

Construction Research Congress 2026

Advanced Technologies, Artificial Intelligence, and Data Analytics in Construction

Selected Papers from the Construction Research Congress
2026

San Antonio, Texas, USA
18-21 March 2026

Volume 1 of 2

Editors:

**Chuma Nnaji
Jiannan Cai
Ibukun Gabriel Awolusi
Kaushik Bhattacharjee**

ISBN: 979-8-3313-4007-0

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2026) by American Society of Civil Engineers
All rights reserved.

Printed with permission by Curran Associates, Inc. (2026)

For permission requests, please contact American Society of Civil Engineers
at the address below.

American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191
USA

Phone: (800) 548-2723
Fax: (703) 295-6333

www.asce.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Contents

Enhancing Performance with Real-Time Information: What and When to Monitor	1
Daniel Mehrabi and David Grau	
LLM-Adjusted TF-IDF Approach to Enhance Context Awareness and Transparency for Cost Data Automation.....	11
Di Liu, Preston Robinson, Adrienne Walley, and Rui Liu	
Salt Pile Measurement for Winter Maintenance Using Modern Sensing Technologies: Toward Accurate and Cost-Effective Inventory Management.....	22
Abbas Mohammadi, Pouria Mohammadi, Biao Kuang, Gang Jiang, Abbas Rashidi, Jianli Chen, and Jessica Wempen	
Agentic AI for Autonomous Construction Issue Detection: A Multimodal Framework Using Model Context Protocol	33
Simge Girgin, Fopefoluwa Bademosi, Parastoo Varshosaz, and Damon Lau	
Impact of Augmented Reality on Construction Assembly Efficiency: A Comparative Analysis of Craft Worker Performance across Experience Levels.....	43
Rahul Chaudhari, Paul Goodrum, and Nolan Brady	
Post-Disaster Building Damage Assessment Using Drone Imagery and Deep Learning	53
Sultan Al Shafian, Kiara O’Neal, Tanjila Rashid Rhythy, Sijie Gao, Honghui Xu, Adeel Khalid, and Da Hu	
EgoGen: Generating Egocentric Images on Construction Sites Using Diffusion Model	63
Jiuyi Xu, Meida Chen, and Yangming Shi	
Improving Generalization Capability of Vision Systems in PPE Detection through Artificial Intelligence-Generated Synthetic Images	73
Ruisong Zheng and Hubo Cai	
Real-Time Enhancement of Safety-Critical Warning Signals in Highway Construction Noise Using DeepFilterNet on Portable Devices	84
Thinh Nguyen, Tuyen Le, and Chau Le	
Talk, See, Support (TSS): A Wearable Multimodal, Intelligent, Agentic LLM-Powered Construction Assistant for Real-Time On-Site Guidance and Compliance Monitoring.....	94
Oscar Poudel, Mohamad Assaf, Rayan H. Assaad, and Mohamad Awada	

Complex Building Code Interpretation Using Knowledge Graph-Based Large Language Models.....	105
Fan Yang and Jiansong Zhang	
T-CLAIM: A Confidence-Based Method for Integrating and Assigning Crowdsourced Labels in Construction Tabular Data	115
SeyedeZahra Golazad and Abbas Rashidi	
Exploring Semantic Compression in Transformer-Based Safety Intelligence.....	126
Unmesa Ray, JeeWoong Park, and Malak Mahdy	
Detecting Hazards at Rail Grade Crossings Using Computer Vision and AI.....	137
Silvia Flores-Osuna, Gasser G. Ali, Darren Espinoza, Felix Chavez, and Constantine Tarawneh	
Estimating Highway Rehabilitation Projects Using Machine Learning	147
Samantha Ocaña, Silvia Flores-Osuna, Gasser G. Ali, and Constantine Tarawneh	
Investigating Switchgear Delays in Electrical Construction Using AI Text Mining.....	157
Alexis Figueroa-Baltazar, Anh D. Chau, and Raissa Seichi Marchiori	
Cross-City Transfer Learning Framework for Sewer Pipe Deterioration Prediction with Limited Data	167
Sihan Zhou, Dulcy M. Abraham, and Tom Iseley	
Ontological Reasoning in the Built Environment: A Survey on Rule Construction, Information Completion, and Compliance	178
Bo Pang and Jiansong Zhang	
Safety Rule Extraction in Human-Robot Collaboration via Prompt-Driven Large Language Models	189
Lirong Quan and Guofeng Ma	
Enhanced Construction Safety Inspection Framework: Combining Image-Based Analysis with Regulatory Knowledge	199
Na Wang, Yujie Lu, Xuanjun Li, Ziyu Chen, and Hanli Wang	
AI-Augmented Cost Estimation in Highway Projects: A Proof of Concept for State DOTs.....	209
Qadri H. Shaheen, Huan Zhou, and Qingbin Cui	
Optimization of HVAC Systems with Edge Computing Using AI and Data Analytics for Building Energy Efficiency	219
Haiyan S. Xie and Md. Farhadur Reza	

