Welcome to NC State

Graduate Program in Construction Engineering

Addressing today's unprecedented challenges of the construction industry

Fitts-Woolard Hall: Faculty Offices (3rd floor)

Alex Albert
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Edward Jaselskis
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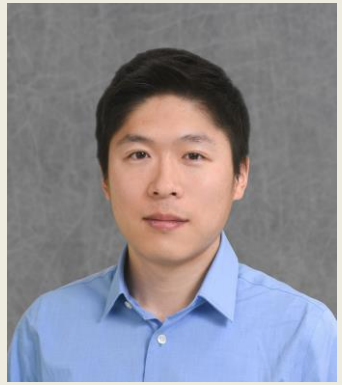

Kevin Han
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William Rasdorf
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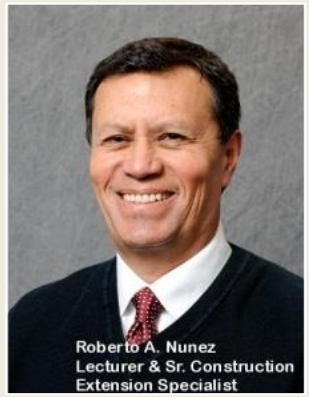

Roberto Nunez
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Jim Rispoli
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Doyun Lee
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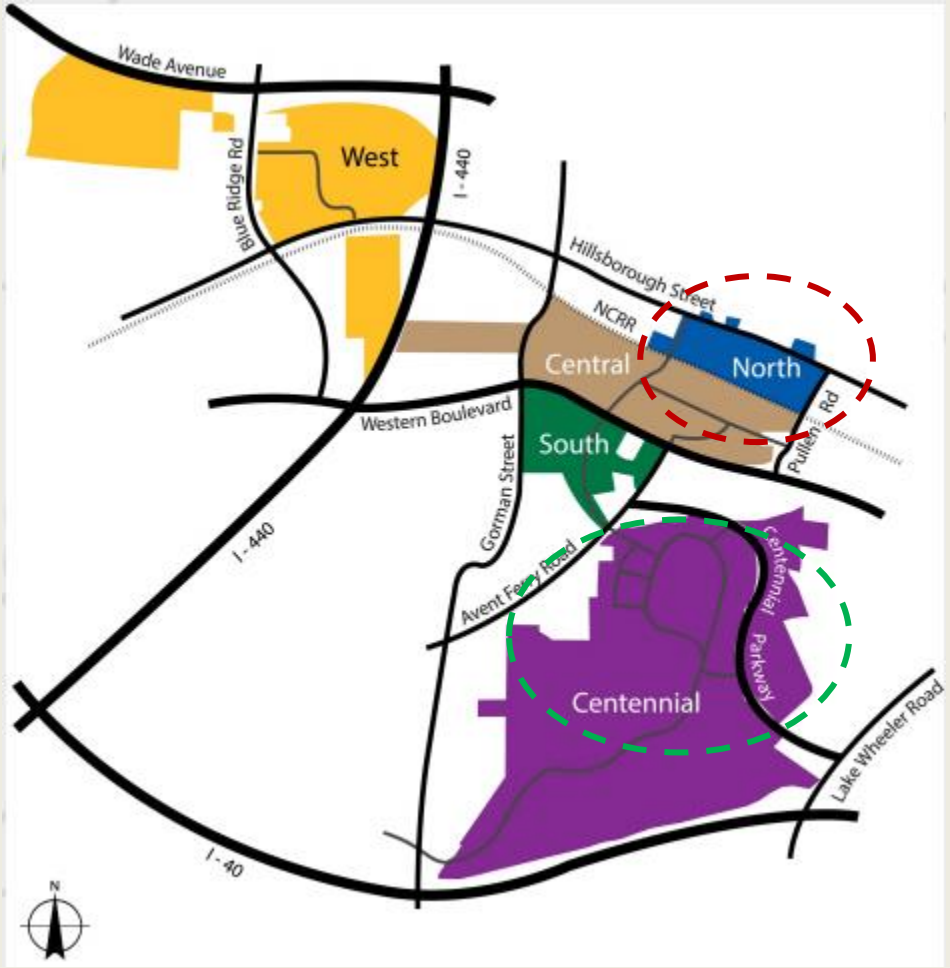
Classes

