MTCE- ISIC Track Summary Report

Introduction

International Society for Intelligent Construction (ISIC) North America (NA) Chapter had supported the ISIC Track of the 2022 Minnesota Transportation Conference and Expo (MTCE) from May 17 to May 19 at the RiverCenter in St. Paul, MN. There were approximately 1,400 attendees for MTCE. The ISIC Track sessions were well-attended. This document is a concise report for the ISIC Track Sessions.

Agenda

The agenda for the ISIC Track sessions is as follows.

Tuesday, May 17

Time	Room	Topics	Presenters
1:00PM to 3:00PM	Ballroom D	1. Veta Training	George Chang, The Transtec Group, Inc. Rebecca Embacher, MnDOT Amanda Gilliland, The Transtec Group, Inc. Michael Johnson, MnDOT James Schneider, MnDOT Abbasali Taghavighalesari, The Transtec Group, Inc.
3:00 PM to 4:00 PM	Ballroom D	2. International Society for Intelligent Construction (ISIC) North American Chapter Meeting	Tim Kowalski, Wirtgen Group

Wednesday, May 18

Time	Room	Topics	Presenters
10:00AM to 11:00AM	Ballroom D	3. Milling 101	Tom Chastain, Wirtgen Group Kevin Garcia, Trimble
11:00PM to 12:00PM	Ballroom D	4. AMG Milling Using Relative Surface	David Ford, Pavement Recycling Systems Ben White, RDO
1:30 PM to 3:00 PM	Ballroom D	5. Paving 101	Laikram Narsingh, Vogele
3:30 PM to 4:30 PM	Ballroom D	6. Compaction 101	Tim Kowalski, Wirtgen Group

Thursday, May 19

Time	Room	Topics	Presenters
9:30 AM to 10:30 AM	Ballroom D	7. Current Intelligent Construction Technologies	Paul Angerhofer, MOBA Ed Shappell, Trimble
10:45AM to 11:15AM	Ballroom D	8. Artificial Intelligence	Soheil Nazarian, University of Texas at El Paso
11:15AM to 11:45AM	Ballroom D	9. Complexity of Using Automation and Autonomous	Kevin Garcia, Trimble
1:30 PM to 2:30 PM	Ballroom D	10. Preplanning Construction with Virtual Playback	Chuck Hixon and Scott XXXX, DCW Ed Shappell, Trimble Jim Preston, TOPCON
2:45 PM to 4:15 PM	Ballroom D	11. Panel Discussion on Intelligent Construction Technologies	Rebecca Embacher, MnDOT (Moderator) Curt Dunn, NDDOT William Johnson, MODOT Kevin Garcia, Trimble Tim Kowalski, Wirtgen Group Brian Nagel, Caterpillar Laikram Narsingh, Vogele Jim Preston, TOPCON

Sessions and Presentations

Veta Training

Veta is a geospatial software for intelligent construction data management (https://www.intelligentconstruction.com/veta/). Veta can import data from various intelligent compaction (IC) machines, paver-mounted thermal profilers (PMTP), and dielectric profile systems (DPS) to perform viewing, filtering, sublotting, and spot tests imports and analysis. Veta displays compaction information in easy-to-read formats, including graphs and maps. Veta has been funded continuously by US FHWA, MnDOT, and the TPF-5(354) study since 2013. Veta is currently sponsored by the National Road Research Alliance - NRRA (Phase-II) (https://www.pooledfund.org/Details/Study/693). Veta is also required in AASHTO R 110 and R111 standards for paver-mounted thermal profiling (PMTP) and intelligent compaction (IC).

MnDOT and Transtec Group conducted a 2-hour Veta training. This hands-on training required attendees to bring a laptop and download the Veta software and some example class files. The class files and Veta software were provided to the attendees before the training. About 70 people from FHWA, DOTs, academics, consultants and manufacturers attended this training.

The objectives of the Veta training are:

- To familiarize attendees with how to get involved with funding of Veta software development and maintenance, the establishment of data lots per AASHTO PP114, and examples of workmanship issues that can be identified using Veta.
- To provide a general overview of the features available within Veta.
- To train attendees on the use of Veta 7.0, including:
    - Creation of new projects.
    - Import of intelligent construction technology (ICT) data such as:
        - Paver Mounted Thermal Profiling (PMTP) – AASHTO R 110 (formerly PP 80)
        - Intelligent Compaction (IC) – AASHTO R 111 (formerly PP81)
        - Dielectric Profile System (DPS) – AASHTO PP98
    - Import standardized legends and alignment files.
    - Creation of filter groups, DPS calibration equations, data and operation filters, and sublots.
    - Adding spot test data to the Veta project.
    - Analysis of ICT data.

