

AI at PLS



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AI Progress

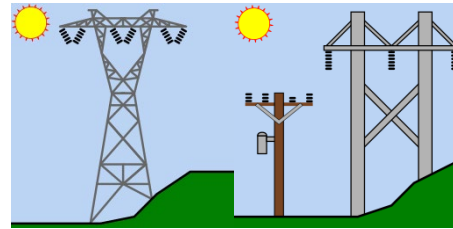
We are continuously monitoring developments in AI to evaluate how they may add value to PLS software.



PLS-GRID MCP Server

Shipping now in version 21.15

Model Context Protocol server that connects your AI to your PLS-GRID data.



PLS-POLE and TOWER MCP Server

Shipping soon in version 21.16

Model Context Protocol server that enables your AI to query your local structure models.



Project "RAGnarok"

Prototype (internal testing)

Retrieval Augmented Generation LLM that our solutions team is testing for immediate answers to PLS questions.

What is MCP?

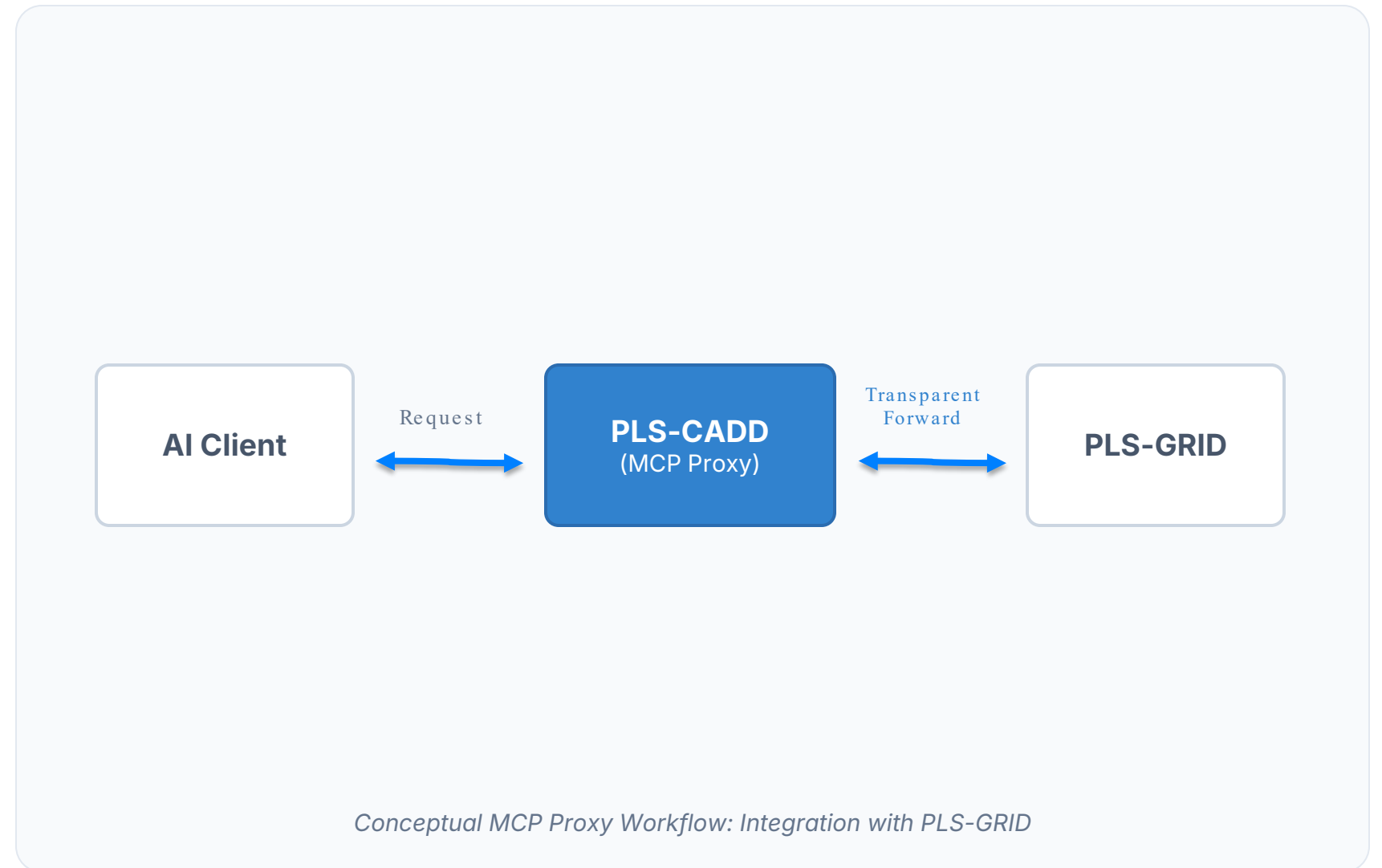
Model Context Protocol (MCP)

