



*Celebrate*  
**PUBLIC WORKS!**



**APWA WA**



APRIL 10-11, VANCOUVER WA  
2024 SPRING CONFERENCE



# AI - Closing the Gap

APWA  
Washington Chapter  
Technology Committee



## Session overview

Artificial Intelligence (AI) is in the news, developing quickly and can help fill gaps in Public Works staffing, level of service and budgets.

Learn how this cutting-edge technology can help Public Works be faster, better and more cost-effective.



# LEARNING OBJECTIVES

- \* Explain what Artificial Intelligence (AI) is.
- \* Discuss AI risks and rewards.
- \* Identify four Public Works services likely to benefit from AI technology. With examples.

# Introductions

## **Paul Wilhelm**

Engineering Resources Manager, City of Everett

## **Marley Kirkham**

Surface Water Specialist, City of Newcastle

## **Ryan Blaser**

APWA WA Technology Committee Member







# What is AI?

**Definition:** the theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

**Examples:** Natural Language Processing (NLP), Image Recognition, Recommendation Systems

Original AI generated image



# Four categories of AI

1. **Machine Learning**

Make decisions based on Data Sets.

2. **Deep Learning**

Bio-inspired AI structures.

3. **Generative AI**

ChatGPT and Large Language Models.

4. **Generative Design**

Create multiple options and optimize.



# Machine Learning

- Process: **Data Collection** → **Model Training** → **Prediction and Improvement** (repeat)
- Types: **Supervised Learning, Unsupervised Learning, Reinforcement Learning**
- Real World Applications: Healthcare, Finance, Agriculture



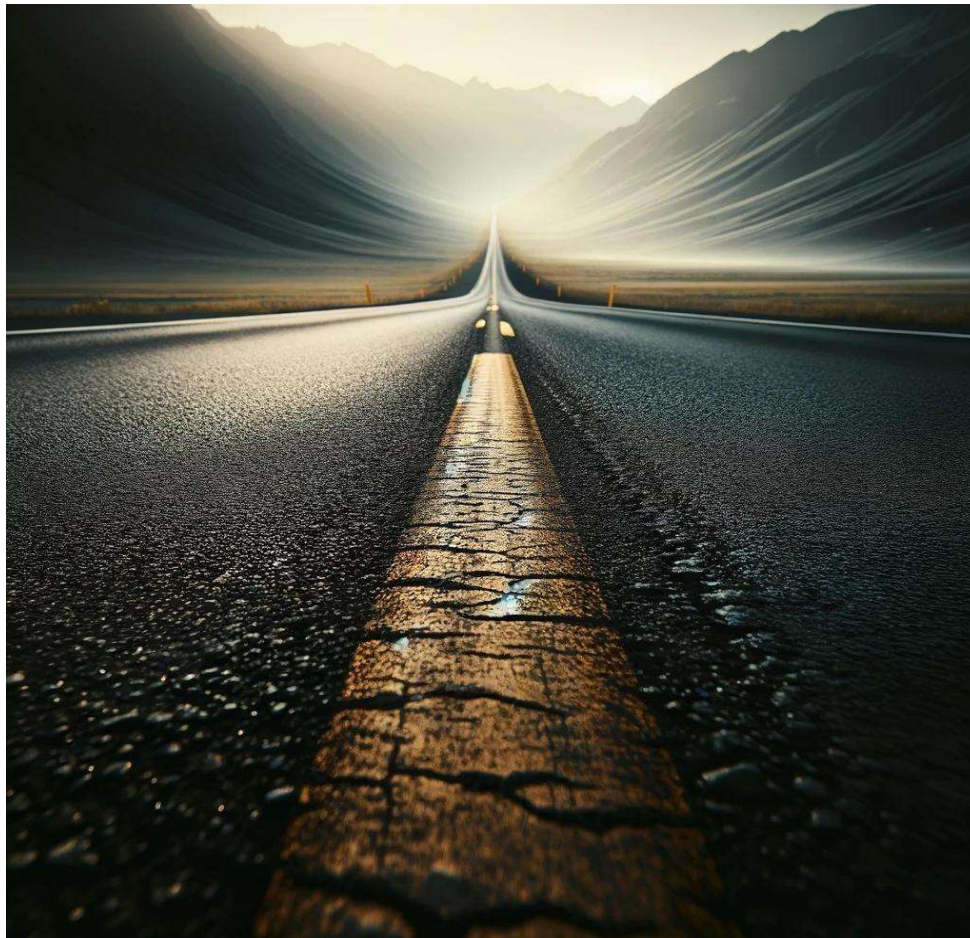


# Public Works Uses for **Machine Learning**

- Infrastructure Maintenance
- Risk Management: Flood Analysis
- Traffic Management
- Water Conservation