The detailed agenda of the Veta training is as follows:

Time	Topics	Presenters
1:00 PM	Welcome	George Chang (The Transtec Group, Inc.)
1:05 PM	Veta software development and maintenance funding	Rebecca Embacher (MnDOT)
1:15 PM	AASHTO PP 114 "Standard Practice for Data Lot Names for Use with Intelligent Construction Data"	Rebecca Embacher (MnDOT)
1:30 PM	Live demonstration of Veta software	George Chang (The Transtec Group, Inc.)
1:45 PM	Navigate to files downloaded in advance to training	Mike Johnson (MnDOT)
1:50 PM	Veta project part 1 New project, import ICT data files, import alignment files, import standardized legends, create filter groups, create DPS calibration equations, modify operation and data filters, apply filter groups, override filters, and view data.	Mike Johnson / Jim Schneider (MnDOT)
2:40 PM	Veta project part 2 Run analyses and review of results	Mike Johnson / Jim Schneider (MnDOT)

The trainers introduced the Veta background, funding mechanism, implemented AASHTO standards, basic features, and hands-on excises with real-world examples of IC, PMTP, and DPS data using the AASHTO PP 114 data lot naming convention. Though the AASHTO standards and Veta are only required in the US, they are shown to be universally applicable to most ICTs worldwide. The Veta software is an essential tool to manage ICT data and facilitate ICT implementation for all producers and users. The audience was encouraged to fund Veta to keep it accessible to all users.

Figure 1. Presentation on Veta Software, Funding, AASHTO Data Lot Names by Rebecca Embacher (with download link)

International Society for Intelligent Construction (ISIC) North American Chapter Meeting

Tim Kowalski, Wirtgen Group, the chair of ISIC NA Chapter, conducted the meeting with Amanda Gilliland (Transtec Group, ISIC NA Chapter's Communication Coordinator) and Jim Preston (TOPCON, ISIC NA Chapter's Treasurer). Tim led the discussions on various hot topics regarding the ISIC NA chapter's current and future activities:

- Data QA verification – summary of efforts to date.
- Webinar content – previous webinars and recordings.
    - BIM for Pavements.
    - Automation in Construction.
    - ICT Book Series – Introduction to Intelligent Construction Technologies for Transportation Infrastructure.
    - New digital As-Builts & Project Information Model (DAB/PIM).
- Amanda to show website including posted meeting minutes.
- Charging for membership – coming soon.
- DPS equipment updates.
- MDMS updates.
- Promotion for international conference 2023.
- Call for topics/resources/NA 2024 conference topics.
- Membership drive.

Milling 101

Tom Chastain, Wirtgen Group, presented part 1 on 2D milling. Kevin Garcia, Trimble, presented part 2 on 3D milling. Jim Preston, TOPCON, facilitate the discussion. The discussion includes:

- The differences between 2D and 3D milling
- The differences between "copying" and "profiling/variable depths" millings
- How to measure the milling quantities correctly

Figure 2. The Speakers for Milling 101 (left to right: Garcia, Chastain, and Preston)

AMG Milling Using Relative Surface

David Ford, Pavement Recycling Systems, and Ben White, RDO, co-present this session on AMG Milling Using Relative Surface.