Access Campus Map: https://maps.ncsu.edu/#



Academic Programs

- Many different paths to success
- Many different student needs

MS/MCE

- Develop a program that makes sense to *YOU*
- Research – develop expertise (guided)

PhD

- Develop and conduct research
- Build on MS/MCE – specialized expertise

Academic Programs: PhD

- Total ~ 3 to 4 years
- Masters + 18 to 24 hrs. typical (+2 to 3 semesters)
  - Course selection with support from advisor/committee
- Preliminary Exams
  - Written + Oral; early in 3rd semester
  - Develop feasible research plan
  - 4 to 5 person committee (one outside department rep)
- Final Defense

Academic Programs: MS/MCE

MS

- *"Thesis"* 3 – 6 hours of research
  - MS if funded - RA
  - Need advisor + 2 person committee
  - TA selected by faculty

MCE

- Only coursework in most cases
  - *"3 Hour Project"* if approved by faculty

Academic Programs: MCE Requirements

- *Minimum* 7 CON courses
- 1 course in CE (not from CON)
- 2 *"Supporting"* courses (see course choice list)
- Total 10 courses = 30 credit hours
- No more than 12 hours per semester!

A complete 30 hour Graduate Plan is due to the construction faculty prior to the end of your first semester.

Academic Programs: MS Requirements

- Same as MCE except:
  - Select courses that support research – recommended courses by advisor

- *Minimum* 7 CON courses
- 1 *"Supporting"* course (see course choice list)
- Total 8 courses = 24 credit hours
- Thesis = 6 credit hours
- No more than 12 hours per semester!

A complete 30 hour Graduate Plan is due to the construction faculty prior to the end of your first semester.

CON Courses

Fall 2023

- CE 592 Global Construction Practices (L&D) (Jaselskis)
- CE 592 Building Information Modeling in Construction (Lee)
- CE 567 Risk and Financial Management in Construction (L&D) (Nunez)
- CE 592 Construction Estimating, Planning & Control (Nunez)
- EGR 517 Facilities Engineering Systems (Rispoli)

Spring 2024

- CE 564 Legal Aspects (L&D) (Jaselskis)
- CE 763 Materials Management (L&D) (Rasdorf)
- EGR 590 Environmental Compliance for Facilities Engineers (L&D) (Rispoli)

(L) Live
(D) Distance Education Class
CE course offered by CON faculty
Supporting course offered by CON faculty

CON Courses

Fall 2024 (likely)

- CE 592 CII Best Practices (L&D) (Jaselskis)
- CE 592 Building Information Modeling in Construction (L) (Han)
- EGR 517 Facilities Engineering Systems (Rispoli)
- CE 538 Information Technology and Modeling (L&D) (Rasdorf)

Spring 2025 (likely)

- CE 561 Construction Project Management (L&D) (Jaselskis)
- CE 564 Legal Aspects of Contracting (L&D) (Jaselskis)
- CE 565 Construction Safety Management (L) (Albert)
- CE 763 Material Management (L&D) (Rasdorf)
- CE 567 Risk and Financial Management in Construction (L&D) (Nunez)
- EGR 590 Environmental Compliance for Facilities Engineers (L&D) (Rispoli)

(L) Live
(D) Distance Education Class

CE course offered by CON faculty
Supporting course offered by CON faculty

CE Courses

- CE 536 Numerical Methods
- CE 537 Computer Methods & Applications
- CE 538 Information Technology (Rasdorf)
- CE 592 Robotic Vision Systems (Han)
- CE 522 Pre-stressed Concrete Design
- CE 523 Steel Design
- CE 524 Masonry Design
- CE 528 Wood Design
- CE 548 Engineering Properties of Soils
- CE 549 Soil & Site Improvement
- CE 744 Foundation Engineering
- CE 503 Highway Design
- CE 504 Airport Design (for Navy and Air Force officers)
- CE 755 Pavement Design

Supporting Courses

- All CON Courses

- Specified CE Courses

- Other Courses
  - ISE 501 Operations Research
  - ISE 510 Applied Engineering Economy
  - ISE 562 Simulation Modeling
  - ST 515 Experimental Statistics for Engineers I
  - ST 516 Experimental Statistics for Engineers II
  - EGR 590-601 Environmental Compliance for Facilities Engineers (Spring) (Rispoli)
  - CE 675 Project (3 hour maximum)