We added a Model Context Protocol (MCP) proxy server to PLS-CADD to bridge the gap between AI clients and PLS-GRID data.

This proxy server acts as a gateway that enables you to securely mine your grid data.

Key Functions

- Empower AI clients to access line information
- Enable you to extend the capabilities of PLS-GRID
- Allow natural language queries of grid data



Why? Natural language queries

```
> what is the name of the project kevin worked on north of madison?
```

← Prompt

- Kevin worked on two projects north of Madison:

Project	Max Lat	Center Location
wpl_demo.don	43.74°N	~43.72°N, 87.85°W (Sheboygan area, NE of Madison)
da Line Shack - 69kV.don	46.79°N	~46.77°N, 88.58°W (far northern WI/UP Michigan border)

The most likely candidate for "north of Madison" is **wpl_demo.don** - it's a Wisconsin Power & Light project centered near Sheboygan, roughly 120 miles northeast of Madison. The **da Line Shack - 69kV.don** is much farther north (~300 miles).

```
C:\projects
```

```
> |
```

```
/ commands · ? help
```

```
Claude Sonnet 4.6
```

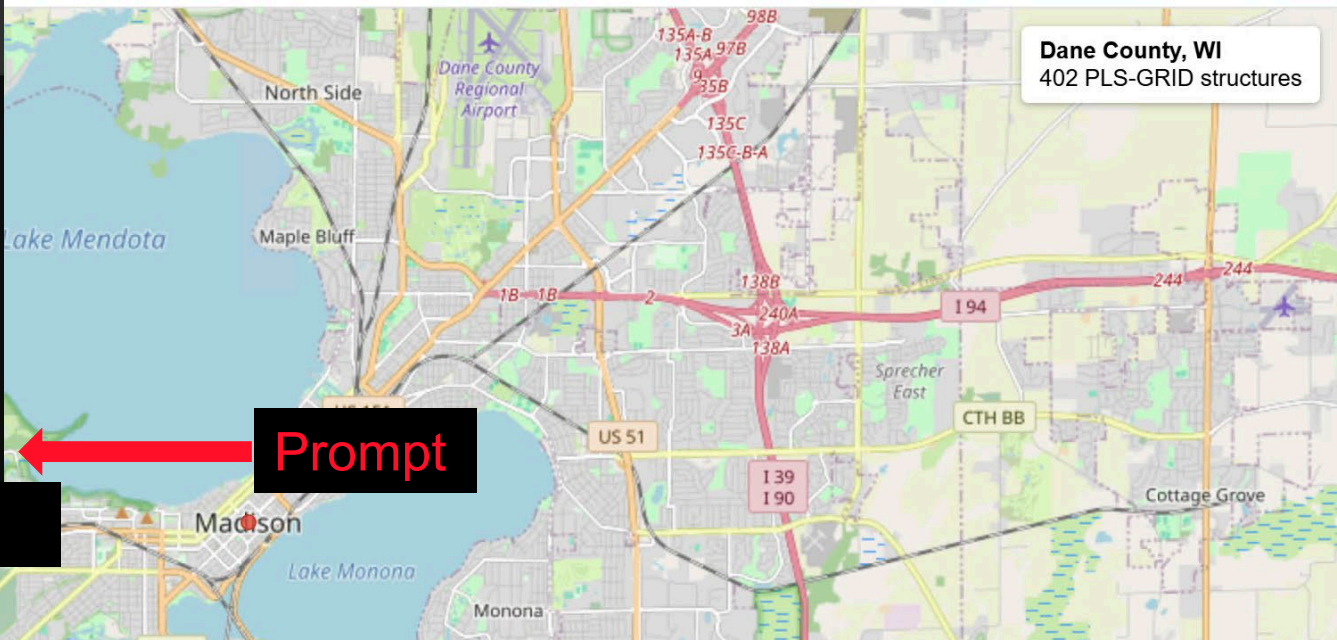
Generate Dane County Struct...