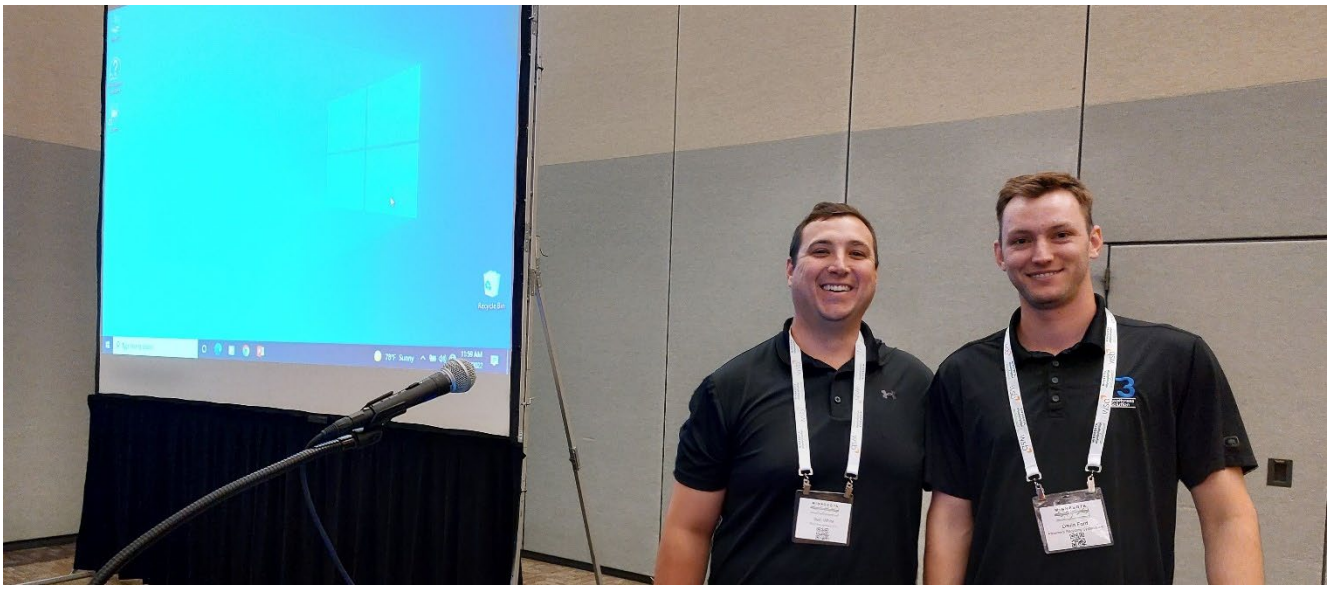

Figure 3. The Speakers for AMG Milling Using Relative Surface (left to right: White and Ford)

Paving 101

Laikram Narsingh, Vogele, made this presentation on Paving 101. The outlines are as follows:

1. Principles of the Free-Floating Screed
    a. How is Screed compaction Achieved
    b. Increase & Decrease of Mat Depth
    c. Automatic Grade Control, including 3D Paver control
    d. Managing the Screed Forces to enhance Smoothness & Density

2. Screed Adjustments & Setup for Paving
    a. Extensions Angle of Attack & Match Height
3. Basics of Segregation
    a. Typical Locations, Causes & Solutions
    b. Mat Flaws: Segregation vs. Screed Adjustment
4. Intelligent construction Technology used to Manage the R & F force

This presentation covers the complete paver technologies and operations. Researchers and specification writers are encouraged to study it in detail.

The discussion includes:

- Does the larger MTV provide a better thermal profile than the smaller MTV?
    - Nar's response: See slide # 23 & 53. MTVs are used for non-contact continuous paving. Proper truck exchange and material management during the truck exchange are critical. If you have to stop, use a proper hopper insert and keep at least ½ full. The total surge is also critical! One must have adequate surge to exchange truck without running the insert low. Larger MTVs allow operators to be more laidback.
- Does an MTV eliminate all segregation
    - Nar's response: No! See slide # 47. Segregation occurs when the material is being handled at various locations. The last two handling locations/points are when filling the hopper or hopper-insert and when the tractor delivers the material under the screed. It must have an adequate remixing device to reduce segregation at these two locations.
- Is there any other solution to reduce segregation under the auger drive box??
    - Nars' response: See slide # 55. Raising or lowering the augers and material height control is usually the first trial. The ideal solution is the reverse flight's push-pull concept. The segregated material gathered under the auger box must be moved away. One must be careful with excessive wear with some abrasive material.

Figure 4. The Speaker for Paving 101 (Narsingh)