Assessing the Risks of Digital Transformation in Green Building Projects: An Interpretive Structural Modelling Approach.....	230
Mohamed Elseknidy, M. K. S. Al-Mhdawi, Maryam Alyahya, Charf Mahammedi, Mostafa Namian, and Suha Jaradat	
Towards Scalable Pavement Roughness Monitoring Using Dual-Polarization Synthetic Aperture Radar (SAR) Imagery and Deep Learning	241
Md. Tashfique Enam Tutul, Ahmed Abdelaty, Mohamed S. Yamany, and Mamdouh Mohamed	
Portable Lightweight Real-Time AI System Using Edge-RAG for Construction Best Practice Interactions.....	252
Gongfan Chen, Yunqing Li, Edward Jaselskis, and Yizhi Liu	
Data-Driven Analysis of Energy Efficiency Measures (EEMs) for Energy Retrofitting in US Residential Buildings	263
Sorena Vosoughkhosravi and Amirhosein Jafari	
A Fuzzy Fault Tree Analysis Model for Evaluating the Failure Potential of Generative AI Integration in Construction Risk Management.....	276
Mohamed Abdelwahab Hassan Mohamed, M. K. S. Al-Mhdawi, Abroon Qazi, Charf Mahammedi, Moheeb Abualqumboz, and Ghazal Shadlooye	
Evaluating Supervised and Vision-Language Models for Automated Culvert Defect Detection in Utah’s Transportation Infrastructure.....	287
Pouria Mohammadi, Sadegh Asgari, and Abbas Rashidi	
Thermal Image-Based Clothing Insulation Level Recognition with Limited Data Using Fine-Tuned Multimodal Large Language Models.....	298
Moein Younesi Heravi, Youjin Jang, and Inbae Jeong	
Comparative AI-Based Forecasting of Pavement Conditions under Maintenance and No-Maintenance Scenarios.....	308
Tamim Adnan, Mohsen Naghdi, and Abdolmajid Erfani	
Can Generative AI Reengineer Construction? Understanding Industry Awareness, Perception, and Digital Evolution	318
Hooman Sadeh, Ruichuan Zhang, Cristian Gaedicke, Farzad Shahbodaghlou, Min Jae Lee, and Dimitar Todorov	
Exploring Public Perceptions of COVID-19’s Impact on the Construction Sector Using Twitter-Based Text Analytics	328
Siddharth Banerjee, Gongfan Chen, Edward Jaselskis, and Jinsung Cho	