Copilot v1.0.60 uses AI. Check for mistakes.

- Tip: /feedback
 - Provide feedback about the CLI

generate a map of all structures in pls-grid that are in Dane County, WI

get_all_structures (MCP: PLS-GRID) ← MCP PLS-GRID query



Done. I generated an interactive map of all 402 PLS-GRID structures located in Dane County, WI and opened it in your browser.

Map: ...session-state...files\dane_county_structures.html

Details:

- Filtered all structures by Dane County's bounding box (lat 42.84-43.29°N, lon -89.84 to -89.00°W), converting the stored radian coordinates to degrees.
- Each structure is a clickable red marker showing its name, project CPID, structure file, height, and max usage.
- Built with Leaflet over OpenStreetMap tiles; the view auto-fits to the structures.

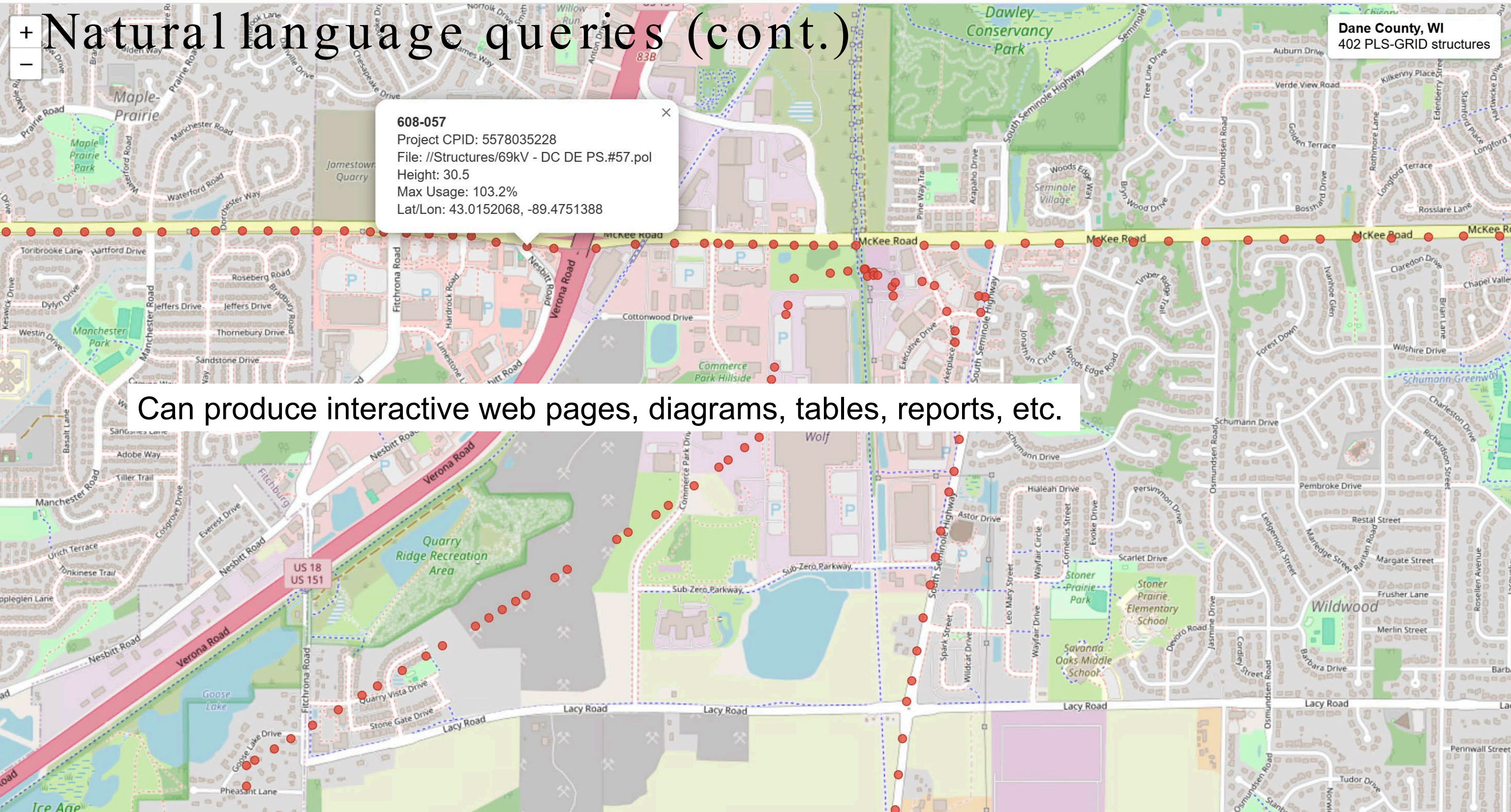
Note: the bounds are a rectangular box approximating Dane County, so a few points near the edges could fall just outside the actual county line. Want me to clip to the precise county polygon instead?