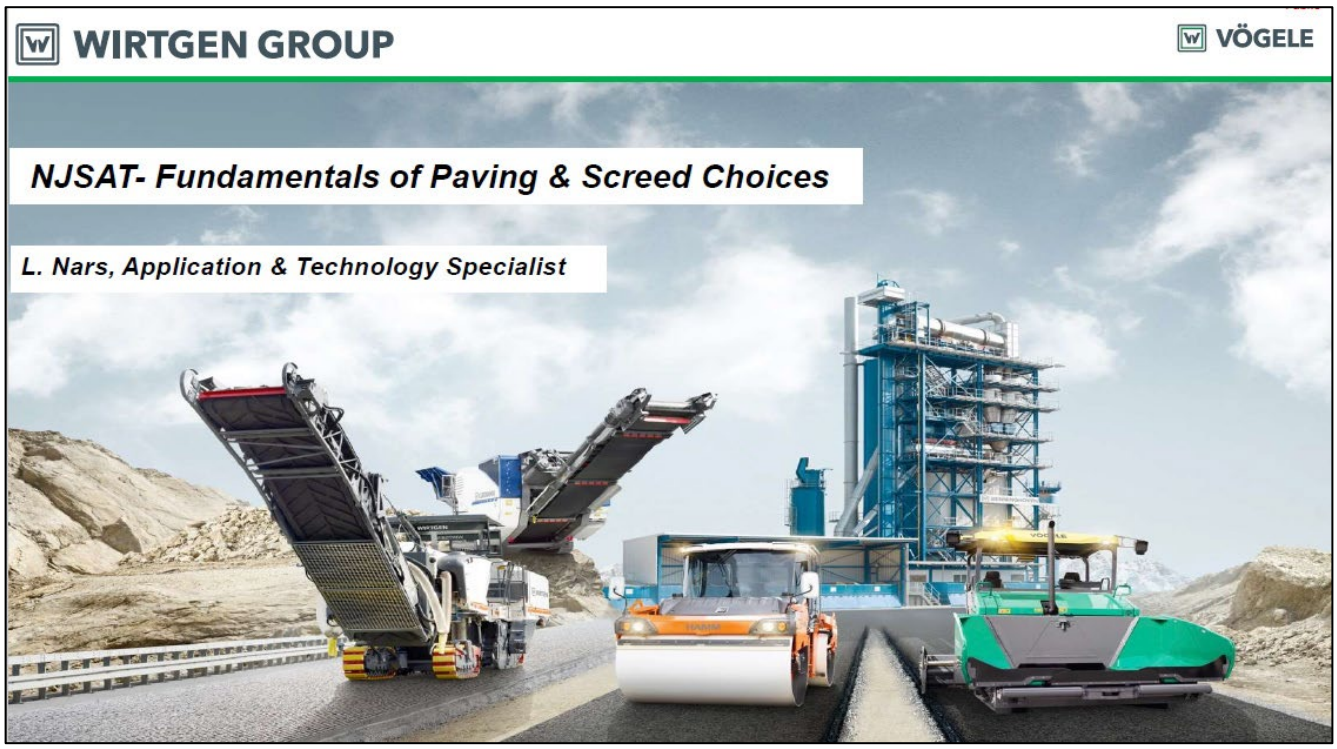

Figure 5. Presentation on Paving 101 by Laikram Narsingh (with a download link)

Compaction 101

Tim Kowalski, Wirtgen Group, made this presentation on Compaction 101. The outlines are:

1. Compaction Basics
   a. What is compaction?
   b. Why do we compact?
2. 4 Elements of compaction
3. Roller Train
   a. Varies with specifications and location
4. Roller types
5. Roller design specs affecting compaction
6. External factors affecting compaction
7. Summary

This presentation covers the complete roller technologies and operations. Researchers and specification writers are encouraged to study it in detail.

Figure 6. The Speaker for Compaction 101 (Kowalski)

Current Intelligent Construction Technologies

Paul Angerhofer, MOBA, presented Part 1 Paver-Mounted Thermal Profiling. Ed Shappell, Trimble, presented the AI application in construction.

Figure 7. The Speakers for Current Intelligent Construction Technologies (left to right: Shappell and Angerhofer)

Figure 8. Presentation on Part 1 Paver-Mounted Thermal Profiling by Angerhofer (with a download link)

Artificial Intelligence for Intelligent Construction

Soheil Nazarian, University of Texas at El Paso, made this presentation on behalf of two other authors, Adeeba Raheem and Hector Cruz. The abstract is described as follows:

The term "Artificial Intelligence" was first coined by John McCarthy in 1956, referring to the science of developing "intelligent" machines. Since then, this field has evolved rapidly to identify the best techniques to create machines that can simulate human behavior and perform specific tasks. Artificial intelligence comprises some major subsets, such as machine learning and natural language processing, which enable the machines to learn from data and understand the human language. Currently, companies are implementing AI solutions for different purposes in various industries. However, the adoption of AI-focused approaches in the construction industry is still low, even though there are numerous applications for this technology that can benefit the construction sector.