# Infrastructure Maintenance



Original AI generated image

# Risk Management: Flood Analysis



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# Traffic Management



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# Survey

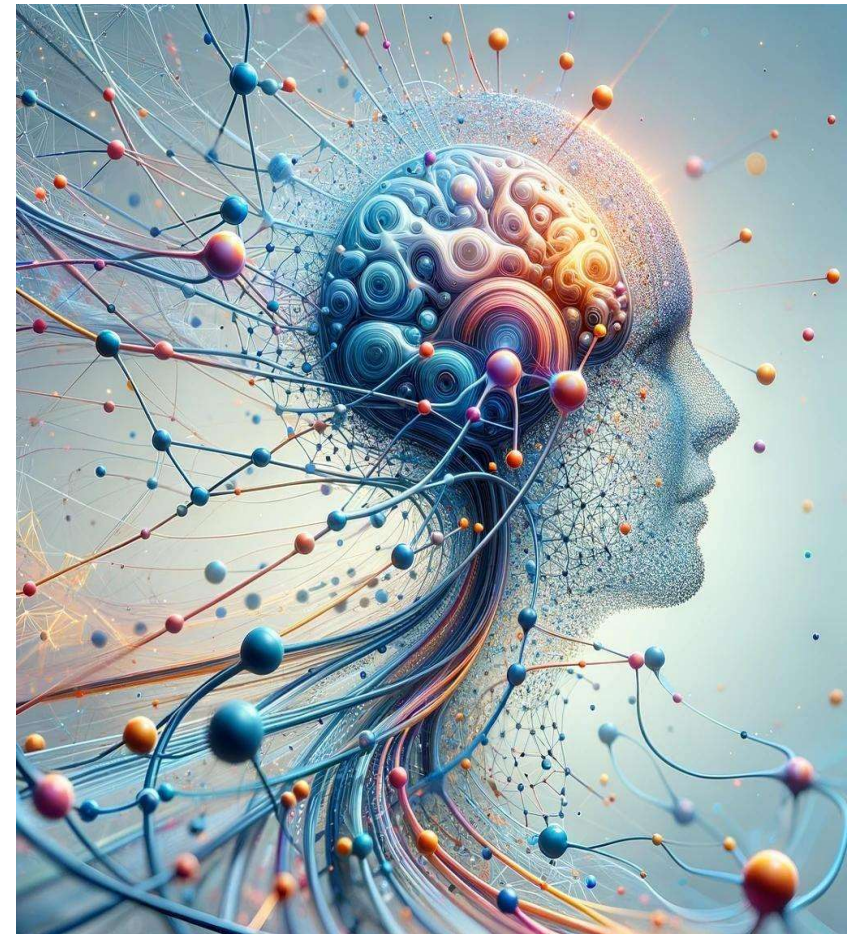
AI in Public Works





# Deep Learning

- Mimics the way humans gain and analyze certain types of knowledge
- Analyzes vast datasets much faster than we can, identifying trends, gaps, and opportunities.



Original AI generated image



# Public Works Uses for **Deep learning**

Uses algorithms to automatically learn insights and recognize patterns from data, to make increasingly better decisions.

- Grant Proposals
- Urban Planning and Development
- GIS
- Construction Management (Specs, submittals, Inspector reports)
- Estimating (auto recognition of objects)
- Jobsite safety and productivity



# Grant Proposals



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# Urban Planning and Development



