

# Hong Lang

POSTDOCTORAL RESEARCH ASSOCIATE · CIVIL & ENVIRONMENTAL ENGINEERING

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Keywords: Artificial Intelligence for Infrastructure Sensing; 3D Reconstruction and Digitalization; Safety and Sustainability in Transportation Systems; Physics-informed Modeling of Tire–Pavement Interaction.

## Academic Appointments

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### **University of Illinois Urbana-Champaign**

*Champaign, IL*

POSTDOCTORAL RESEARCH ASSOCIATE AT ILLINOIS CENTER FOR TRANSPORTATION

*2024 – Present*

- Advisor: Dr. Imad L. Al-Qadi (CEE Department head)

### **Tongji University**

*Shanghai, China*

RESEARCH ASSOCIATE PROFESSOR AT THE TRANSPORTATION RESEARCH INSTITUTE

*2023 – 2024*

- Served as the sole PI on projects funded by NSFC and the Shanghai and Henan DOTs.

### **Tongji University**

*Shanghai, China*

POSTDOCTORAL RESEARCH FELLOW AT THE COLLEGE OF TRANSPORTATION ENGINEERING

*2021 – 2024*

- Advisor: Dr. Jian John Lu & Dr. Jinsong Qian (Dean of Department of Transportation Infrastructure)

## Education

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### **Tongji University**

*Shanghai, China*

PHD IN COLLEGE OF TRANSPORTATION ENGINEERING

*2016 - 2021*

- Graduated with Highest Distinction/Outstanding Graduate/Honors thesis
- Dissertation: Automatic Distress Detection and Classification Algorithms Using 3-D Pavement Images
- Advisor: Dr. Jian John Lu (Dean of the College of Transportation)

### **Tianjin University of Science & Technology**

*Tianjin, China*

BACHELOR OF MEASUREMENT AND CONTROL TECHNOLOGY & INSTRUMENT

*2012 - 2016*

- Graduated with Highest Distinction/Outstanding Graduate
- Undergrad research advisor: Dr. Yizhong Wang (Dean of the College of ECE)

## Research Grants

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### **Modernization and Web-Based Implementation of the Illinois Pavement Feedback System**

*Champaign, IL*

SPONSOR: ILLINOIS DEPARTMENT OF TRANSPORTATION, PROJECT ICT-R27-288 (\$653K)

*Mar 2026 - Feb 2028*

- PI: **Hong Lang**:

### **Intelligent Pavement Distress Detection Using Bidirectional 3-D Triangulation and Multi-information Fusion**

*Shanghai, China*

SPONSOR: NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA, PROJECT 62206201 (\$30K)

*Jul 2022 - Jul 2024*

- PI: **Hong Lang**

- Proposed a method for absolute elevation measurement of surfaces using bidirectional 3-D Laser.
- Conducted an analysis of the coupling mechanisms between inherent segment features and the regional distribution features of road sections.

### **Integrated Active Road Traffic Safety Prevention and Control Technology**

*Shanghai, China*

SPONSOR: NATIONAL KEY RESEARCH AND DEVELOPMENT PROJECT OF CHINA, PROJECT

*Jan 2018 - Jan 2023*

R2017YFC0803902 (\$660K)

- PI: Jian John Lu; Co-PI: **Hong Lang**
- Proposed an algorithm for road traffic behaviour extraction using unmanned aerial vehicle (UAV).
- AI-based method for road traffic behavior identification and risk prediction in various scenarios.