LLM-Based Tool for Automatic Feedback for Rubric-Based Feedback in Construction.....	339
Zhenlin Yang, Gabriel Castelblanco, and Laura Cruz-Castro	
EEG-Based Mental Fatigue Assessment during Exoskeleton-Assisted Construction Postures: A GAN-Augmented Approach.....	349
Jeniya Sultana, Adeeba A. Raheem, Jaeho Jang, Jin Sol Lee, Yoojun Kim, Jinwoo Kim, and Jaeyoon (Jason) Kim	
Guardrail Detection in Rural Roads Using Zero- and Few-Shot Learning with Vision Language Models.....	359
Maedeh Sadeghi, Ali Mansouri, and Abdolmajid Erfani	
Risk-Aware Building Control: A Probabilistic Forecasting Framework Using Quantile Patch Transformers.....	370
Mohammad Saleh Nikoopayan Tak, Andy Ghosh, Faith Leverett, Reyhaneh Moazami Goodarzi, and Yanxiao Feng	
Applications and Challenges of Generative AI in AEC	381
Rohantha Rukshan Jayasinghe, Ali Katooziani, Gabriel Castelblanco, Masoud Gheisari, and Idris Jeelani	
A Framework of RGB-Thermal Sensor Fusion with Zero-Shot and Prompt-Aware Deep Learning for Enhanced and Real-Time Thermal Anomaly Detection in Buildings.....	391
Xi Hu, Rayan Assaad, Jeritt Williams, and Akshat Santhana Gopalan	
AI-Enabled Virtual Human to Enhance Cultural Competency in the Construction Industry.....	401
Rahat Hussain, Minerva Bonilla, Michael Redelick, Juan Pablo Flores Villarreal, Ashrant Aryal, and Chukwuma Nnaji	
Proximity-Driven Electrotactile Feedback System for Preemptive Excavation Hazard Warnings.....	412
Yeon Chae, Abul Al Arabi, Jeeun Kim, and Youngjib Ham	
Large Language and Vision Models for Construction Workflows: A Literature Review.....	421
Abdolmajid Erfani, Ali Mansouri, and Mohsen Naghdi	
Automated Approach for Clothing Insulation Estimation Using RGB Images and Deep Learning.....	432
Nidia Bucarelli and Huzaifa Suri	

Evaluating AI-Generated Durations in Construction Scheduling Using Language Models: Insights from Industry Survey on Adoption, Challenges, and Future Prospects	443
Mackenzie Murtha, Mamdouh Mohamed, and Emma Trisch	
Multimodal AI for Advancing Construction Safety through Visual Question Answering	452
Ning Wang and Raja R. A. Issa	
Reducing Fragmentation in Projects' Communication and Ensuring Real-Time Visibility of Project Performance: A Natural Language Processing Approach.....	463
Yasmein Shahin, Mohamed S. Eid, Khaled Hamdy, and Yasmeen A. S. Essawy	
Automation of BOQ Analysis and Material List Selection Using NLP and Multi-Class Prediction	474
Omar I. Aly and Mohamed S. Eid	
A Review of Reinforcement Learning for Design in the AEC Industry.....	485
Seungah Suh and Christopher Rausch	
Reducing Demolition Regulatory Non-Compliance and Permitting Duration Using Question Answering Retrieval-Augmented Generation.....	496
Roshan Panahi, Alexander J. Baldwin, Juyeong Choi, and Mohamed Badr	
Evaluating the Construction Project Cost Impacts of Lane Closure Restriction Policies in Roadway Projects	507
Mark N. Abuanor, Kalyan R. Piratla, and Radwa Eissa	
Automated Construction Progress Reporting from Drone Images via Vision-Language Models.....	518
Yajie Liu, Mojtaba Noghabaei, and Minerva Bonilla	
Data-Driven Assessment of Long-Term Bidding Behavior in Construction Firms	529
Huan Zhou, Niping Duan, Qadri H. Shaheen, and Qingbin Cui	
Development of an Agentic AI System for Project Planning and Management in a Digital Collaborative Environment.....	539
Juan C. Cruz, Benjamin Hemenger, Alejandro M. Perez, and Jiannan Cai	
The Current State of Using AI Applications for Field Coordination Meeting Minutes of Construction Projects	550
Timothy C. Becker, Manaswini M. Khadilkar, Vasanti Kadu, Mohammed Arshad Ali, Souhasi Kintali, and Yash Anil Darade	