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# GIS



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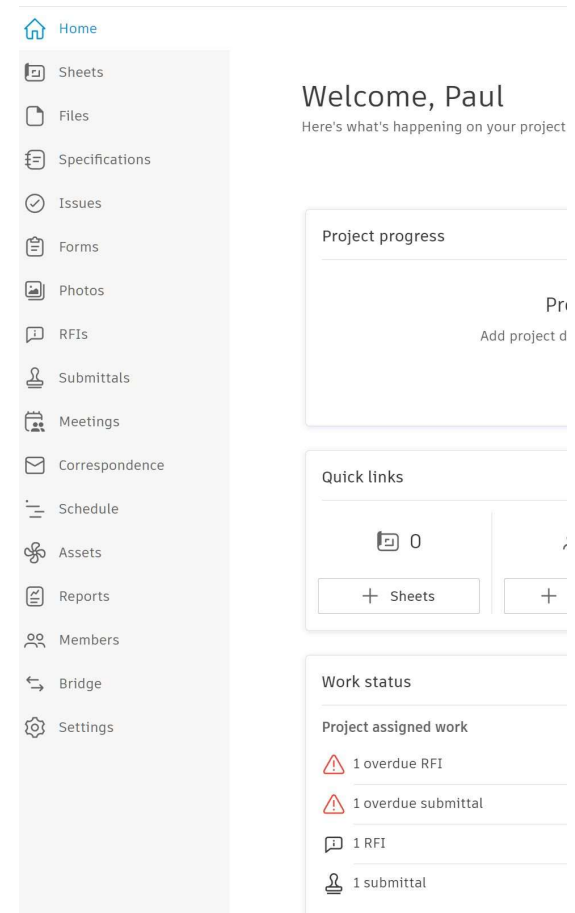


# Construction Management

Rules based security access with AI enhanced data management. Swiftly search the entire plans and specs along with all correspondence and resolutions.



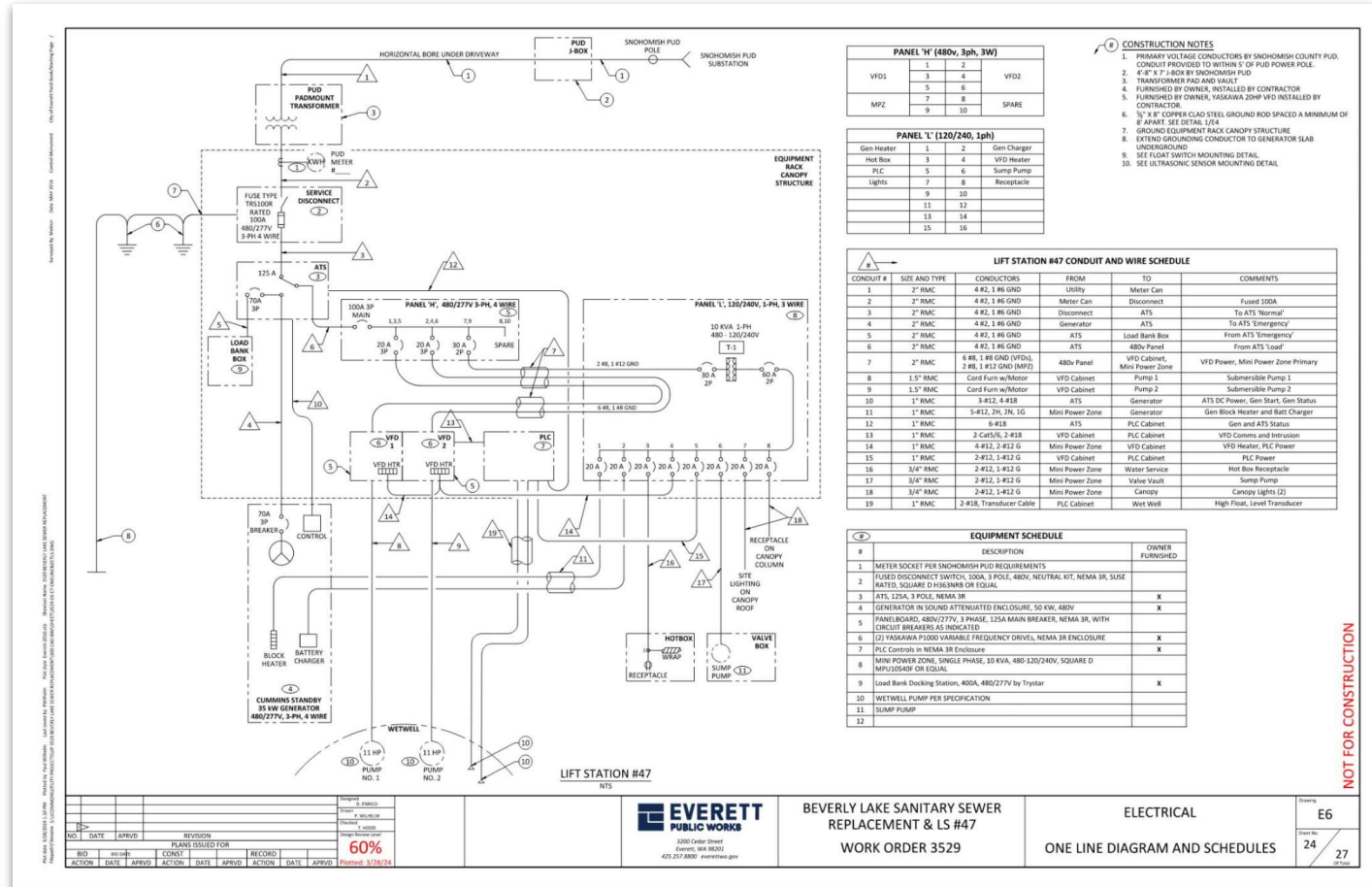
Autodesk Build



# AI Assisted Estimating

Graphically select an object and it will search the set to give you a count.