MCE Plan

Name: _____

Fall:	Spring:	Fall:
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

CON 1	_____	CON 6	_____
CON 2	_____	CON 7	_____
CON 3	_____	CE	_____
CON 4	_____	*Support 1*	_____
CON 5	_____	*Support 2*	_____

Best Practices for Success

- Attend Classes and Complete Assignment on time
- Submit independent work for exams and quizzes
- Submit Assignments according to instructor instructions
- Avoid *Plagiarism*
  - Always cite source when ideas are adopted
  - Use quotation marks when text is adopted verbatim along with citation
  - Don’t resubmit term paper for another course for credit
- Make use of Professional Development Opportunities
  https://sites.google.com/ncsu.edu/ccee-professional-development/home

***Note:* Plagiarism consequences are severe**

Best Practices for Success

Because plagiarism is an offense against core principles of academic integrity and a violation of NCSU's Code of Student Conduct, the consequences are severe.

So that you will be absolutely clear about the University's standards and expectations, as well as the consequences for failing to meet those standards. You may find below the Code of Student Conduct's Chapters 8 (Academic Integrity), 9 (Cheating), 10 (Plagiarism), and 13 (Sanctions for Academic Dishonesty).

Note that in all cases, *regardless of the seriousness of the offense and the sort of supplemental penalty that might have been imposed, all violations are also punished with a student being placed on academic integrity probation for the remainder of his or her career at NCSU.*

Job Placement

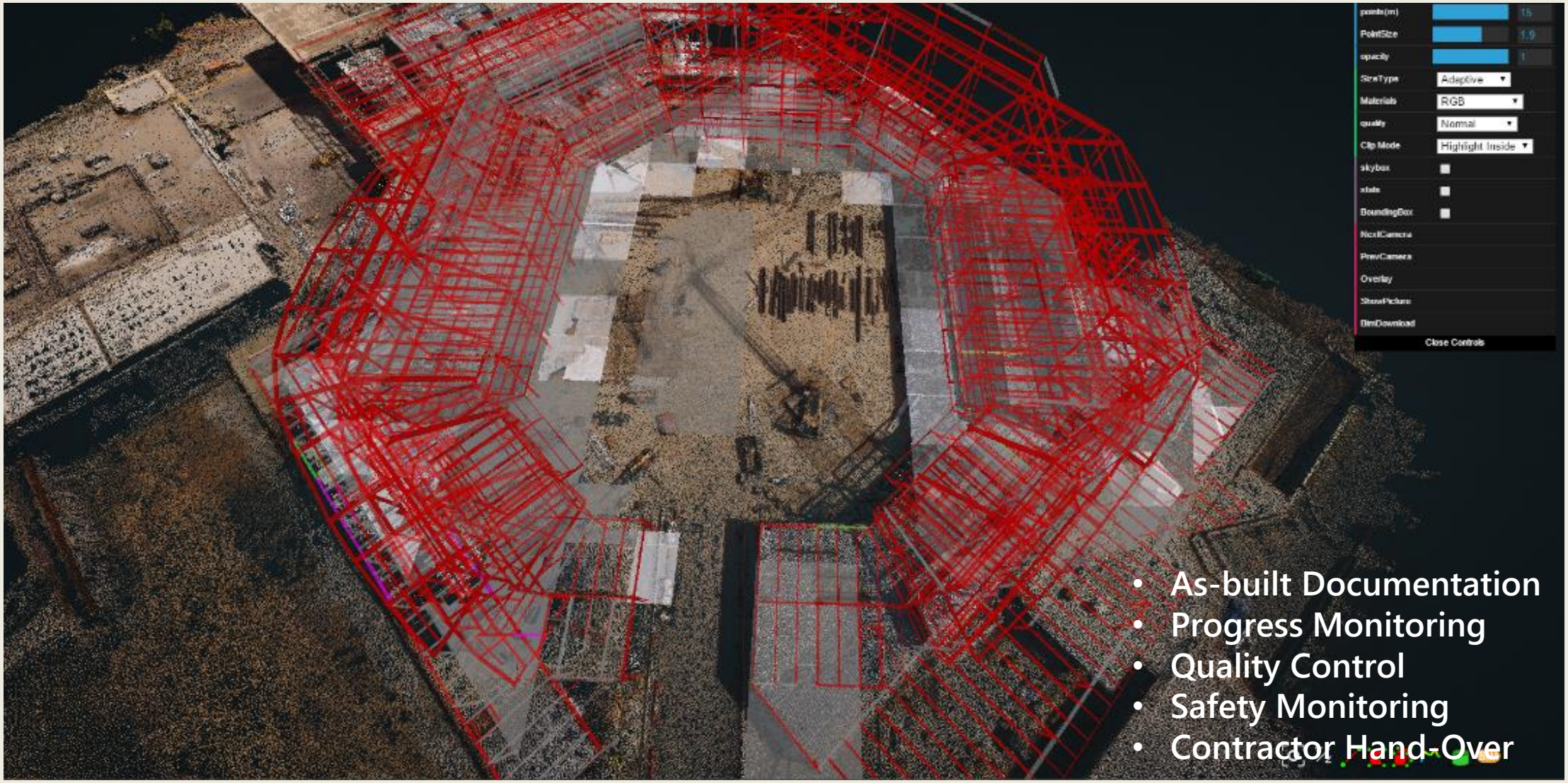
- *Attend Career Fairs*
- *Attend Information Sessions*