Natural language queries (cont.)

608-057
Project CPID: 5578035228
File: //Structures/69kV - DC DE PS.#57.pol
Height: 30.5
Max Usage: 103.2%
Lat/Lon: 43.0152068, -89.4751388

Can produce interactive web pages, diagrams, tables, reports, etc.



Natural language queries (cont.)

> were these structures designed with consistent criteria?

Prompt

• No – the structures were not designed with fully consistent criteria. Here's the summary across the 9 accessible projects covering 402 structures:

Key Inconsistencies

Issue	Detail
NESC Safety Grade	Most lines use Grade B (2.0× longitudinal safety factor), but the <i>Verona Supplemental Example Line</i> uses Grade C (4.0× – much more conservative)
Rule 261A High Wind	Only applied on <i>McKee Road Line</i> ; not used on other 69 kV lines nearby
Unanalyzed projects	5 of 9 projects show no load case results at all – structures may never have been formally checked against a design standard
Coordinate System	One project (<i>Verona</i>) uses a custom Dane County CRS; all others use NAD83 Wisconsin South
ROW Width	Ranges from 30 ft to 100 ft – inconsistent even at the same voltage level

What Is Consistent

- All projects reference NESC Rules 250B/C (Heavy loading district – appropriate for Wisconsin)
- All checked projects are modeled as "As-Built"
- Most use NAD83 Wisconsin South coordinates

Caveats

- Load case files (.lca) are external and weren't compared directly – the Grade/Rule conclusions are inferred from the load case names attached to structure max-usage results
- Some projects (McK-SSS, McKee to Epic, Optimization demo) may have load cases that simply haven't been run yet in the server context

Would you like me to drill into any specific project or update the map to color-code structures by NESC Grade?

Natural language queries (cont.)

```
> What is the heaviest and lightest structures on the Mckee line ← Prompt
```

- The McKee Road Line is CPID 5578035228 – I already have its project JSON cached.

Natural language queries (cont.)

• Here are the results for the McKee Road Line (69 kV):

🍃 Lightest

Structure 608-006 (tie with an undefined structure at sta. 1660 ft)

- 2,086 lb (946 kg)
- Type: 69kV - DC Tan, Braced Post PS.#7.pol - a lightly loaded tangent pole

⚙️ Heaviest

Structure 608-060

- 31,697 lb (14,378 kg)
- Type: 69kV - DC DE PS.#60.pol - a dead-end pole at sta. 5016 ft
- Location: 43.01525, -89.47065

Summary

	Structure	Weight	Type
Lightest	608-006	2,086 lb / 946 kg	Tangent braced-post
Heaviest	608-060	31,697 lb / 14,378 kg	Dead-end

The ~15× weight difference is expected - dead-end structures anchor the conductor tensions longitudinally, requiring much heavier hardware and framing than simple tangent poles.

Natural language queries (cont.)

> which structure is closest to a tavern?

Prompt

- The winner is Structure #31 – only 28 m (93 ft) from the Seminole Tap 🍺

	Detail
Structure	#31 – Structures\M1M2\substation
Project	Seminole Hwy Electric Park-McKee Road Sub 24kV (CPID 4364981372)
Location	43.013695, -89.456334
Tavern	<u>Seminole Tap</u> (pub)
Distance	~28 m / 93 ft

Makes sense – a substation right next to a bar named after the same road. Structures #29, #30, and #4 from the same 24 kV line also cluster near the Seminole Tap (155–319 ft away). The second-closest *different* tavern is Monkeyshines Bar & Grill at 62 m from a 69 kV dead-end structure on the McKee Road Line.

How Does It Work?