Improving Embedding-Based Retrieval for Crane Safety Regulations	560
Bing Shuai and Carlos H. Caldas	
Exploring the Utility of Large Language Models (ChatGPT) in Biophilic Design Evaluation.....	569
Hoda Alemrajabi, Ruichuan Zhang, and Tanyel Bulbul	
Leveraging Large Language Models with Hierarchical Decoding and Modular Finetuning for Extraction of Information from Building Codes	580
Haonan Sun and Nora El-Gohary	
Multimodal LLM Framework for Context-Aware Locomotion Prediction in Construction Exoskeletons	589
Asif Faisal Chowdhury, Ehsan Ahmadi, and Chao Wang	
Automated Zero-Shot Video Segmentation of Indoor Walls via SAM2 with Pretrained Semantic Prompts	599
Yuxiang Huang and Nora El-Gohary	
Enabling Intelligent Collaboration in Architectural Programming: A Hierarchical Multi-Agent Reinforcement Learning Framework for Mega Transportation Projects.....	609
Shitao Jin, Yuan Deng, and Huijun Tu	
Linear Fit Noise Reduction for Improved Pavement Condition Forecasting	620
Shavil Singh, Houman Kamran Habibkhani, Tin Phan, Khan Linh Nguyen, John Milton Ponce, Pham Anh Thu Nguyen, Negar Ghoojani, Luke Lee, Baabak Ashuri, and Frederick Chung	
Long-Horizon Pavement Degradation Forecasting: Direct versus Recursive RNN Models under Short Lookback Window	630
Khanh Linh Nguyen, Houman Kamran Habibkhani, Tin Phan, Shavil Singh, Pham Anh Thu Nguyen, John Milton Ponce, Negar Ghoojani, Luke Lee, Baabak Ashuri, and Frederick Chung	
Enhanced Data-Driven Safety Analysis Using NLP: Extracting Key Information from Highway-Rail Grade Crossing Accident Reports	640
Siqi Chen, Dianping Yang, Yu-Cheng Chang, and Shanyue Guan	
Assessing AI Readiness and Strategic Priorities in the US Construction Industry: Insights from Industry and Academic Stakeholders	650
Mostafa Namian, Samuel Olatunbosun, Moslem Sheikhhoshkar, and M. K. S. Al-Mhdawi	
Effect of AI Trainer Demographic Matching on Construction Safety Training Outcomes.....	660
Samuel Olatunbosun, Mostafa Namian, Mohammad Khalid, and Chukwuma Nnaji	

Vision-Based Segmentation for Localized Construction and Demolition Waste: A Review of Datasets and Techniques	670
Ashwani Jaiswal, Nikhil Bugalia, and Quang Phuc Ha	
Detecting Energy-Use Behaviors in Buildings Using Nonintrusive Sensing and Deep Learning	681
Kaiyu Huang and Kaijian Liu	
A Flexible Technology Assessment Tool for Remote Construction Inspections	692
Yelda Turkan, Heidar Rastiveis, Michael J. Olsen, Donghoon Ji, Dan Tran, Nhien Dinh Le, Christopher Parrish, Chase Simpson, Devin Harris, and Roger Chen	
SMART-Inspect: Standards Management and Retrieval Technology for Inspection.....	702
Khaled Sayed and Reihaneh Samsami	
Large Language Models for Personalized Construction Safety Training: A Cross-Sector Review.....	713
Chia-Ling Liu and Sogand Hasanzadeh	
LLM-Based Construction Safety Monitoring Utilizing Human-Centered Image Simplification	724
Amirpooya Shirazi and Arezoo Shirazi	
Evaluating Large Language Models for Converting Traditional Construction Contracts into Smart Contracts	734
Erfan Moayyed and Chimay Anumba	
Review of Case-Based Reasoning Applications in Transportation Projects	744
Haidy S. Ghali and Jennifer S. Shane	
AI-Driven Transformer-Based Trajectory Prediction Model to Support Worker Monitoring in Work Zone Digital Twins.....	755
Woei-Chyi Chang, Nathan Daniel Weston, and Sogand Hasanzadeh	
Physical Fatigue Monitoring of Construction Workers Using Edge-Based Machine Learning and Wearable Sensors	765
Sharjeel Anjum, Arnia Goode, Chukwuma Nnaji, and Ashrant Aryal	
Air Quality Prediction of 3D-Printed House Using Long Short-Term Memory and Large Language Models	776
Sadegh Haghighat, Min Jae Lee, Ruichuan Zhang, Hooman Sadeh, Ashtarout Ammar, Andrew McCoy, Xinghua Gao, and Phillip Agee	

