAS officers Shantih Spanton (CSX), Steve Tyber (Wabtec), Yashar Khayati (BNSF), and Qing He (University at Buffalo, SUNY), as well as session chairs Kiran Chahar (Norfolk Southern), Hadi Karimi (BNSF), and Je Sang Sung (BNSF). This year’s student liaisons were Faeze Ghofrani (University at Buffalo, SUNY), Zhoutong Jiang (University of Illinois), and Reza Mohammadi (University at Buffalo). This team has been great to work with, and it’s amazing what we’ve accomplished!

We thank Andrea Arias (BNSF) for heading the 2019 problem-solving competition. With the assistance of problem owners Boliang Lin (Beijing Jiaotong University) and Xuesong Zhou (Arizona State University), this year we had a record-setting 52 teams register for the competition. We thank Nikola Besinovic (TU Delft) and Qing He (University at Buffalo, SUNY) for leading the student paper competition smoothly.

Our two newest activities, the interactive session and the poster session, were well-received by our members as indicated by solid attendance and favorable survey responses in 2018. Therefore we continued to offer these activities in 2019. This year’s interactive session was organized by Clark Cheng (Norfolk Southern) and features presenters from Amtrak, BNSF, CSX, Norfolk Southern, and Wabtec. The 2019 poster session was organized by Kiran Chahar (Norfolk Southern) and featured awards for best student poster. The RAS Roundtable was organized by Jeremiah Dirnberger (Wabtec) and brought together speakers from BNSF, Princeton Consultants, the Technical University of Denmark, and Wabtec.

This year for the first time, we established a Leadership Advisory Committee consisting of too many members to list here. A very special thanks goes out to this group of knowledgeable folks who provided important guidance throughout 2019.
Looking Ahead: As the rail industry continues to evolve and we push toward more data-driven solutions, RAS will maintain its focus on providing timely and relevant activities and networking opportunities. We will continue our work to standardize and formalize the processes behind awards and events, which we began with the bylaws amendments introduced in October 2019. RAS offers a staggering number of competitions, awards, and special sessions for an organization of our small size, and we will continue to strive for excellence in these areas. We hope that more active marketing of our exciting activities and competitions can increase membership in a sustained way. I’m excited to be a part of this great organization and I look forward to serving you all as chair in 2020!

Meet the 2020 RAS Officers

Qing He, Public Relations Officer

There is a great deal of new blood entering the Railway Applications Section leadership next year. A concerted effort was made by the current leadership to solicit new candidates, and this in fact resulted in a very competitive election. We appreciate those candidates who took the time to write something about themselves and consider these positions. We genuinely wanted to encourage more activism, and to offer members more choices in the direction of the organization.

Aside from incoming Chair Nathaniel Richmond, who offers his own introduction here in the newsletter, there are three new officers and one “trading up”. We reprint here their biographies and election statements. Photos have been obtained from public profiles, such as LinkedIn.

Vice Chair: Steve Tyber, GE Transportation

Steve is moving up from his position last year as RAS Secretary.

Bio/Position Statement: I am an operations researcher at Wabtec where I develop algorithms in the intermodal and automotive terminal space. Prior to joining Wabtec, I worked at the GE Global Research Center and solved problems across multiple industries including transportation, aviation, healthcare, and power. I caught the rail bug four years ago and I’ve never looked back. Currently, I serve as Secretary of RAS and will co-chair this year’s session on intermodal. In the past, I have judged both the student paper and problem solving competitions and presented in and helped chair RAS cluster sessions. RAS has cultivated my interest in the rail industry and has played a key role in professional development as a rail practitioner. I view the role Vice Chair as a continuation of my service to RAS and a chance to give back to the community. As Vice Chair, I would ensure the same opportunities that I had to learn and get involved are available to other newcomers in the industry. Many of these RAS activities would not be possible without the support of our sponsors. I would also like to explore new ways to engage with sponsors and make sure they see the benefit of their contributions to RAS.

Secretary: Jianqiu Huang, GE Transportation

Jianqiu Huang is an operation research scientist at GE Transportation, a Wabtec company. He received his Ph.D. in Industrial and Systems Engineering from University of Florida. His current works focus on developing models and algorithms for the intermodal terminal optimization. In 2019, he served as a judge for the RAS student paper competition.
Hadi is new to RAS administration.

**Bio/Position Statement:** I received my Ph.D. degree in Industrial Engineering from Clemson University in Spring 2018. My main research interest during graduate school was in the area of Operations Research 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. Other affiliations with office involvements include IIESE (Institute of Industrial and Systems Engineers) and Alpha Pi Mu (industrial engineering honor society).

In May 2018, I joined the BNSF Railway as a Senior Operations Research Specialist. Last year, I served as the Cluster co-chair for Railway Applications Section (RAS) of INFORMS. This year, I am interested to serve as a Treasurer for RAS to expand my experience and increase my involvement with RAS. As a Treasurer for RAS in 2019-2020, 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, and effectively communicate with INFORMS regarding the annual budget and Section spending.

**Public Relations Officer: Andrea Arias, BNSF**

Andrea is new to RAS administration.

**Bio/Position Statement:** Andrea Arias 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.

Andrea has been an INFORMS member since 2015, and RAS member since 2019. In 2018 she organized a session in OR applied to drone delivery systems at the INFORMS Annual Meeting, and currently she serves as chair for the 2019 RAS Problem Solving Competition. As Public Relations officer, Andrea plans to improve the RAS website, and to work very hard to attract new members and to keep current members engaged. Also, one of her main goals is to keep the OR community well informed about all RAS activities and events.

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**Thank You 2019 Silver Sponsors!**
Did you know?

That RAS has multiple contact points on social media?

connect.informs.org/railway-applications

www.linkedin.com/groups/2399643/

www.facebook.com/groups/INFORMSRAS/

Incoming RAS 2020 Officers

Chair: Nathaniel Richmond, Keurig Dr Pepper
Vice Chair: Steve Tyber, GE Transportation
Secretary: Jianqiu Huang, GE Transportation
Treasurer: Hadi Karimi, BNSF
Public Relations Officer: Andrea Arias, BNSF

Business meeting
Sunday, October 20th, 18:30-19:30
Continues in the same room (39-CC-Room 608)

RAS dinner – SOLD OUT
Sunday, October 20th, 7:30 pm
Blueacre Seafood; 1700 7th Ave, Seattle, WA 98101
Please contact Yashar Khayati (Yashar.Khayati@bnsf.com) if you have not already registered, this meal is at capacity and no further seats are available.