Using Whisper in a Civil Engineering Field Methods Course

## Downloads

* [Download as Word Document (DOCX)](/downloads/teaching/civil-engineering-whisper.docx)

# Case Study: Using Whisper to Create Accessible Materials in Civil Engineering Education

## Course Context

**Course:** Transportation Engineering Fundamentals (CE 3604)
**Level:** Junior/Senior
**Enrollment:** 85 students
**Prior Format:** Lecture-based with field visits and design projects
**Tools:** CAD software, traffic simulation tools
**Faculty:** Dr. T, Professor of Civil Engineering

## Implementation Challenge

Dr. T identified several challenges in his transportation engineering course that needed addressing:

1. **Diverse Learning Needs:** Increasing number of students requiring accessibility accommodations
2. **Field Documentation:** Difficulty capturing and sharing field observations effectively
3. **Guest Speaker Integration:** Valuable industry speakers but content often not well-documented
4. **Course Material Access:** Students benefiting from multiple modalities of content delivery
5. **International Student Support:** Non-native English speakers struggling with technical terminology

## Implementation Goals

The integration of Whisper (OpenAI’s automatic speech recognition system) aimed to:

1. Enhance accessibility for students with diverse learning needs
2. Create comprehensive documentation of field experiences
3. Capture and index guest lecturer insights
4. Provide multiple access paths to course content
5. Support English language learners with transcribed technical content

## Implementation Process

### Phase 1: Faculty Preparation (Summer before semester)

1. **Tool Exploration:**
	* Tested Whisper through OpenAI’s API
	* Evaluated accuracy with civil engineering terminology
	* Explored integration with existing course platforms
	* Developed workflow for transcript editing and distribution
	* Tested with sample lectures and field recordings
2. **Technical Setup:**
	* Set up cloud-based processing system for audio files
	* Created repository structure for organizing transcripts
	* Established quality control process for transcript accuracy
	* Developed tagging system for searchable content
	* Created integration with course management system
3. **Content Planning:**
	* Identified key lectures for transcription priority
	* Planned field visit documentation approach
	* Scheduled guest speakers with transcription in mind
	* Developed template for transcript formatting
	* Created captioning standards for video content

### Phase 2: Implementation Setup (First two weeks)

1. **Student Introduction:**
	* Explained Whisper integration and accessibility benefits
	* Demonstrated how to access and search transcripts
	* Showed examples of field visit documentation
	* Discussed ethics and privacy considerations
	* Gathered baseline data on student needs
2. **Initial Content Creation:**
	* Transcribed first two weeks of lectures
	* Created searchable PDF and HTML formats
	* Linked transcripts to corresponding slides and materials
	* Demonstrated transcript-based study techniques
	* Gathered initial student feedback
3. **Process Refinement:**
	* Adjusted transcription settings for technical terminology
	* Created custom dictionary for transportation engineering terms
	* Established student assistant role for transcript quality control
	* Developed consistent format for distribution
	* Set up analytics to track transcript usage

### Phase 3: Full Implementation (Throughout semester)

1. **Comprehensive Content Transcription:**
	* All lectures recorded and transcribed within 24 hours
	* Field visits documented with audio notes and transcribed
	* Guest lectures captured with speaker permission
	* Student presentations optionally transcribed upon request
	* Special topics and technical discussions preserved
2. **Accessibility Integration:**
	* Transcripts formatted for screen reader compatibility
	* Key terminology highlighted with definitions
	* Visual elements described in text
	* Time-stamped connections to visual materials
	* Multiple format options (text, searchable PDF, HTML)
3. **Field Visit Documentation:**
	* Students recorded audio observations during site visits
	* Whisper transcribed field notes for inclusion in reports
	* Created comprehensive record of site observations
	* Enabled comparison across student experiences
	* Integrated photos with transcribed observations

## Implementation Examples

### Example 1: Enhanced Lecture Accessibility

**Traditional Approach:** Lectures were delivered with slides and recorded on video. Students with hearing impairments requested note-takers or relied on lip reading and partial audio.

**Whisper-Enhanced Approach:** 1. Lectures recorded with quality microphone 2. Audio processed through Whisper API 3. Transportation engineering terminology verified and corrected 4. Transcripts formatted with timestamps and speaker identification 5. Technical terms linked to glossary definitions 6. Transcripts made available in multiple formats within 24 hours 7. Content made searchable across all lecture transcripts

**Student Workflow:**

1. Attend or watch lecture
2. Access transcript alongside video/slides
3. Use search function to find specific concepts
4. Reference technical terms in context
5. Create study guides based on transcript content
6. Annotate transcripts with personal notes

### Example 2: Field Visit Documentation

**Traditional Approach:** Students took handwritten notes and photos during site visits, often missing details while trying to document observations.