<b>Pavement Distress Mechanism of Spatial Domain Generalization by Multi-Data Fusion</b>	<i>Shanghai, China</i>
SPONSOR: CHINA POSTDOCTORAL SCIENCE FOUNDATION, PROJECT 2023M732644 (\$12K)	Jul 2023 - Jul 2024
<ul style="list-style-type: none"> <li>• PI: <b>Hong Lang</b></li> <li>• Analyzed the imaging mechanisms of pavement distresses based on multi-view data.</li> </ul>	
<b>Development and Application of an AI-Based Pavement Inspection Data System</b>	<i>Shanghai, China</i>
SPONSOR: SHANGHAI SCIENCE AND TECHNOLOGY COMMISSION, PROJECT 23692118200 (\$7,500)	Mar 2023 - Mar 2024
<ul style="list-style-type: none"> <li>• PI: <b>Hong Lang</b></li> <li>• Compiled a report on global research trends in digital road technology.</li> <li>• Produced a verification report on pavement database establishment and AI model transfer.</li> </ul>	
<b>Bridge Differential Settlement Detection Based on Inertial Navigation</b>	<i>Shanghai, China</i>
SPONSOR: JIANGSU PROVINCIAL KEY LABORATORY OF TRANSPORTATION SAFETY, PROJECT TTS2021-03 (\$4,500)	Mar 2021 - Dec 2023
<ul style="list-style-type: none"> <li>• PI: <b>Hong Lang</b></li> <li>• Proposed a novel measurement system for differential settlement in bridge approach.</li> <li>• Case study: verify the detection results through manual surveys of 89 bridges in a specific region.</li> </ul>	
<b>Intelligent Monitoring and Analysis of Asphalt Pavement Service Condition</b>	<i>Shanghai, China</i>
SPONSOR: HENAN PROVINCIAL DEPARTMENT OF TRANSPORTATION, PROJECT 2023-1-1 (\$60K)	Jan 2023 - Mar 2025
<ul style="list-style-type: none"> <li>• PI: <b>Hong Lang</b></li> <li>• Achieved rapid detection of subsidence and asset-related defects using unorganized MLS point clouds.</li> <li>• Established relationships between pavement distresses and subsidence based on 3D-Laser and LiDAR.</li> </ul>	
<b>High-Resolution 3D Runway Damage Detection for Airport Pavement Monitoring</b>	<i>Shanghai, China</i>
SPONSOR: TONGJI UNIVERSITY, PROJECT 2023-03 (\$250K)	Mar 2023 - Jun 2024
<ul style="list-style-type: none"> <li>• PI: <b>Hong Lang</b></li> <li>• Developed a high-precision 3-D detection system with a resolution of 1-mm 8192 pixels.</li> <li>• Achieved full-width stitching of airport runways and established a defects database in Chinese airports.</li> </ul>	
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<b>Submitted Proposals (★ Awarded)</b>	
<b>Modernization and Web-Based Implementation of the Illinois Pavement Feedback System ★</b>	IDOT
ILLINOIS DEPARTMENT OF TRANSPORTATION	Submitted Jan 2026
<ul style="list-style-type: none"> <li>• PI: Dr. <b>Hong Lang</b>;</li> </ul>	
<b>Artificial Intelligence (AI) Analyses of Balanced Mix Design (BMD) Mixtures</b>	WisDOT
WISCONSIN DEPARTMENT OF TRANSPORTATION- WISCONSIN HIGHWAY RESEARCH PROGRAM	Submitted Jan 2026
<ul style="list-style-type: none"> <li>• PI: Dr. Jaime Hernandez; Co-PI: Dr. Imad L. Al-Qadi; Co-PI: <b>Hong Lang</b></li> </ul>	
<b>Surface Safety Readiness for CAVs on Rural Roads under Adverse Weather</b>	CCAT
CENTER FOR CONNECTED AND AUTOMATED TRANSPORTATION: SAFETY, MOBILITY	Submitted Nov 2025
<ul style="list-style-type: none"> <li>• PI: Dr. Imad L. Al-Qadi; Co-PI: Dr. Yanfeng Ouyang; Co-PI: Alireza Talebpour</li> </ul>	
<b>Unified Distress Severity Framework and Enhanced CRS Calculation Models for Illinois Pavements ★</b>	IDOT
ILLINOIS DEPARTMENT OF TRANSPORTATION: CONDITION RATING SURVEY DISTRESS PARAMETERS	Submitted Oct 2025
<ul style="list-style-type: none"> <li>• PI: Dr. Yanfeng Ouyang; Co-PI: Dr. Imad L. Al-Qadi;</li> </ul>	
<b>Ensuring Resiliency of Asphalt Pavement in Real-Time during Construction Using Ground-Penetrating Radar (GPR)</b>	USDOT
U.S. DEPARTMENT OF TRANSPORTATION: ARPA-I IDEAS AND INNOVATION CHALLENGE	Submitted Sept 2025
<ul style="list-style-type: none"> <li>• PI: Dr. Imad L. Al-Qadi;</li> <li>• Designed a GPR real-time density and thickness acquisition and analysis tool; contributed to proposal drafting by introducing an AI-physics framework to reconstruct pavement profiles from GPR signals for smoothness measurement.</li> </ul>	

## **Freeze-Thaw Informed Decision-Support Tool for Minnesota's Spring Load Restrictions**

MnDOT

**MINNESOTA DEPARTMENT OF TRANSPORTATION: IMPROVED SEASONAL LOAD LIMITS**

Submitted Aug 2025

- PI: Dr. Imad L. Al-Qadi; Co-PI: Dr. Ashish Sharma (climate scientist)
- Drafted the proposal and coordinated communications with collaborators, including Dr. Bora Cetin and Dr. Michele Lanotte (MSU) and Dr. Ashish Sharma (DPI).

## **Demonstration of an Innovative Technique to Eliminate Road Surface-Related Fatalities**

USDOT

### **Fatalities**

**U.S. DEPARTMENT OF TRANSPORTATION: SAFE STREETS AND ROADS FOR ALL (SS4A)**

Submitted Jun 2025

- PI: Dr. Imad L. Al-Qadi; Co-PI: Dr. Yanfeng Ouyang and Dr. Mani Golparvar-Fard
- Contributed to drafting the proposal and assisted the Associate Director for Finance and Administration in preparing and SEPTEMBERsubmitting required documents.

## **Projects**

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### **Automated and Contactless Identification of Asphalt Pavement Surface Friction Based on Computer Vision Image-based 3D Reconstruction and Machine Learning Techniques**

Champaign, IL

**SPONSOR: ILLINOIS DEPARTMENT OF TRANSPORTATION, PROJECT R27-247**

Jul 2024 - Jun 2026

- PI: Dr. Imad L. Al-Qadi; Co-PI: Dr. Mani Golparvar-Fard
- Guided students in building a pavement friction detection system based on Structure-from-Motion vision techniques.
- Developed a customized SAINT tabular deep learning model for friction prediction, achieving 6% higher accuracy than XG-Boost and Random Forest.