Autodesk Construction Cloud



NOT FOR CONSTRUCTION

NO.	DATE	APPROVED	REVISION

60%



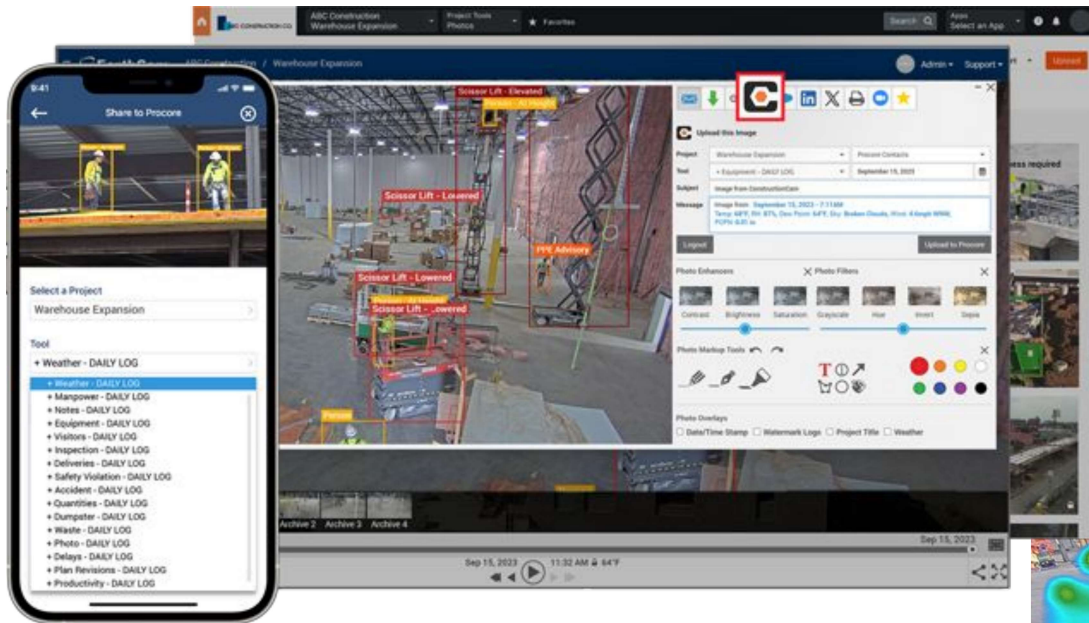
BEVERLY LAKE SANITARY SEWER REPLACEMENT & LS #47  
WORK ORDER 3529

ELECTRICAL  
ONE LINE DIAGRAM AND SCHEDULES

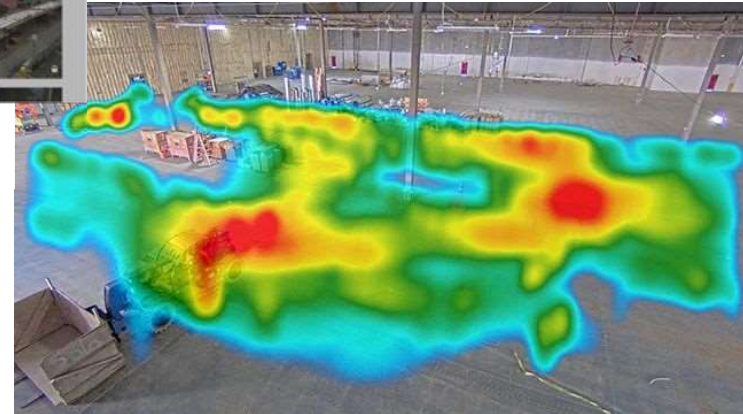
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27



# Jobsite Safety and Activity



Images courtesy of Earthcam



# Generative AI

- A broader concept that encompasses the use of AI algorithms and techniques.
- These are used to generate new content or data that is similar to existing data it has been trained on.
- It involves using machine learning and deep learning models to learn patterns and characteristics from a given dataset and then using that knowledge to create new, original content.