01

Enable MCP

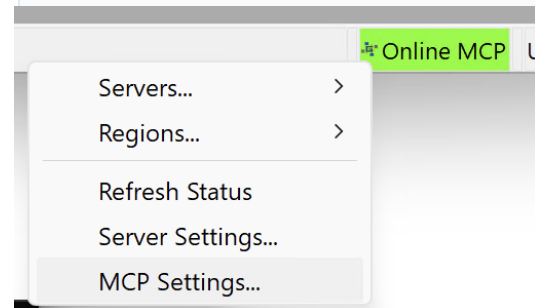
PLS-GRID administrator enables Model Context Protocol on your server.

```
{  
  "CoordinateSystem": "'nad83' '4803'  
  "McpEnabled": true,
```

02

Configure PLS-CADD Proxy

Right-click on the **PLS-GRID status pane** in PLS-CADD to configure.



03

Connect Client

Run your AI client (e.g., GitHub Copilot or Google Gemini) and add the MCP server.

```
> /mcp add PLS-GRID  
@ files · # issues Claude Sonnet 4.6
```

04

Query Data

Start asking questions about your line data using natural language.

*"Securely connect your AI to **your** overhead line data in PLS-GRID."*

How Doesn't It Work?

Private & Secure

The Model Context Protocol (MCP) implementation is designed with your data security as the top priority.



We do not send your data across the Internet.



Your data is not shared. We never see it.



You are not locked into our AI client.

MCP establishes a localized, secure bridge between your AI tools and your data. Control remains entirely within your environment, adhering to your existing data governance and security protocols.

Security First

Vulnerable Model (Direct Access)

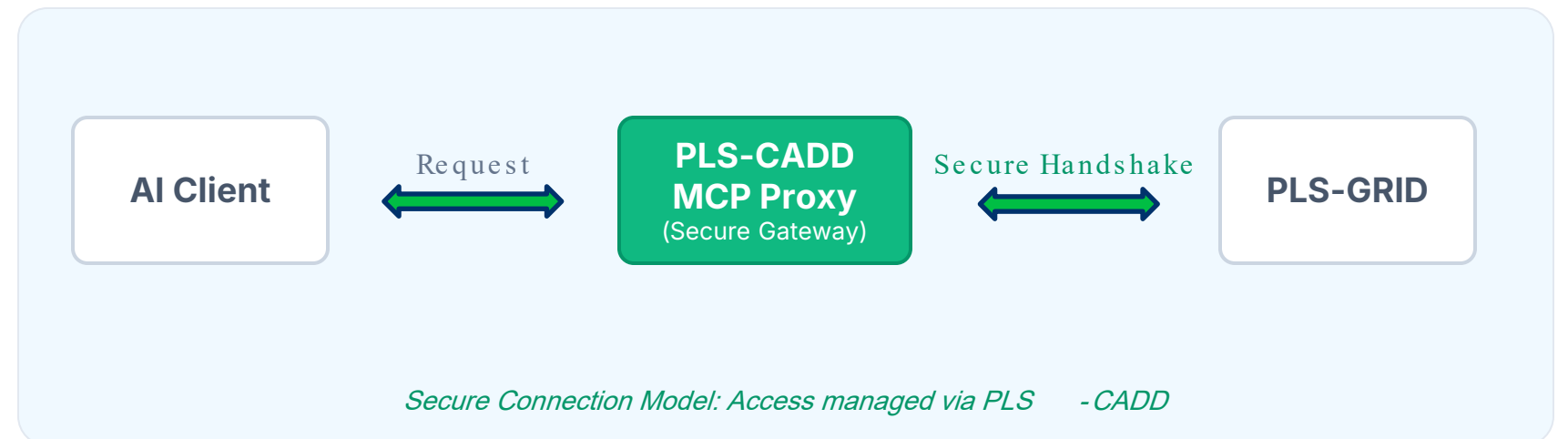
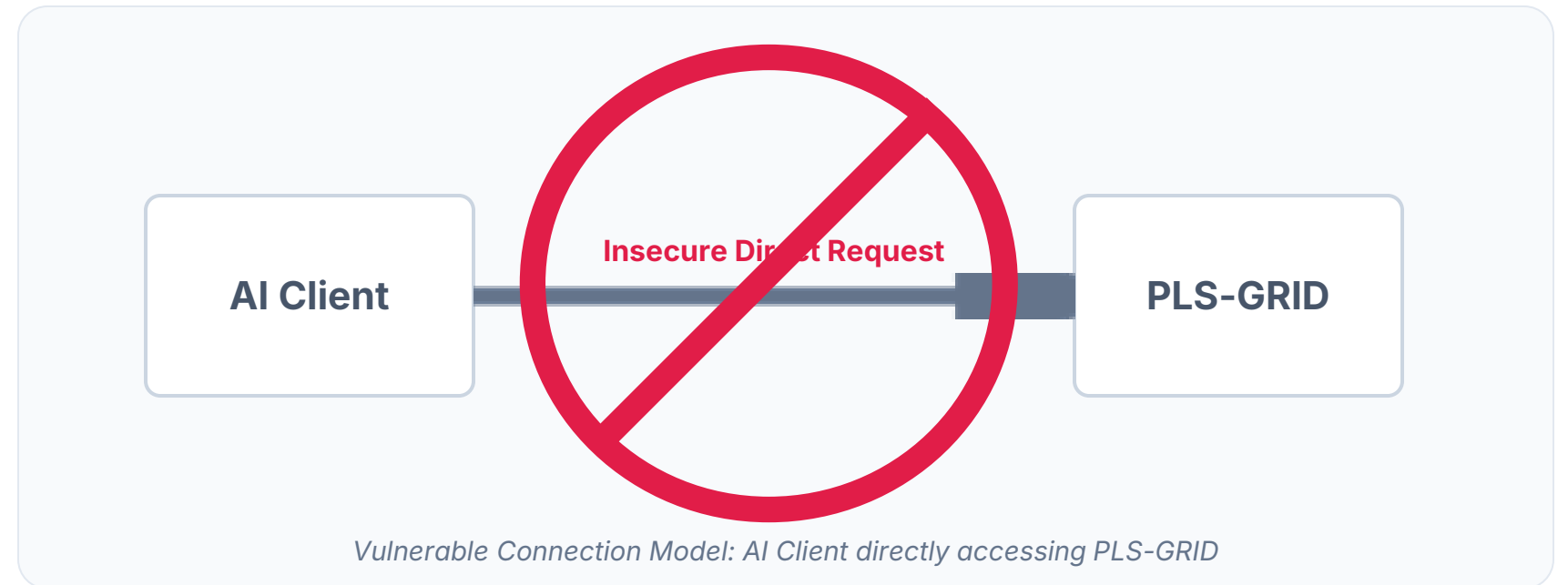
AI network connection to PLS-GRID would pose a significant security risk as MCP acts as a direct conduit. MCP does not provide for fine-grained Access Control Lists (ACLs).