### **Using Advanced Binder Rheological Parameters to Predict Cracking Potential of Hot-Mix Asphalt Mixtures with Modified Binders**

Champaign, IL

**SPONSOR: ILLINOIS DEPARTMENT OF TRANSPORTATION, PROJECT R27-250 (\$540K)**

Oct 2024 - Sep 2025

- PI: Dr. Imad L. Al-Qadi
- Developed an AI-driven mix design tool using 10 years of IDOT cracking and rutting data, automating binder and aggregate optimization to reduce time, cost, and material use. **ICT Optimal Mix Design Tool**.
- Provided guidelines for blending and thresholds for softener-modified binders, along with a model for informed material selection, reducing premature failure risk, and enabling cost-effective strategies. **Asphalt Binder Selection Guidance Tool**.

### **Update of Traffic Factor Equations for IDOT Mechanistic-Empirical Pavement Design**

Champaign, IL

**SPONSOR: ILLINOIS DEPARTMENT OF TRANSPORTATION, PROJECT R27-277**

Dec 2024 - Present

- PI: Dr. Imad L. Al-Qadi
- Analyzed Illinois Weigh-in-Motion data and developed a physics-informed pavement-tire interaction model.

### **Optimizing the Use of Local Aggregates in SMA Accelerated Pavement Testing**

Champaign, IL

**SPONSOR: ILLINOIS DEPARTMENT OF TRANSPORTATION, PROJECT R27-216**

Oct 2024 - Dec 2025

- PI: Dr. Imad L. Al-Qadi
- Developed a line-laser rut extraction algorithm to analyze pavement structural response under continuous loading.
- Conducted comprehensive engineering analysis across six SMA test sections under different loading configurations.

## **Patents, Reports and Books**

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### **PATENTS**

#### **Road 3D Reconstruction Using Primary & Auxiliary LiDAR with Integrated Navigation**

China

*China. Invention Patent. PATENT PENDING.*

2024

- **H.Lang.**, Z.Zou, X.T.Chen, J.S.Qian.

#### **Road Roughness Detection with 3D Structured Light and Vibration Fusion**

China

*China. Invention Patent. PATENT PENDING.*

2024

- **H.Lang.**, Z.Chen, J.S.Qian.

<b>Pavement 3D Detection Using a Bidirectional Triangulation System</b>	China
<i>China. Invention Patent. PATENT AUTHORIZED. ZL202210445208.9.</i>	2023
• H.Lang., Y.Yuan., J.Chen.	
<b>A Pavement Rutting Anomaly Detection System and method based on 3D Triangulation</b>	China
<i>China. Invention Patent. PATENT PENDING.</i>	2023
• J.M.Ling., H.Lang., J.S.Qian.	
<b>A Multidimensional Pavement Distress Data Processing Method</b>	China
<i>China. Invention Patent. PATENT PENDING.</i>	2022
• H.Lang., S.Ding., Y.Y.Xing.	
<b>A 3-D Image Pavement Detection System.</b>	China
<i>China. Patent Application. PATENT AUTHORIZED. CN 110415232 A.</i>	2020
• H.Lang., J.J.Lu.	
<b>Communication Channel Extension System for an Internet of Things Gateway</b>	China
<i>China. Invention Patent. PATENT AUTHORIZED. ZL201610937604.8.</i>	2019
• Y.Z.Wang, R.Zhang., H.Lang., Y.Z.Peng.	
<b>Asphalt Pavement Distress (18,256 samples, detection/segmentation). Pavement Type Classification (53,265 samples, classification). Concrete Distress (7,414 samples, detection/segmentation). MLS point clouds(800km, 9,056 samples).</b>	China
<i>Data Sharing &amp; Open Access</i>	2019
• Owner: H.Lang. • Updated on 2025.06.26. <a href="https://github.com/IP2RG">https://github.com/IP2RG</a> .	

## REPORTS

<b>Optimizing the Use of Local Aggregates in Stone Mastic Asphalt</b>	Illinois
<i>FHWA-ICT-25-XXX(R27-216). IN PRODUCTION.</i>	2026
• I.L.Al-Qadi, J.J.García Mainier, H.Lang, Lara Diab, Greg Renshaw.	
<b>Using Advanced Binder Rheological Parameters to Predict Cracking Potential of Hot-Mix Asphalt Mixtures with Modified Binders</b>	Illinois
<i>FHWA-ICT-25-011(R27-250). 10.36501/0197-9191/25-011.</i>	2025
• I.L.Al-Qadi, A.O.Sulaiman, M.A.Uthman, H.Lang, J.J.García Mainier.	