# Public Works Uses for **Generative AI**

Can be applied to various domains, including image generation, text generation, music generation, and more.

- Programming: GitHub Copilot (\$100/year individual, \$19 per user per month business)
  - verified
- Microsoft integrating their own Copilot into Windows 11.
  - Hopefully microsoft suite integration
- Always-on AI Assistant
  - Gemini for Google Workspace)



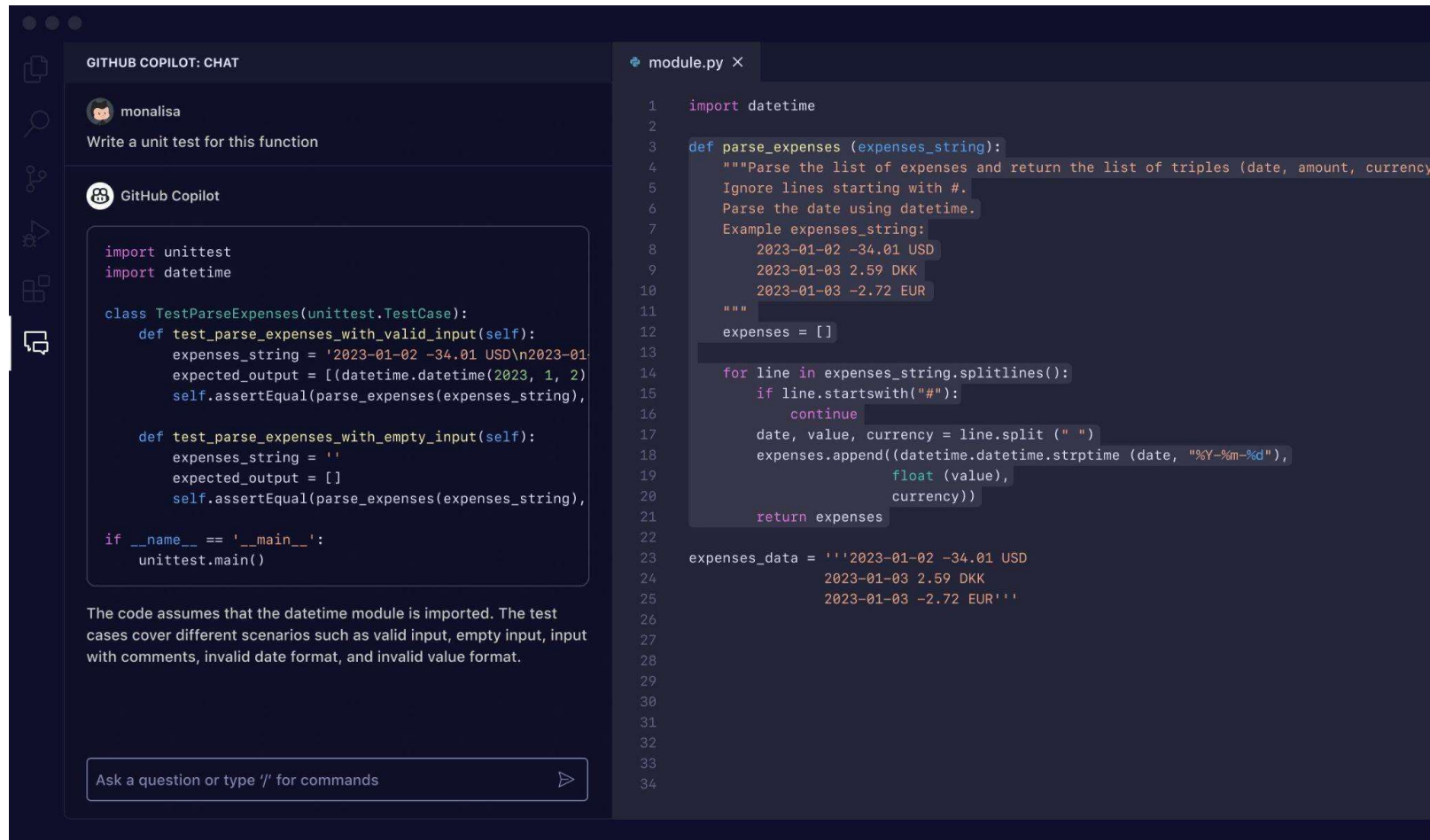
# Software Integration

The image shows a screenshot of the City of Newcastle website (www.newcastlewa.gov) with a Copilot AI chat interface overlaid on the right side. The website header includes the City of Newcastle logo and navigation links: City Hall, Departments, Your Community, Doing Business, and I Want To... A search bar is visible in the center of the main image. The Copilot chat interface is titled "Your everyday AI companion" and displays a query: "Where should I travel if I have pollen allergies?". Below the query, it offers suggestions like "Generate page summary" and "Compare latest iPhone vs Android features". The chat interface also shows a "Choose a conversation style" section with options: More Creative, More Balanced (selected), and More Precise. At the bottom of the chat, there is a text input field with the placeholder "Ask me anything..." and a character count "0/2000".



Image courtesy of City of Newcastle

# Programming Assistance



The screenshot displays the GitHub Copilot interface. On the left, a chat window titled "GITHUB COPILOT: CHAT" shows a conversation between a user (monalisa) and the AI. The user asks to "Write a unit test for this function". The AI responds with a Python code snippet for a unit test class named `TestParseExpenses`. The code includes imports for `unittest` and `datetime`, and defines two test methods: `test_parse_expenses_with_valid_input` and `test_parse_expenses_with_empty_input`. Below the code, a note states: "The code assumes that the datetime module is imported. The test cases cover different scenarios such as valid input, empty input, input with comments, invalid date format, and invalid value format." At the bottom of the chat window is a text input field with the placeholder "Ask a question or type '/' for commands" and a send button.