Advancing AI-Driven Near-Miss Detection: A YOLOv8-YOLOv12 Evaluation Framework for Construction Safety	786
Shahid Ali, Ammar Alzarrad, Sudipta Chowdhury, Husnu S. Narman, and Shifa Saleem Ahmed Khan	
Artificial Intelligence and Fraudulent Practice in AEC: A Scoping Review of Cross-Sector Lessons and Opportunities	796
Sushmit Sharma Bhattarai, Sabin Bhandari, Bongjun Ji, and Hyunhwan Kim	
Procedural Learning through VR-Based Embodied Conversational Agents for Construction Safety Education.....	806
Rahat Hussain, Chukwuma Nnaji, and Yewande S. Abraham	
Automatic Classification of Construction Accident Reports Using Text Mining and Machine Learning	817
Zhenhui Ou, Peiyi Lyu, and Siyuan Song	
Translating Perceptions into Action: Vision Language and TrueSkill Integration for Urban Livability Mapping	827
Mirsalar Kamari, Mahdi Ghafoori, and Mohammadsoroush Tafazzoli	
Thermal and RGB-Aware Vision Language Model for Built Environment with 3D Scene Rendering	837
Yining Wen, Jingwei Bao, and Kaiwen Chen	
Feasibility Study on Inferring Construction Workers' Roles and Cooperation Status Using Graph Neural Networks	848
Siyeon Kim, Heung Jin Oh, and Soowon Chang	
Automated Classification of Construction Incident Reports: A Systematic Review and Evaluation of Models.....	858
Anto Ovid, Alex Albert, Abdullah Alsharef, S. M. Jamil Uddin, and Gongfan Chen	
Evaluating Closed-Set and Open-Vocabulary Object Detectors in Real-Time Construction Environment	868
Anto Ovid, Alex Albert, Gongfan Chen, Abdullah Alsharef, and S. M. Jamil Uddin	
Leveraging Amazon Customer Reviews to Identify Household Water Quality Challenges.....	878
Shuojia Fu, Krishnam Goel, Kainan Hu, and Khalid K. Osman	
Large Language Models for Human State Inference: A Case Study on Stress Detection from Wearable Sensors	889
Tianzhi He and Farrokh Jazizadeh	

Weather-Integrated Computer Vision Framework for Real-Time Construction Safety Risk Assessment	900
Roy Lan, Olugbenga Falomo, and Ibukun Awolusi	
Computer Vision Framework for Detecting Unsafe Exoskeleton Use in Construction Activities	910
Muhammad Khan, Otokini Cotterell, Ashrant Aryal, and Chukwuma Nnaji	
AI-Powered Real-Time Safety Monitoring in Construction: An Object Detection and Depth Estimation Approach	920
Rizwan U. Farooqui, Mariam El Al Alaoui, Ilyas Amal, and Asad Waqar Malik	
Generative AI and Augmented Reality for Personalized Biophilic Design in Senior Living Environments.....	930
Akash Reddy Mallepally, Ruichuan Zhang, and Tanyel Bulbul	
Bidirectional Prediction of Occupancy and Indoor Environmental Quality	941
Kofi A. B. Asare and Srija Repudi	
AI-Enabled Decision Support for Preconstruction Services Forecasting in State DOTs.....	951
Rajnish Lekhi, Rakeshkumar Mahto, and Deepak Sharma	
Advances in Off-Site Construction: A Systematic Review of Prefabrication Methods	961
Fady Mansour and Ashtarout Ammar	
Sensor-Based Framework for Proximity Monitoring of Heavy Rigging Operations	971
Yeji Hong, Dulcy M. Abraham, and Hubo Cai	
Autonomous UAV-Based Framework for Detection and Severity Assessment of Hurricane-Damaged Power Poles.....	983
Sujan Gyawali, Daisy Mouka, and Mahmoud Habibnezhad	
Benefits and Barriers to Adopting Reality Capture in Construction: Insights from the Iowa Industry	993
Manner Thurlby Atimboro and Cristina Poleacovschi	
Key Factors for Effective AI Implementation in Construction Cost Optimization: A Literature-Based Study	1002
Zhili Gao, Asad Sultan, and Mijia Yang	