- ***Curricular Practical Training (CPT)***
  - *Do well in classes*
  - *Fewer classes in your last semester*
  - *Local jobsites/offices/remote*
  - *Summer (internship) or last semester*

Construction Research

Integrated Information Models for production control

Jointly registered 4D Building Model and point clouds



Automated Mobile Robotic Welding System

GOAL

Development of automated mobile robotic welding system for off-site construction.

APPROACH

Advances in deep learning-based welding joint detection, vision-based automated robotic welding, and UGV integration.

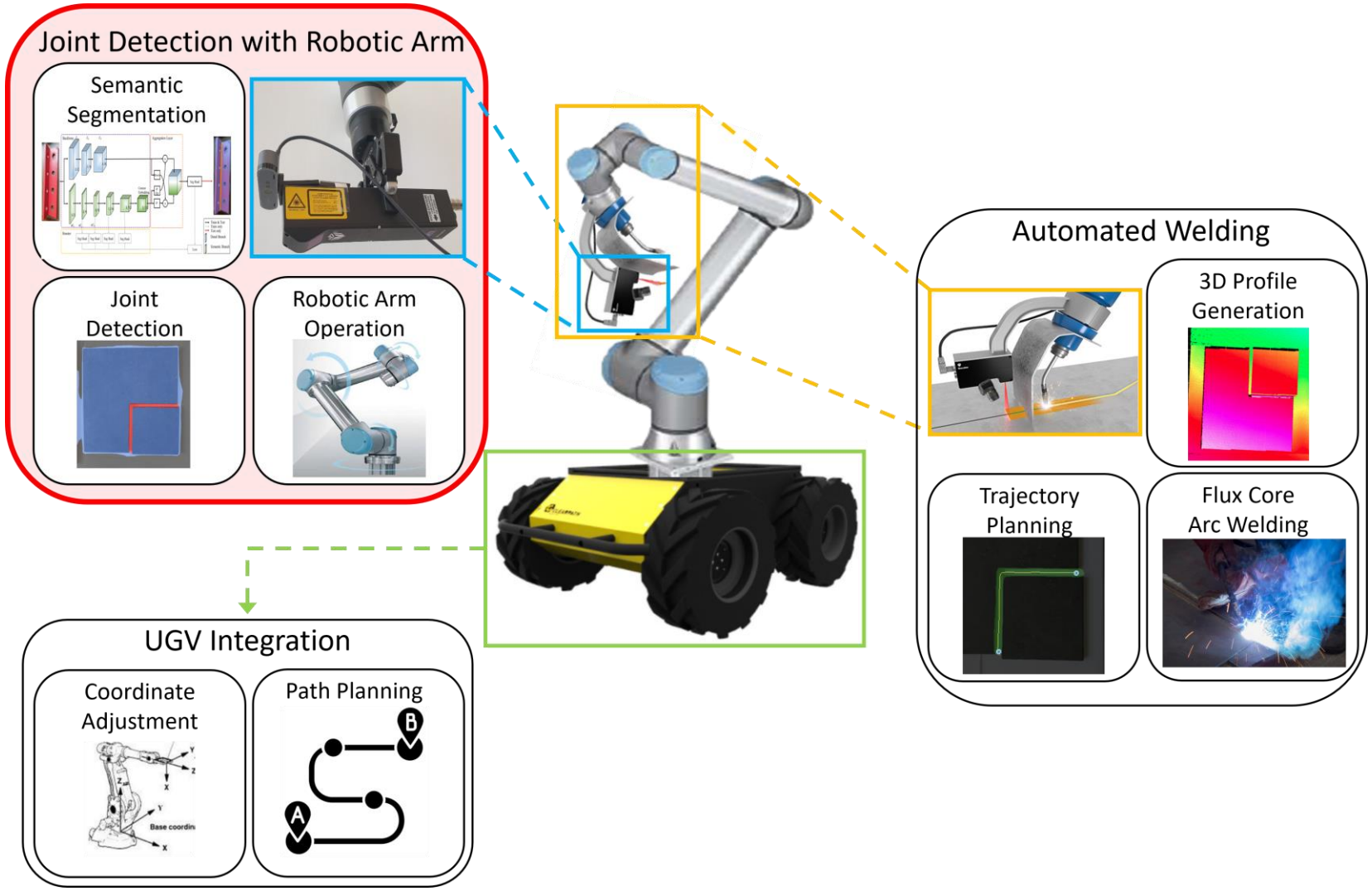
IMPACT

Improve quality and efficiency of welding in nuclear construction site.

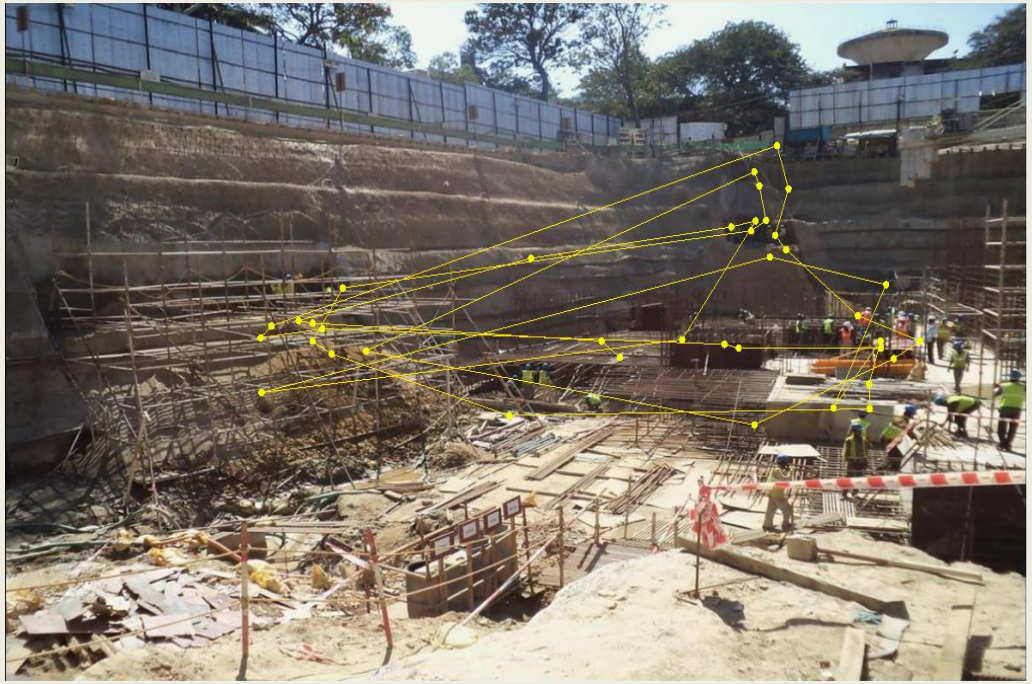
METHODS

Joint detection using deep-learning with visual sensors and robotic arm operation; Trajectory planning based on scanned data and performing welding; UGV integration for mobility.