**Whisper-Enhanced Approach:** 1. Students used smartphones to record audio observations during field visits 2. Recordings uploaded to secure course platform 3. Whisper generated transcripts of field observations 4. Students edited transcripts for accuracy and added context 5. Photos and diagrams linked to relevant transcript sections 6. Comprehensive field documentation included in project reports

**Field Documentation Assignment:** > During our visit to the Highway 26 Traffic Management Center, record your observations using the audio recording feature in the course app. Focus your observations on the traffic flow management systems and control room operations. After the visit, you will: > > 1. Review the Whisper-generated transcript of your observations > 2. Edit for accuracy, especially technical terminology > 3. Organize your observations into the categories listed in the field report template > 4. Integrate relevant photos with specific transcript sections > 5. Compare your observations with those of your teammates > 6. Synthesize a comprehensive site analysis for your project report

### Example 3: Guest Speaker Knowledge Capture

**Traditional Approach:** Industry professionals gave valuable guest lectures, but their insights were often lost or incompletely captured in student notes.

**Whisper-Enhanced Approach:** 1. Guest lectures recorded with speaker permission 2. Whisper generated complete transcripts 3. Key insights and industry examples tagged and highlighted 4. Question and answer sessions fully documented 5. Content made searchable and referenceable for projects 6. Industry terminology captured accurately

**Knowledge Integration Assignment:** > After reviewing the transcript from our guest speaker from the Department of Transportation: > > 1. Identify three key insights about traffic signal timing optimization > 2. Find specific examples that relate to your intersection design project > 3. Extract relevant design parameters mentioned by the speaker > 4. Connect the speaker’s real-world examples to concepts from our textbook > 5. Incorporate these insights into your project documentation with appropriate citations

## Assessment Strategy

### Accessibility Impact Assessment

Dr. T evaluated the impact of Whisper integration on accessibility using:

1. **Student Surveys:** Regular feedback on transcript usefulness
2. **Access Analytics:** Tracking which transcripts were most utilized
3. **Performance Comparisons:** Analyzing outcomes for students using different modalities
4. **Accommodation Requests:** Monitoring changes in formal accommodation needs
5. **Learning Variability:** Assessing performance across different learning preferences

### Quality and Technical Assessment

The technical implementation was evaluated based on:

1. **Transcription Accuracy:** Percentage of technical terms correctly transcribed
2. **Production Efficiency:** Time from recording to available transcript
3. **Integration Effectiveness:** How seamlessly transcripts connected with other materials
4. **Search Functionality:** Ability to locate specific technical concepts across materials
5. **Format Accessibility:** Compatibility with assistive technologies

## Potential Outcomes and Considerations

### Expected Benefits

* Enhanced experience for students with hearing impairments
* Improved comprehension for international students with technical terminology
* Universal access to searchable content archives
* Better integration of field experiences into theoretical understanding
* More comprehensive capture of guest speaker expertise
* Reduced faculty time spent on creating accessible materials
* Improved documentation quality in student projects

### Potential Challenges

* Specialized civil engineering terms may require consistent correction
* Field recordings can have environmental noise issues
* Initial workflow may need refinement for efficiency
* Some students might prefer to use transcripts instead of attending lecture
* Privacy concerns require clear permissions processes
* Technical setup has an initial learning curve

## Faculty Implementation Considerations

### Key Implementation Strategies

1. **Universal design benefits** extending beyond students with accommodations
2. **Field documentation quality** improvements through audio-to-text workflow
3. **Technical content searchability** enhancing student research and connections
4. **Guest lecturer insights** preserved and integrated into course knowledge base
5. **Multiple modality access** supporting diverse learning preferences

### Important Considerations

1. **Civil engineering terminology** requires custom dictionary and post-processing
2. **Audio quality matters significantly** for transcription accuracy
3. **Integration with existing platforms** needs careful planning
4. **Clear student guidance** on appropriate use prevents over-reliance
5. **Time investment shifts** from accommodation creation to content organization

### Future Refinement Directions

If implementing such an approach, consider: 1. Creating a comprehensive civil engineering technical dictionary for Whisper 2. Developing better field recording protocols for environmental conditions 3. Implementing interactive features connecting transcripts to visual materials 4. Creating a structured system for student-generated content transcription 5. Exploring real-time transcription for in-class discussions

## Resources Developed

1. **Technical Setup Guide:** Step-by-step implementation instructions
2. **Civil Engineering Term Dictionary:** Specialized vocabulary for better recognition
3. **Field Recording Protocol:** Best practices for on-site documentation
4. **Transcript Templates:** Standardized formats for different content types
5. **Student Guide:** Instructions for accessing and utilizing transcripts

## Implementation Advice

### For Faculty Considering Similar Integration:

1. **Start with highest-impact content** such as technical lectures and guest speakers
2. **Invest in good audio equipment** for significantly better results
3. **Create discipline-specific term lists** to improve technical accuracy
4. **Consider privacy and permissions** for all recorded content
5. **Integrate with existing platforms** students already use

### Technical Considerations:

1. **Whisper accuracy varies** with audio quality and technical terminology
2. **Post-processing workflow** is essential for specialized engineering content
3. **Storage and organization** need planning for searchability
4. **Multiple format outputs** serve different student needs
5. **Backup procedures** prevent content loss

*This case study was developed as part of the “Strategies for Integrating Generative AI in Engineering Education” workshop materials in collaboration with Claude-3.7 Sonnet.*