Implementing AI into the different stages of a construction project can contribute to numerous benefits, including improvements in productivity, safety, and cost reduction. However, there are currently some barriers that complicate transitioning from conventional techniques to AI tools. Some general challenges that can apply to the construction industry are the Lack of AI professionals, high initial investment, algorithms bias, and model errors. Implementing new emerging technologies is always a complicated process for every industry due to different possible barriers that each company may encounter. However, current opportunities will enable this technology to succeed in various industries, including the infrastructure construction sector. The 2019 American AI Initiative aimed at a national strategy collaborating with the private sector, academia, the public, and other international partners to pursue a multipronged approach to advancing AI. The approach includes promoting sustained AI R&D investment, enhancing access to high-quality cyberinfrastructure and data, removing barriers to AI innovation, providing education and training opportunities to prepare the workforce for AI, and fostering an international environment favorable to AI innovation. This initiative will create immense opportunities for organizations and companies to adopt AI and benefit from the enormous potential of this technology.

The discussion includes:

- Importance of training data for AI
- Recent examples of AI applications for ICT

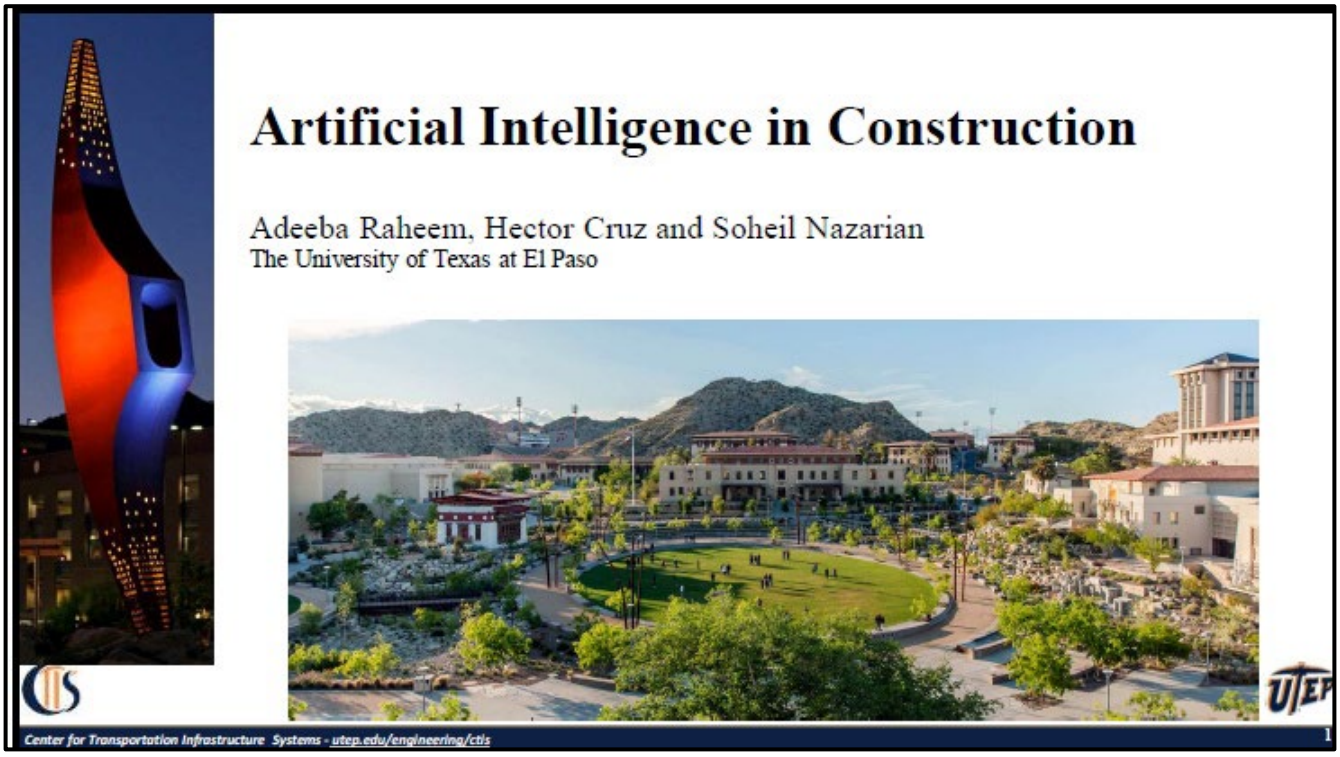

Figure 9. Presentation on Artificial Intelligence for Intelligent Construction by Nazarian (with a download link)

Complexity of Using Automation and Autonomous

Kevin Garcia, Trimble, made this presentation on the Complexity of Using Automation and Autonomous.