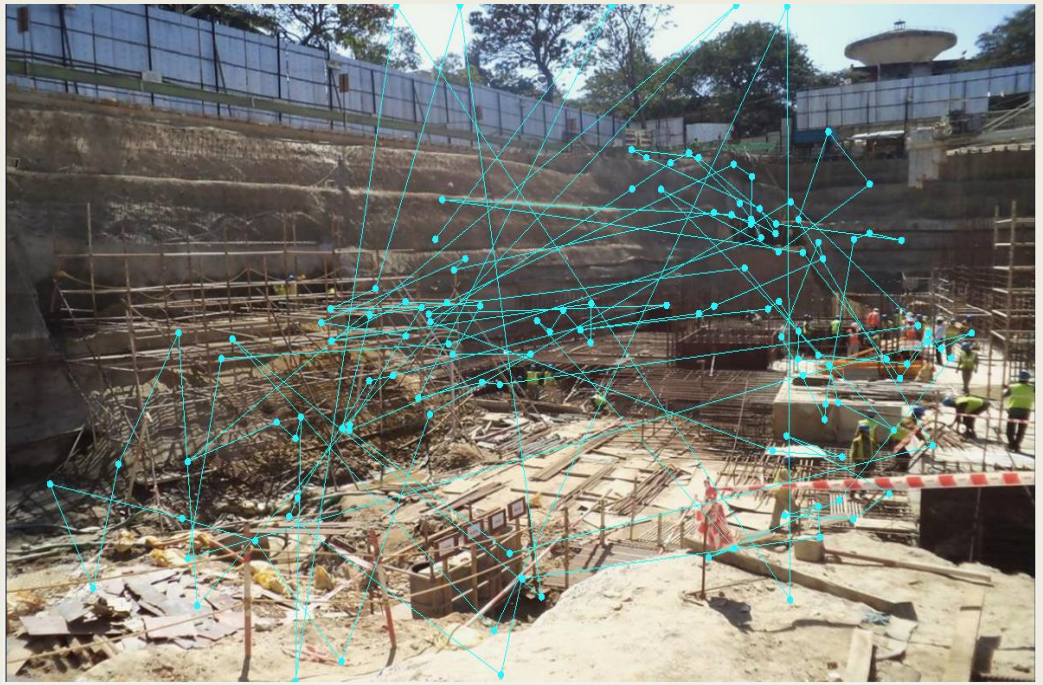
Schematic Diagram of Proposed Automated Mobile Robotic Welding System



Construction Safety



Hazard recognition performance: 33%



Hazard recognition performance: 67%

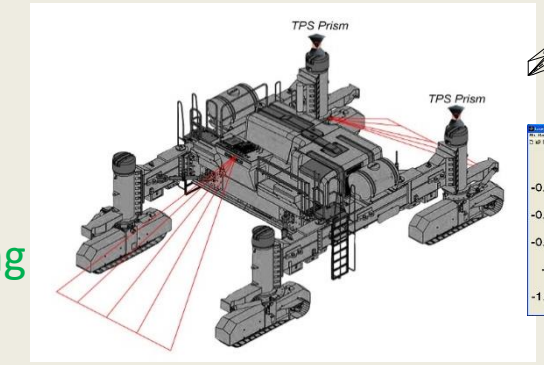
Construction Safety

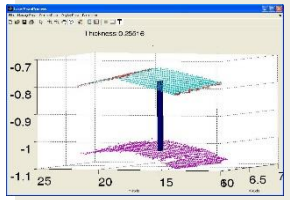
<u>Examples</u>: Falling objects, fall and Trip hazards, collapsing roof, etc.