## STANDARDS AND BOOKS

<b>Automatic Bridgehead Settlement Detection System</b>	China
<i>Group Standard of the China Highway and Transportation Society (CHTS). STANDARD PENDING.</i>	2024
• J.J.Lu, Y.M.Jiang, S.D.Chen, H.Lang, et al.	
<b>Vehicle-Mounted 3-D Detection System for Pavement Distress</b>	China
<i>Group Standard of the CHTS. STANDARD AUTHORIZED.</i>	2023
• J.J.Lu, Y.M.Jiang, R.J.Cao, M.Cao, H.Lang, et al.	
<b>Advanced Pavement Quality Evaluation and Detection Technology</b>	China
<i>Tongji University Press Book. Book PUBLISHED.</i>	2022
• J.J.Lu, Y.M.Jiang, H.Lang, S.D.Chen, Y.X.Lou.	

Publications (\* as corresponding author; † as co-first author) \_\_\_\_\_

## LIDAR FUSION AND PAVEMENT ASSET DIGITIZATION

- [J6] **Coarse-to-refined Road Alignment Extraction and Parameterization from MLS Point Clouds.**  
 X.T.Chen; **H.Lang\***; Z.Zou; Y.Chen; Y.M.Jiang.  
 2026 Major Revision. *Automation in Construction*. 10.2139/ssrn.6017017.
- [J5] **Robust Estimation for Pavement Plane Coefficients from Road Point Cloud.**  
**H.Lang**; Z.Zou\*; H.L.Cheng; A.D.Wang; J.S.Qian.  
 2025 Under Review. *Automation in Construction*.
- [J4] **LiDAR-Driven Innovations in Pavement Distress Detection: A Review.**  
 Y.H. Si<sup>†</sup>; **H. Lang<sup>†</sup>**; J.S. Qian\*; Z. Zou.  
 2025. *ASCE Journal of Computing in Civil Engineering*. 40(1): 03125003. 10.1061/JCCEE5.CPENG-6662.
- [J3] **Multi-Feature-Filtering-Based Road Curb Extraction from Unordered Point Clouds.**  
**H.Lang**; Y Peng; Z Zou; S Zhu\*; Y Peng; H Du\*.  
 2024. *Sensors*. 24(20): 6544. 10.3390/s24206544.
- [J2] **Coarse-to-Refined Road Curb Segmentation From MLS Point Clouds.**  
 Z.Zou; **H.Lang\***; J.J.Lu.  
 2024. *Automation in Construction*. 166: 105586. (TOP). 10.1016/j.autcon.2024.105586.
- [J1] **Plane-based Global Registration Method for Pavement 3D Reconstruction Using Hybrid Solid-state LiDAR.**  
 Z.Zou; **H.Lang\***; Y.X.Lou; J.J.Lu.  
 2023. *Automation in Construction*. 152: 104907. (TOP). 10.1016/j.autcon.2023.104907.
- [C2] **Coarse-to-refined Road Alignment Extraction and Parameterization from MLS Point Clouds.**  
 X.T.Chen; **H.Lang\***; Z.Zou; Y.Chen; Y.M.Jiang.  
 2026 (Lectern Session). *TRB 105th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA.
- [C1] **Road Curb Extraction from Unordered Point Clouds Based on Multi-Feature Filtering.**  
 Y.Peng; **H.Lang\***; Z.Zou; J.J.Lu.  
 2024. *TRB 103rd Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO. TRBAM-24-02096.
- AI- INTELLIGENT DETECTION AND MECHANISM ANALYSIS OF INFRASTRUCTURE DISTRESS**
- [J17] **Automated Pavement Pothole Detection and Multi-dimensional Indicators Extraction Using Deep Learning and 3D Reconstruction.**  
 A.D.Wang; **H.Lang\***; J.Chen; Z.Zou; Y.J.Zou; J.S.Qian.  
 2026 Accepted (In Production). *IEEE Transactions on Intelligent Transportation Systems*. 10.2139/ssrn.4885302.
- [J16] **Automated Image-level Pavement Type Recognition on Cross-regional Data Using a Multi-feature FusionNet**  
**H.Lang**; Z.Chen\*; J.S.Qian\*; A.D.Wang; Y.C.Peng; H.Du.  
 2025. *International Journal of Pavement Engineering*. 10.1080/10298436.2025.2569612.
- [J15] **Active Learning for Infrastructure Distress Segmentation via Pixel-Level Difficulty Estimation.**  
**H.Lang**; J.Chen\*; H.R.Gong; Z.Chen; Q.W.Zhou; J.S.Qian.  
 2026 Under Review. *Automation in Construction*.
- [J14] **Selecting and Optimizing Distress Feature Descriptors from Multi-source Images for Pavement Distress Classification.**  
 A.D.Wang; **H.Lang\***; Y.C.Peng; X.T.Chen; J.S.Qian.  
 2025. *International Journal of Transportation Science and Technology*. j.ijtst.2025.05.003.
- [J13] **The Two-step Method of Pavement Pothole and Raveling Detection and Segmentation Based on Deep Learning.**  
 A.D.Wang; **H.Lang\***; Z.Chen; Y.C.Peng; J.J.Lu.  
 2024. *IEEE Transactions on Intelligent Transportation Systems*. (TOP). 10.1109/TITS.2023.3340340.
- [J12] **Augmented Road Crack Segmentation: Learning Complete Representation to Defend Noise in Concrete Pavements.**  
**H.Lang**; Y.Yuan\*; J.Chen; S.Ding; J.J.Lu.  
 2024. *IEEE Transaction on Instrumentation and Measurement*. (TOP). 10.1109/TIM.2024.3378205.
- [J11] **Automatic Pixel-Level Detection of Multiple Pavement Distresses and Surface Design features with PDSNet II.**  
**H.Lang**; J.S.Qian; Y.Yuan\*; J.Chen; Y.Y.Xing; A.D.Wang.  
 2024. *ASCE Journal of Computing in Civil Engineering*. 10.1061/JCCEE5.CPENG-5894.