Figure 10. The Speakers for Artificial Intelligence for Intelligent Construction (left: Nazarian) and Complexity of Using Automation and Autonomous (right: Garcia)

Preplanning Construction with Virtual Playback

Chuck Hixon and Scott Langbein, DCW, presented Part 1 of Preplanning Construction with Virtual Playback. The presentation stressed the need to integrate data produced from digital applications and workflows. The presentation featured DCW's innovative solutions to integrate the Mass Haul Plan, the 4D schedule, and the job site machine control monitoring system on a project. This unique workflow enables construction managers to manage mass-haul operations

more effectively by integrating multiple applications. The result is more reliable estimations and near real-time project risk management.
Ed Shappell, Trimble, presented Part 2 of Preplanning Construction with Virtual Playback. Jim Preston, TOPCON, facilitated the discussion.

Figure 11. The Speakers for Preplanning Construction with Virtual Playback (left to right: Langbein, Shappell, and Hixon)

Figure 12. Presentation on Part 1 of Preplanning Construction with Virtual Playback by Hixson and Langbein (with a download link)

Panel Discussion on Intelligent Construction Technologies

Rebecca Embacher, MnDOT, moderated the panel discussion on Intelligent Construction Technologies (ICT). The panel includes Curt Dunn (NDDOT), William Johnson (MODOT), Kevin Garcia (Trimble), Tim Kowalski (Wirtgen Group), Brian Nagel (Caterpillar), Laikram Narsingh (Vogele), Jim Preston (TOPCON), and Paul Angerhofer (MOBA).
The discussion topics include:

- Agencies' adoption of ICT

- Industry's adoption of ICT
- ICT technical support and training
- ICT data telematics, process, analysis, and management
- Data standardization
- Data ownership and security
- Use of ICT data for identifying workmanship issues and forensic
- Agencies' specifications: incentives and disincentives for ICT
- How to overcome low bid environment
- Return of investment for ICT
- Emerging and future ICT

Figure 13. The Panel Members for Panel Discussion on Intelligent Construction Technologies (left to right: Dunn, Preston, Nagel, Angerhofer, Embacher, Kowalski, Johnson, Narsingh, and Garcia)

Summary

The MTCE ISIC track was successful, with high-quality presentations and valuable discussions. The feedback from the audience was all positive.

ISIC will continue to sponsor ICT-selected conferences worldwide in the future and will follow up with the action items from this conference:

- To provide the MTCE ISIC presentation and report to ISIC members and friends.
- To form an ICT Data Standardization task force to work with US, EU, and Asia countries and ISO.
- Conduct ISIC webinars with the selected MTCE ISIC materials (e.g., milling 101, paving 101, compaction 101, etc.)
- Expand the ISIC ICT training and education subcommittee to include critical constants and vendors and develop a road map for the ICT training curriculum – drawing from the ISIC ICT book series, 2022 MCTCE ISIC track materials, etc.

Acknowledgment

ISIC would like to acknowledge MnDOT, who has always been a great partner for ISIC! MnDOT also greatly assisted the first ISIC International Conference in Minneapolis in 2017. ISIC would also appreciate all the presenters for the MCTE ISIC track.

Disclaimer

This report is related to ISIC-sponsored activities. All contents comply with the ISIC Bylaws and visions. The ISIC non-collusion agreement is as follows: The purpose is to *promote the collaboration between federal and state agencies, vendors, manufacturers, consultants, and contractors, to advance technology and working knowledge of Intelligent Construction Technologies. In adherence to the Sherman Antitrust Act and applicable Federal and State laws, all persons present acknowledge and agree that they will not be a party to any collusion in restraint of freedom of competition. Topics including, but not limited to, bid submissions, geographical area of business, customer list, or pricing will not be discussed in any capacity at this meeting or in any subsequent meetings*.

The brand names were cited only to show examples of technologies. The download links for selected presentations are available in this report per the presenters' permission. However, readers should also observe the IP of the presentation contents.

Authors

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