On the right, a code editor window titled "module.py" shows the implementation of the `parse_expenses` function. The function takes an `expenses_string` as input and returns a list of `expenses`. It includes a docstring with an example input string and a list of expected output tuples. The code uses `splitlines()` to process the input, skips lines starting with `#`, and uses `datetime.strptime` to parse the date and `float` to parse the value. The output list is populated with the parsed data.



Image from GitHub Copilot

# Prompt Engineering

- Prompt: Write an article about recycling
- Prompt Engineered Query: Pretend you are a public director who is trying to persuade the public to participate in their local recycling campaign.





# Generative Design

- Uses algorithms and computational methods to explore a wide range of design possibilities and generate optimized solutions based on given constraints and objectives.
- It involves using computational power to automate and enhance the design process.
- This allows for the exploration of design options that may not have been considered through traditional methods.
- Focuses on the design to generate innovative and optimized solutions.



# Public Works Uses for **Generative Design**

- Civil3D Grading Optimization
- Autodesk Forma
- Revit



# Autodesk - Civil3D Grading Optimization



The screenshot displays the Autodesk Civil3D Grading Optimization interface. On the left is a dark sidebar with a list of grading objects, each with a corresponding icon and a red number '1' next to the 'Reveal' option. The main workspace shows a 3D terrain model with a building footprint and a pond, overlaid with a color-coded surface. A vertical elevation scale on the right ranges from 1432.00 to 1484.00. A 'Grading Optimization' panel on the right contains several sections: 'Optimization' with a red '4' and a 'Violation View' section with radio buttons for 'Max slope violation', 'Min slope violation', 'Drain direction', 'Relaxed direction', and 'Multiple violations'; 'Convergence' with a status message 'More iterations needed to determine a solution' and a 'Feasibility' graph showing 'Proximity Measure' vs 'Iteration'; and a 'Workflow' section with numbered steps: '1. Review optimization options.' and '2. Vary object constraints.' At the bottom right, there are buttons for 'Optimize' and 'Send Optimized Result', with a red '6' next to the 'Optimize' button. A 'Help Center' panel with a red '5' is also visible on the far right.