- [J10] **Automated Pavement Distress Segmentation on Asphalt Surfaces Using a Deep Learning Network.**  
 T.Wen; S.Ding; **H.Lang\***; J.J.Lu; Y.Yuan; Y.C.Peng; J.Chen; A.D.Wang.  
 2023. *International Journal of Pavement Engineering*. 24(2), 2027414. 10.1080/10298436.2022.2027414.
- [J9] **Automated Crack Segmentation on 3D Asphalt Surfaces with Richer Attention and Hybrid Pyramid Structures.**  
 S.Ding; **H.Lang\***; J.Chen; Y.Yuan; J.J.Lu.  
 2023. *International Journal of Pavement Engineering*. 24(1), 2246097. 10.1080/10298436.2023.2246097.
- [J8] **Multi-distress Detection Method for Asphalt Pavements Based on Multi-branch Deep Learning.**  
 J.Chen; Y.Yuan; **H.Lang\***; T.Wen; S.Ding; J.J.Lu.  
 2023. *Journal of Southeast University (in Chinese)*. 53(1): 123-129. 10.3969/j.issn.1001-0505.2023.01.015.
- [J7] **PCDNet: Seed Operation-Based Deep Learning Model for Pavement Crack Detection on 3D Asphalt Surface.**  
 T.Wen; **H.Lang\***; S.Ding; J.J.Lu; Y.Y.Xing.  
 2022. *ASCE Journal of Transportation Engineering, Part B: Pavements*. 148(2): 04022023. 10.1061/JPEODX.0000367.
- [J6] **The Improvement of Automated Crack Segmentation on Concrete Pavement with Graph Network.**  
 J.Chen; Y.Yuan; **H.Lang\***; S.Ding; J.J.Lu.  
 2022. *Journal of Advanced Transportation*. 10.1155/2022/.
- [J5] **Line-Structured Light Rut Detection of Asphalt Pavement with Markings Interference under Strong Light.**  
 S.Ding, Y.Y.Xing, **H.Lang**, T.Wen, J.J.Lu\*.  
 2022. *ASCE Journal of Transportation Engineering, Part B: Pavements*, 148(2), 04022007. 10.1061/JPEODX.0000341.
- [J4] **Pavement Cracking Detection and Classification Based on 3D Image Using Multiscale Clustering Model.**  
**H.Lang**; J.J.Lu; Y.X.Lou\*; S.D.Chen.  
 2021. *ASCE Journal of Computing in Civil Engineering*, 34(5): 04020034. 10.1061/(ASCE)CP.1943-5487.0000910.
- [J3] **AI Algorithm-Based Road Surface 3D Detection Technology and Cutting-Edge Applications.**  
**H.Lang\***.  
 2021. *China Highway (in Chinese)*. (22): 84-88.
- [J2] **3D Pavement Crack Detection Method Based on Deep Learning.**  
**H.Lang**; T.Wen; J.J.Lu\*; S.Ding; S.D.Chen.  
 2021. *Journal of Southeast University (in Chinese)*. 51(1): 53-60. 10.3969/j.issn.1001-0505.2021.01.008.
- [J1] **Traffic Video Significance Foreground Target Extraction in Complex Scenes.**  
**H.Lang**; S.Ding; J.J.Lu\*; X.L.Ma.  
 2019. *Journal of Image and Graphics (in Chinese)*. 24(01):50-63. 10.11834/jig.180313.
- [C6] **Intelligent Pixel-Level Segmentation of Pavement Sealed Cracks Using CycleGAN-Based Domain Adaptation.**  
 Y.M.Li; J.Chen; **H.Lang\***; J.S.Qian.  
 2025. *TRB 104th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO. TRBAM-25-02916
- [C5] **Efficient Data Selection Based on Difficulty-Aware Module for Pavement Distress Segmentation.**  
 J.Chen; Y.Yuan; **H.Lang\***; S.Ding; J.J.Lu.  
 2024. *TRB 103th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO. TRBAM-24-03862.
- [C4] **The Two-step Method of Pavement Pothole and Raveling Detection and Segmentation Based on Deep Learning.**  
 A.D.Wang. **H.Lang\***; Z.Chen; Y.C.Peng; J.J.Lu.  
 2024. *TRB 103th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA . NO. TRBAM-24-02687.
- [C3] **Automatic Distress Segmentation on Asphalt Pavement Based on Deep Learning with Multiple Branches.**  
 J.Chen; T.Wen; S.Ding; Y.Yuan; **H.Lang\***; J.J.Lu.  
 2022. *TRB 101th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO. TRBAM-22-01850.
- [C2] **Automated Rutting Abnormality Detection on 3D Asphalt Pavement Surfaces Based on Disease Seeds.**  
**H.Lang**; Y.C.Peng; J.J.Lu\*.  
 2020. *TRB 99th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO.20-05363.
- [C1] **A Review of 3D Pavement Automatic Measurement System.**  
**H.Lang\***; Y.X.Lou; J.J.Lu\*; Y.Chen.  
 2018. *17th COTA International Conference of Transportation Professionals*.3D Pavement System.

