

International Conference on Transportation and Development 2021

Transportation Operations, Technologies,
and Safety



Selected Papers from the Proceedings
of the International Conference on
Transportation and Development **2021**
■ June 8–10, 2021

ASCE

Edited By
Chandra R. Bhat, Ph.D., PE



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& DEVELOPMENT
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SAFETY*

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SPONSORED BY
The Transportation & Development Institute
of the American Society of Civil Engineers

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Preface

It is my great pleasure to present to you the proceedings from the ASCE International Conference on Transportation and Development (ICTD 2021), organized by the Transportation and Development Institute (T&DI) of ASCE. ICTD is ASCE's flagship conference in transportation and development. The 2021 conference is set to build up on the theme from our 2018, 2019, and 2020 conferences, and speaks to the need for mobility solutions that are smart, integrated, and human-centric. The conference was scheduled to be held at The Hilton in the heart of the beautiful downtown Austin, but as in case of other ASCE events, has been moved to be delivered as a virtual event from June 8 – 10, 2021 due to concerns related to the COVID-19 pandemic.

While the decision to move the conference from an onsite event in Austin, Texas to a virtual event came after intense deliberations, it was the right thing to do in the interest of the health and safety of our members, attendees, and stakeholders. The good news is that following ICTD 2022 in Seattle, we are all set to bring ICTD back to Austin in 2023 to showcase all the exceptional transportation and development projects and initiatives that have become the force behind the success of this thriving city.

ASCE ICTD 2021 conference proceedings follow the great success of ICTD 2020, 2019, 2018, and 2016 proceedings, and attracted significant interest as indicated by the rich content. Each paper went through a rigorous peer review by at least two to three technical experts and a quality assurance process before becoming a publication of ASCE – the world's largest publisher of Civil Engineering content.

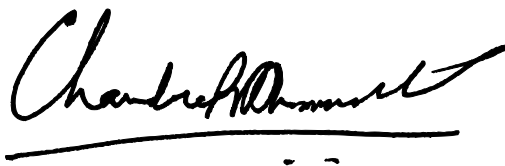
The proceedings for this conference have been organized into two (2) high-level volumes based on topical distribution as follows:

- Volume I: Transportation Operations, Technologies, and Safety
- Volume II: Transportation Planning & Development

ASCE ICTD 2021's three-day technical program has been designed to feature three plenary sessions with national leaders from ASCE, government agencies, and private industry, discussing core conference themes. The program also covers deeper technical content on multiple topics and modes in transportation and development through several breakout panel and presentation sessions. The synchronous online sessions have been carefully designed to enhance the experience of participants and provide the opportunity to earn PDHs. In addition, a virtual poster session has been designed to provide the opportunity for attendees to learn about cutting edge research. An important part of the program is the availability of on-demand content in the form of pre-recorded presentations from transportation practitioners and researchers around the world. The on-demand content will be available to conference attendees during and after the event. The program is also designed to include a variety of special events, such as the Diversity, Equity, and Inclusion (DEI) sessions, Younger Members' online social, a T&DI Annual Awards Event, and several other opportunities for technical and nontechnical learning and networking.

All these accomplishments were due to the incredible efforts of my leadership partners and ICTD 2021 Conference Co-Chairs, Jen Duthie and Steve Dellenback, the Conference Steering Committee, and the terrific support from ASCE T&DI staff. I would also like to express my sincere gratitude to all the authors for their contributions. I am also grateful to all paper reviewers for their outstanding volunteer efforts.

Our unique integration of private, government, and academic leaders makes the ASCE ICTD event series an excellent platform for information exchange, experience sharing, and professional networking. Please note that ASCE ICTD 2022, our next onsite conference, is scheduled to be held from June 1 to 3, 2022 at the downtown Hyatt Regency in Seattle, Washington. I am confident that it will be a wonderful and rewarding experience, and I look forward to seeing you there. I sincerely hope that ASCE ICTD becomes a ‘can’t miss’ conference in each year that follows. On behalf of the conference leadership, organizing committee, and the ASCE T&DI family, I wish you all the best!



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