Construction Safety

Innovative Technologies

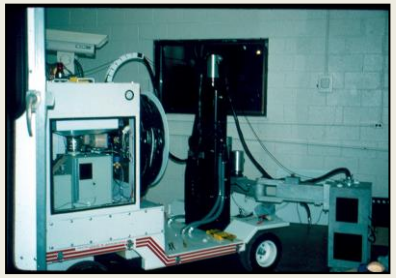
Concrete Pavement Profiler using Laser Scanning





Real time Asphalt Pavement Density using Microwaves

Robotic Sampling System



Project Success

- Modeling Project Success and failure
- Lessons Learned (NCDOT)
- Risk Assessment Programs (NCDOT)
- Evaluating Contingency Factors (NCDOT)
- Promoting CII Best Practices through promotional videos)

Developing Fit-for-Purpose Project Delivery Guidelines

GOAL

Increase visibility and use of Construction Industry Institute (CII) research

APPROACH

Develop a handbook that identifies CII Best Practices and tools for different Upstream, Midstream and Mining project characteristics

IMPACT

Increase use of CII tools by organizations with mature and less mature project management processes

Project Complexity and **Importance Ratings** used to determine project management requirements

Concept for Fit-for-Purpose Project Delivery Handbook

CII Project Delivery Phases	Establish Business Case (or Need)	Front End Planning			Execution				Operations	
	Pre-Feasibility	Feasibility	Concept	Detailed Scope	Detailed Design and Procurement	Construction	Commissioning and Start up	Turnover	Operate Facility	
GOAL	**Gate 0** (check robustness of project business case or need and determine if it is ready to move forward for Feasibility development)	**Gate 1** (check project feasibility and determine if it is ready to move forward to Concept development)	**Gate 2** (evaluate project Concept phase and determine if it is appropriate to move forward to the Detailed Scope phase)	**Gate 3** [check Detailed Scope of project and determine if project is ready to move forward to execution (design and construction)]						
PROCESS	(1) Identify Project Sponsor (2) Establish project relationship to mission or vision of the organization (3) Identify Alternatives/Options, if known (4) Establish current cost estimate / economic analysis, if available (5) Perform market analysis (if available) including buiness drivers (6) Establish current operational need date. (7) Determine priority of this project versus others, if known. (8) Consider Environmental, Health and Safety (EHS) considerations and other risks, if applicable.	Generate and Filter Options. *PDRI 1 (550-800)*	Analyze Alternatives. Develop Conceptual Scopes and Estimates. Evaluate and Select Best Alternative. *PDRI 2 (450-600)*	Preliminary Design and Engineering. Finalize Scope Definition. Prepare Cost and Schedule Control Estimates. *PDRI 2i, PDRI 3 (150-250)*						
DELIVERABLES	Initial Requirements Document	Feasibility Report	Concept Phase Report	Project Definition Package						
CII BEST PRACTICES AND TOOLS	Establish Business Case (or Need)	Front End Planning			Execution				Operations	Project A CII Tools and Best Practices
	Pre-Feasibility	Feasibility	Concept	Detailed Scope	Detailed Design and Procurement	Construction	Commissioning and Start up	Turnover	Operate Facility	
Design Effectiveness Toolkit (64 Strategies)			X	X	X					Recommended
17 Constructability Principles		X	X	X	X	X				Recommended
eGuide for Materials Management					X	X				Recommended
PEpC				X	X	X				REQUIRED
Common Commodity Codes (?)						X				Recommended
Product Integrity Concerns (video – no tool?)				X	X	X	X			Recommended
Interim Product Database (IPD)				X	X	X	X			Recommended
Industrial Engineering Techniques				X	X	X				Recommended
Lean Principles in Construction (35 Principles & Sub-principles)				X	X	X				REQUIRED
Planning for Startup SuPERTool				X	X	X	X			Recommended
Activity Analysis				X	X	X				Recommended
Rework Reduction						X				Recommended
Crew Scheduling 'Look Up' Table						X				Recommended
Leader Selection Guide	X	X	X	X	X	X	X			REQUIRED
Team Leadership Planner	X	X	X	X	X	X	X			REQUIRED
...										Recommended
Best Practices Productivity Improvement Index (BPPII)						X				Recommended
Voice of the Craft Worker (VOW) Tool						X				Recommended

Shopping List

Infrastructure Decarbonization

79% (!) of Global GHG Emissions come from Infrastructure

Energy

Materials

1 **Use Less Energy & Materials**
(Improved Efficiencies, Different Tech, NOT Reduced Infrastructure Services)

2 **Use Different Energy & Materials**
(Electrify, Switch to Green Electricity, Reduce Embodied Carbon)

3 **Offset** Unavoidable Emissions
(Infrastructure is not a luxury)

Work Hard! Play Hard!

Have a wonderful semester!