## AI- SAFETY AND SUSTAINABILITY IN TRANSPORTATION SYSTEMS

- [J11] **3D Tire-Pavement Contact Stresses: Physics-Informed Prediction Approach.**  
**H.Lang\***; W.D.Villamil; I.L.Al-Qadi;  
2026. *International Journal of Pavement Engineering*, 27(1). 10.1080/10298436.2026.2621970.
- [J10] **Designing Asphalt Concrete Mixtures Based on BMD Requirements Utilizing A Two-Step Approach.**  
**H.Lang\***; I.L.Al-Qadi; M.A.Uthman.  
2025. *Journal of Transportation Research Record*, 03611981251344912. 10.1177/03611981251344912.
- [J9] **Smartphone-Based Image Analysis Method for Estimating Moisture Content in Subgrade Filling.**  
H.Y.Ouyang; J.S.Qian\*. **H.Lang**; J.K.Zhang; Y.Zhang;  
2025. *International Journal of Transportation Science and Technology*. j.ijtst.2025.06.010.
- [J8] **The Unification of Damage Evolution in Asphalt Mixtures under Various Strain Waveforms Using the Dissipated Energy Indicator.**  
H.L.Chen; C.Y.Xue. **H.Lang**; Y.H.Wang; K.L.Zhuang; Z.C.Han; L.J.Sun; X.Y.Chen;  
2025. *Construction and Building Materials*, 493, 143214. 10.1016/j.conbuildmat.2025.143214.
- [J7] **Optimization of Water-road Freight Transportation Routes for Reduced Fuel Consumption and Traffic Risk.**  
T.R.Zhang; **H.Lang**; Y.B.Chen\*; A. Moeinaddini\*; Y.Zou.  
2025. *IET Intelligent Transport Systems*, 19(1), e70078. 10.1049/itr2.70078.
- [J6] **A Dynamic Dual Optimization Method for Safe Lane Changing in Autonomous Driving.**  
J.C.Jiang; **H.Lang**; Y.B.Chen\*; Y.Zhang; Y.Wang; H.Zhang; Y.Zou\*.  
2025. *Transportmetrica A: Transport Science*, 1-33. 10.1080/23249935.2025.2497887.
- [J5] **Automated Bridgehead Settlement Detection on the Non-Staggered-Step Structures Based on Settlement Point Ratio Model**  
**H.Lang**<sup>†</sup>; Y.Peng<sup>†</sup>; Z.Zou\*; S.X.Zhu; Z.Chen; M.Zhang.  
2023. *Applied Sciences*, 13(13), 7888. 10.3390/app13137888.
- [J4] **What Is the Impact of a Dockless Bike-Sharing System on Urban Public Transit Ridership.**  
**H.Lang**; S.Zhang; K.Fang; Y.Xing\*; Q.Xue.  
2023. *Sustainability*, 13(18), 9996. 10.3390/app13189996.
- [J3] **A Portable Measurement System for Pavement Surface Macrotexture—a Case Study in China.**  
Y.X.Lou; S.D.Chen; J.J.Lu; **H.Lang**.  
2022. *International Journal of Pavement Engineering*. 23(12), 4136-4148. 10.1080/10298436.2021.1935939.
- [J2] **The Situation of Hazardous Materials Accidents during Road Transportation in China from 2013 to 2019**  
S.X.Zhu; S.W.Zhang; **H.Lang**\*; C.Jiang; Y.Xing.  
2022. *International Journal of Environmental Research and Public Health*, 19(15), 9632. 10.3390/ijerph19159632.
- [J1] **Asphalt Pavement Rutting Anomaly Inspection Method Considering 3D Characteristics of Distress.**  
**H.Lang**; J.J.Lu\*; S.D.Chen; Y.X.Lou.  
2020. *Journal of Southeast University (in Chinese)*. 50(3): 454-462.
- [C8] **Hot-Mix Asphalt Cracking Potential Prediction from Binder Rheological Parameters.**  
A.O.Sulaiman\*; **H.Lang**; I.L.Al-Qadi;  
2026 (Lectern Session). *TRB 105th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. (TRR)
- [C7] **3D Tire-Pavement Contact Stresses: Physics-Informed Prediction Approach.**  
**H.Lang**\*; W.D.Villamil; I.L.Al-Qadi;  
2026. *TRB 105th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA.
- [C6] **Seasonal Load Spectra on Illinois Interstate Highways.**  
A.Singh\*; **H.Lang**; I.L.Al-Qadi;  
2026. *The 11th International Conference on the Bearing Capacity of Roads, Railways and Airfields*. Ljubljana, Slovenia.
- [C5] **Aviation Accident Report Causality Extraction Based on Transformer with BERT-embeddings.**  
Z.Chen; **H.Lang**; Y.Y.Xing\*; L.Wang; S.W.Zhang.  
2025 (Lectern Session). *TRB 104th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA.
- [C4] **Automatic Pavement Type Recognition for Image-based Data Using a Multi-Features Fusion Network.**  
Z.Chen; **H.Lang**\*; A.D.Wang; Y.Peng; Y.Y.Xing.  
2024. *TRB 103rd Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO. TRBAM-24-02961.