Image from AutoDesk Civil3D Grading Optimization

# Autodesk: Revit Software

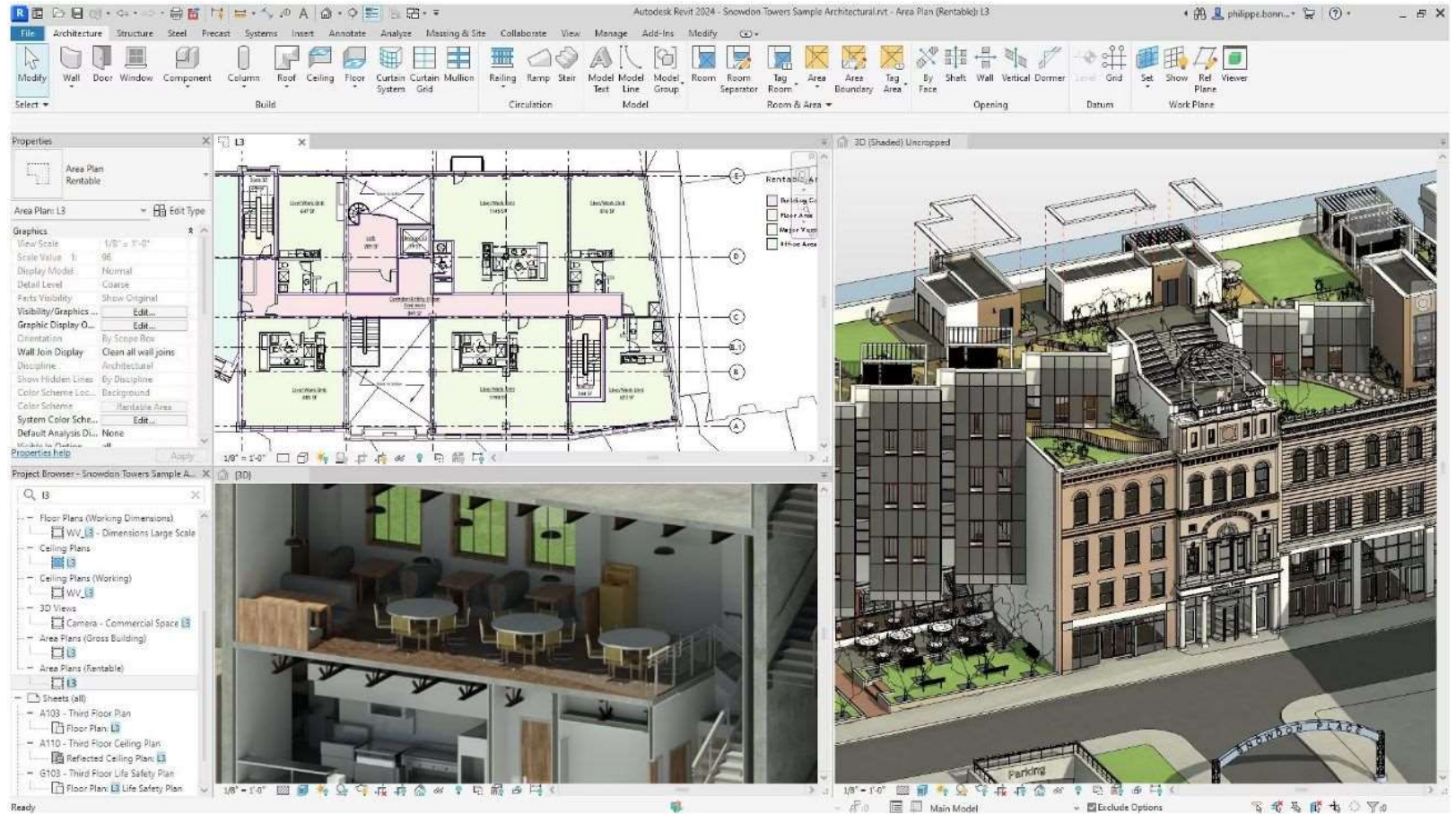


Image from Autodesk Revit



# Autodesk: Forma Software

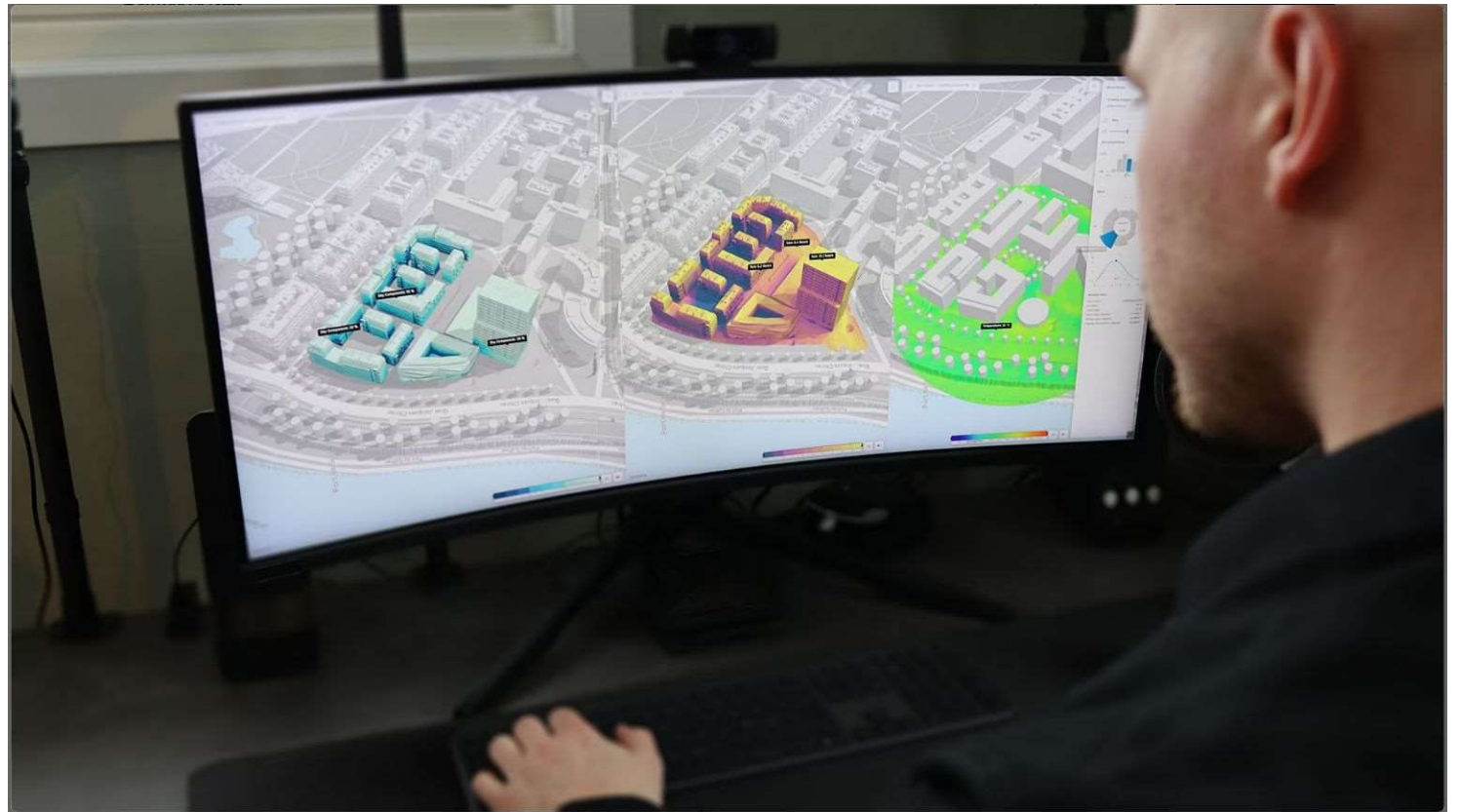


Image from Autodesk Forma - Analysis Comparison

# Using AI -Risks and Rewards

## Risks

1. Can require training to design the correct prompt.
2. Reliance on potentially inaccurate information
3. Can make up answers (lie).
4. Opensource! Security malware



## Rewards

1. Relatively easy to learn
2. Increase productivity
3. Can utilize large amounts of data. **Without getting tired**
4. Opensource! Lots of tool are free to use





# Trending APWA Technology Topics

- **Artificial Intelligence (AI)**
  - **Condition Assessment Data Collection**
  - **Use of AI in the workplace**
- **Availability of Centralized Community GIS Mapping Data**
- **Lead Service Line Identification**
- **Microgrids**
- **Sustainability Due to Severe Events—Improving Transportation Infrastructure**



# Survey

AI in Public Works



# Survey Responses

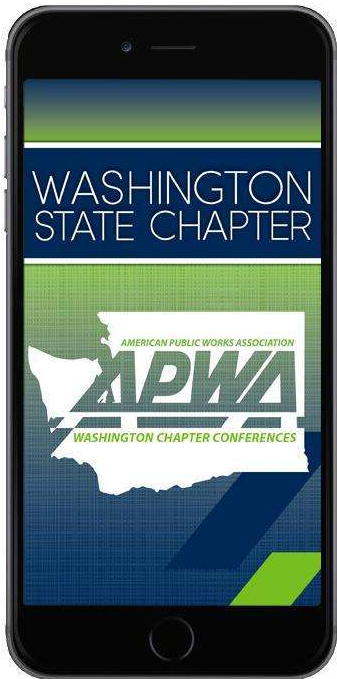


Original AI generated image





# Session Evaluation



Please take a few minutes to use the evaluation form on the mobile app and provide your feedback on this session!

Evaluations help us select sessions for future conferences and provide valuable feedback for conference planners & speakers.

Thank you!





*Thank You*