- [C3] **Smart Pavement: An Attention-Based Classification Model for Road Pavement Material.**  
Y.Yuan; Q.W.Xue; **H.Lang\***; J.Zhu; J.Chen; Y.Peng  
2022. *5th KES International Symposium on Smart Transportation Systems*. 133-140. 10.1007/978-981-19-2813-0-14.
- [C2] **Rutting Abnormality Detection and Correction on 3D Asphalt Pavement Surfaces Using Segmentation Model.**  
A.D.Wang; S.Ding; **H.Lang\***; T.Wen; J.J.Lu.  
2022. *TRB 101th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO. TRBAM-22-01795.
- [C1] **Development of A Portable Pavement Surface Macrotexture Measurement System Applied in China.**  
**H.Lang**, Yuxin Lou; Jian John Lu\*.  
2019. *TRB 98th Annual Meeting of the Transportation Research Board*. Washington, D.C., USA. NO. 19-03777.).

## Professional Experience

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- 2024-2024 **Research Associate Professor**, Transportation Research Institute of Tongji University
- 2021-2024 **Senior Research Scientist**, Shanghai PRES Road Traffic Technology Co., Ltd, Supervisor: Dr. Shendi Chen
- 2017-2021 **Research Scientist**, Shanghai PRES Road Traffic Technology Co., Ltd, Supervisor: Dr. Jian John Lu
- 2017-2021 **Research Assistant**, Tongji University, Supervisor: Dr. Jian Johh Lu
- 2014-2016 **Undergraduate Research Assistant**, Tianjin University of Science & Technology, Supervisor: Dr. Fengzhi Dai

## Honors & Awards

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- 2025 **Scholarship and Teaching for Engineering Postdocs (STEP)**, Grainger College of Engineering, University of Illinois Urbana-Champaign
- 2024 **First Prize**, Shanghai Institute Traffic Engineering Science and Technology, *Driving Behavior Spectrum Theory and Intelligent Risky Driving Identification under Full-Road Perception*
- 2023 **Best Paper Award**, 2nd China Highway & Transportation Society (CHTS) Smart Transportation Annual Conference
- 2022 **Two Paper Awards (Technical Innovation & Technology Exploration)**, 12th Annual Conference on Highway Maintenance and Management, CHTS
- 2021 **Two Paper Awards (Technical Innovation & Technology Exploration)**, 11th Annual Conference on Highway Maintenance and Management, CHTS
- 2021 **Outstanding Graduate**, Tongji University
- 2019 **First Prize (6th National Ranking)**, China Graduate Mathematical Modeling Competition
- 2018 **Second Prize**, China Graduate Mathematical Modeling Competition

## Certifications & Licenses

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- 2026 **FAA Remote Pilot Certificate (Part 107)**, Federal Aviation Administration (FAA) (UAS field operations)

## Invited Talks & Seminar

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2026. *Coarse-to-refined Road Alignment Extraction and Parameterization from MLS Point Clouds*. **TRB 105th Annual Meeting of the Transportation Research Board**, Washington, D.C., USA.
2026. *Hot-Mix Asphalt Cracking Potential Prediction from Binder Rheological Parameters*. **TRB 105th Annual Meeting of the Transportation Research Board**, Washington, D.C., USA.
2025. *Efficient Prediction of Asphalt Concrete Mix Design Based on Performance Tests*. **ASCE International Airfield & Highway Pavements Conference**, Glendale, AZ, USA.
2025. *SCRIM Friction Number Prediction Using Decision Tree Algorithms*. **Annual Road Profile Users' Group (RPUG) Conference**, DALLAS, TX, USA.

2025. *Aviation Accident Report Causality Extraction Based on Transformer with BERT-embeddings*. **TRB 104th Annual Meeting of the Transportation Research Board**, Washington, D.C., USA.

2023. *5th Big Data and Intelligent Highway Maintenance Forum: Applications of Next-Generation AI in Highway Precision Inspection and Decision-Making*. **China Highway & Transportation Society**, Xian, China.

2022. *Smart Pavement: An Attention-Based Classification Model for Road Pavement Material*. Invited Talk at **5th KES International Symposium on Smart Transportation Systems**, Remote.

2021. *4th Big Data and Intelligent Highway Maintenance Forum: AI-Based 3D Pavement Inspection Technology and Applications*. **China Highway & Transportation Society**, Guiyang, China.

2021. *Development and Application of Pavement Inspection Technologies*. **Security & Privacy Seminar (World Transport Convention)**, Xian, China.

## Teaching Experience

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Multimodal Infrastructure Intelligence: Measurement, Data, Method (2-hour Workshop),		
Fall 25	Department of Civil and Environmental Engineering, University of Illinois Urbana-Champaign	Instructor
<b>Smart Transportation &amp; Digital Highway Workshop: Digital Empowerment for Intelligent Highway Operations and Applications</b> , College of Transportation, Tongji University		
Spring 24	High-Quality Highway Construction and Maintenance Development Training: Digital Empowerment for Intelligent Highway Operations—Theory, Technology, and Practice, College of Transportation, Tongji University	Instructor
<b>Transportation Engineering (TE)-Intelligent Sensing and Detection Technologies</b> , College of Transportation, Tongji University		
Spring 22		Co-Instructor

## Mentoring

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2025-	<b>William Villamil Martinez</b> , Worked on R27-277 WIM project, UIUC Ph.D. Student
2024-2025	<b>AbdulGafar Sulaiman</b> , Worked on R27-250 Binder project, UIUC Ph.D. Student
2024-	<b>Aditya Singh</b> , Worked on R27-277 WIM project, UIUC Ph.D. Student
2024-2026	<b>Mohammad Fakhreddine</b> , Worked on R27-247 Friction project, UIUC Ph.D. Student
2024-2025	<b>Javier García Mainieri</b> , Worked on R27-216 SMA-APT project, UIUC Ph.D. Student
2024-	<b>Yihan Chen</b> , Worked on FHWA GPR Matlab Tool, UIUC Ph.D. Student
2020-2024	<b>Zheng Zou</b> , Worked on LiDAR Fusion Project, Tongji Ph.D. Student
2022-2024	<b>Yuan Peng</b> , Worked on LiDAR Fusion Project, Tongji Master Student
2023-2024	<b>Xinting Chen</b> , Worked on LiDAR Fusion Project, Tongji Master Student
2020-2022	<b>Tian Wen</b> , Worked on AI- Intelligent Infrastructure Detection, Tongji Master Student
2020-2023	<b>Shuo Ding</b> , Worked on AI- Intelligent Infrastructure Detection, Tongji Ph.D. Student
2020-2024	<b>Ye Yuan</b> , Worked on AI- Intelligent Infrastructure Detection, Tongji Ph.D. Student
2020-2024	<b>Jiang Chen</b> , Worked on AI- Intelligent Infrastructure Detection, Tongji Ph.D. Student
2020-2024	<b>Aidi Wang</b> , Worked on Intelligent Infrastructure Monitoring, Tongji Ph.D. Student, now an exchange student in University of Cambridge
2021-2024	<b>Zhen Chen</b> , Worked on Intelligent Infrastructure Monitoring, Tongji Ph.D. Student
2023-2024	<b>Yiming Li</b> , Worked on AI- Intelligent Infrastructure Detection, Tongji Undergraduate Student, now a Ph.D student in Tongji
2023-2024	<b>Junyi Hu</b> , Worked on AI- Intelligent Infrastructure Monitoring, Tongji Undergraduate Student, now a master student in ETH Zurich
2023-2024	<b>Li Chen</b> , Worked on Intelligent Infrastructure Monitoring, Tongji Undergraduate Student

## Professional Service

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### PROGRAM COMMITTEE

- 2025 Visiting Research Scientist Search Committee, CEE, UIUC, Committee Member
- 2024 Visiting Research Scientist Search Committee, CEE, UIUC, Committee Member
- 2024 Journal of Transport Information and Safety, Associate Editor
- 2024 China Highway & Transportation Society, Expert Committee
- 2023 Shanghai Highway & Transportation Society, Member

### EXTERNAL REVIEWER [JOURNAL]

*Transportation Research Part C, Automation in Construction, IEEE Transactions on Intelligent Transportation Systems, Engineering Applications of Artificial Intelligence, Reliability engineering & systems safety, ASCE Journal of Computing in Civil Engineering, International Journal of Pavement Engineering, Construction and Building Materials, Structural Control and Health Monitoring, Measurement, Case Studies in Construction Materials, IEEE Open Journal of Intelligent Transportation Systems, Computers and Electrical Engineering, Journal of Advanced Transportation, Journal of Zhejiang University(Engineering Science).*

### EXTERNAL REVIEWER [CONFERENCE]

*Transportation Research Board (TRB), COTA International Conference of Transportation Professionals (CICTP), International Conference on Accelerated Pavement Testing (APT).*

## Media Press

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- 2025 **ICT develops AI tool for optimal mix design of flexible roadways**, Illinois Center for Transportation
- 2025 **Cracking the code to predict modified asphalt binder performance**, Illinois Center for Transportation

## COMPUTER SKILLS AND ELECTRICAL FUNDAMENTALS

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Proficiency in C++ (13 years experience), C Sharp, VB.Net, Python, Halcon, Matlab, SPSS.

Experienced in Measurement and Control Circuits, Sensors, Principles of Automatic Control, Error Analysis, Analog and Digital Circuits. Devices that have been developed for some sensor manufacturers include: **3-D Camera**-Automation Technology (AT) AT-C2-2040HS, AT-C5-2040, AT-C6-4096; **LiDAR**-DJI Livox Horizon, Bynav X1 INS; **2-D Camera**-Canada DALSA LA-GM-04K08A; **Digital Acquisition Card**-NI-DT9801, DT9814, MCC1608G; **Other sensors**: point lasers, accelerometers, IMUs, encoders, etc.