Secure Model (Access by PLS -CADD Proxy)

Instead, the AI client makes requests via PLS-CADD so that the built-in, tested security of the PLS-CADD to PLS-GRID interface is used.

Secure by Design

- MCP server disabled by default
- All MCP tools are read-only
- MCP tools run in the context of the PLS-CADD user and are thus limited to the access that user has
- Uses **your** AI client subject to your data governance policies



What Would You Like To Know?

MCP gives your AI client access to any information in **PLS-GRID** that you could get with PLS-CADD.

Write custom reports, run complex queries, your imagination is the only limit of what you can do with your data.

Please share what you choose to do. **Your feedback will guide future development!**



Custom Reports



Complex Queries



Infinite Possibilities

PLS-POLE and TOWER MCP servers

Model Context Protocol (MCP)

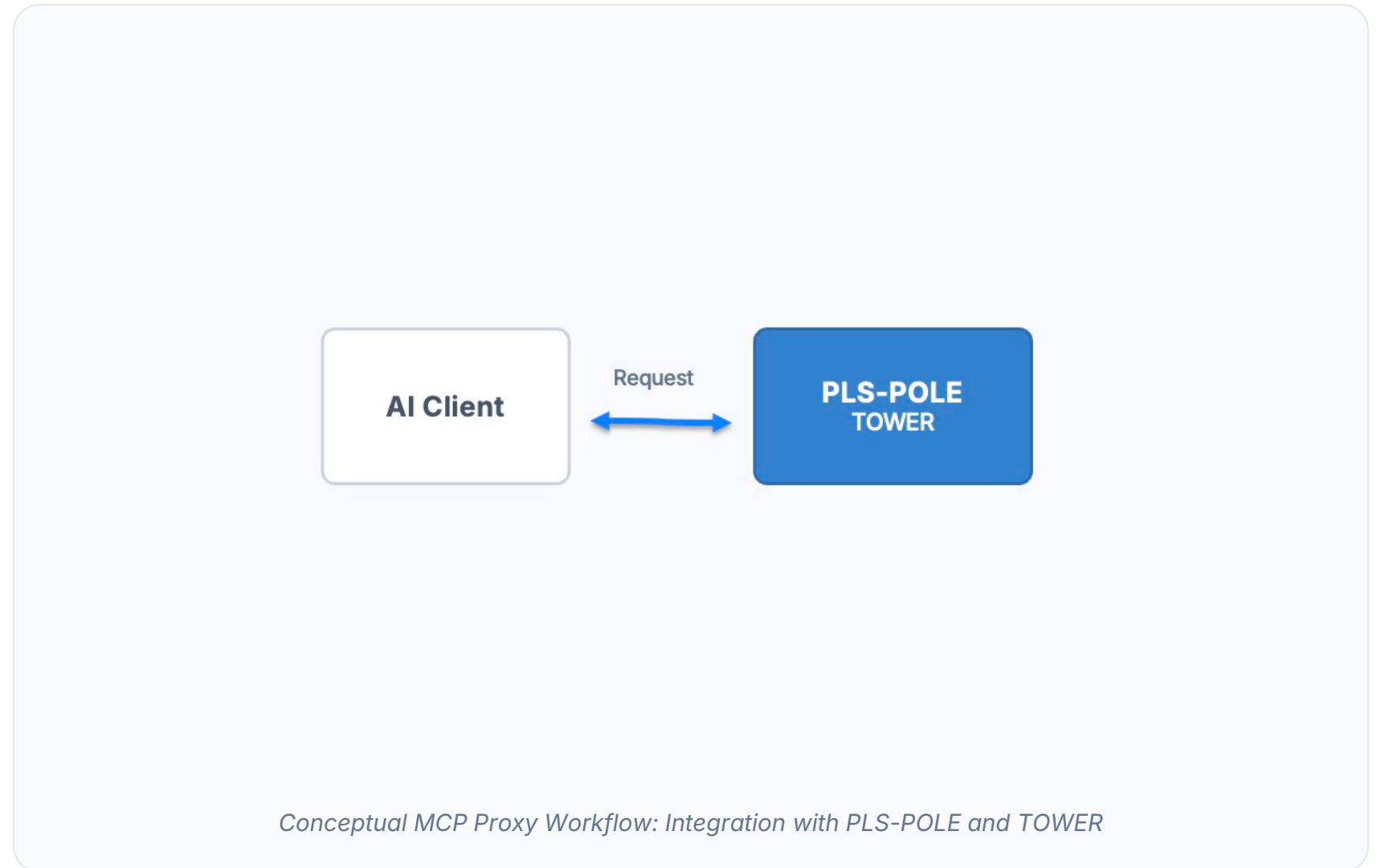
Connects AI client to PLS-POLE and TOWER.
The MCP server transparently runs inside PLS-POLE and TOWER on your desktop.

Read-only as we explore the possibilities and dangers inherent in allowing AI manipulation of structure models.

Key Functions

- Open a model
- Check models
- Run an Analysis and return reports
- Generate raster or vector images

What would you like it to do?



PLS-POLE and TOWER MCP examples

```
Copilot v1.0.60 uses AI.  
Check for mistakes.
```

- Tip: /help
 ↳ Show help for interactive commands
- Folder C:\support_workspace\McKee Road Line has been added to trusted folders.

```
> find the .pol files in this project
```

← Prompt

- Search (glob)
 ↳ "**/*.pol"
 ↳ 22 files found
- Found 21 .pol files, all located in the .\Structures\ folder:
 - tu-1.pol
 - 69kV - DC DE PS.pol (+ variants #9-#60)
 - 69kV - DC Tan, Braced Post PS.pol (+ variants #7-#63)
 - 69kV - DC Tan, Braced Post, Wood PS.pol (+ variants #50, #66)
 - 69kV - DC Tan, Braced Post PS_2.pol
 - DC Tan-2part insulators.pol (+ variant #60)
 - mouse_ears.pol

PLS-POLE and TOWER MCP examples (cont.)

```
> export a DXF file of the non "69kV*" structures to @C:\support_workspace\McKee Road Line\DXF
```

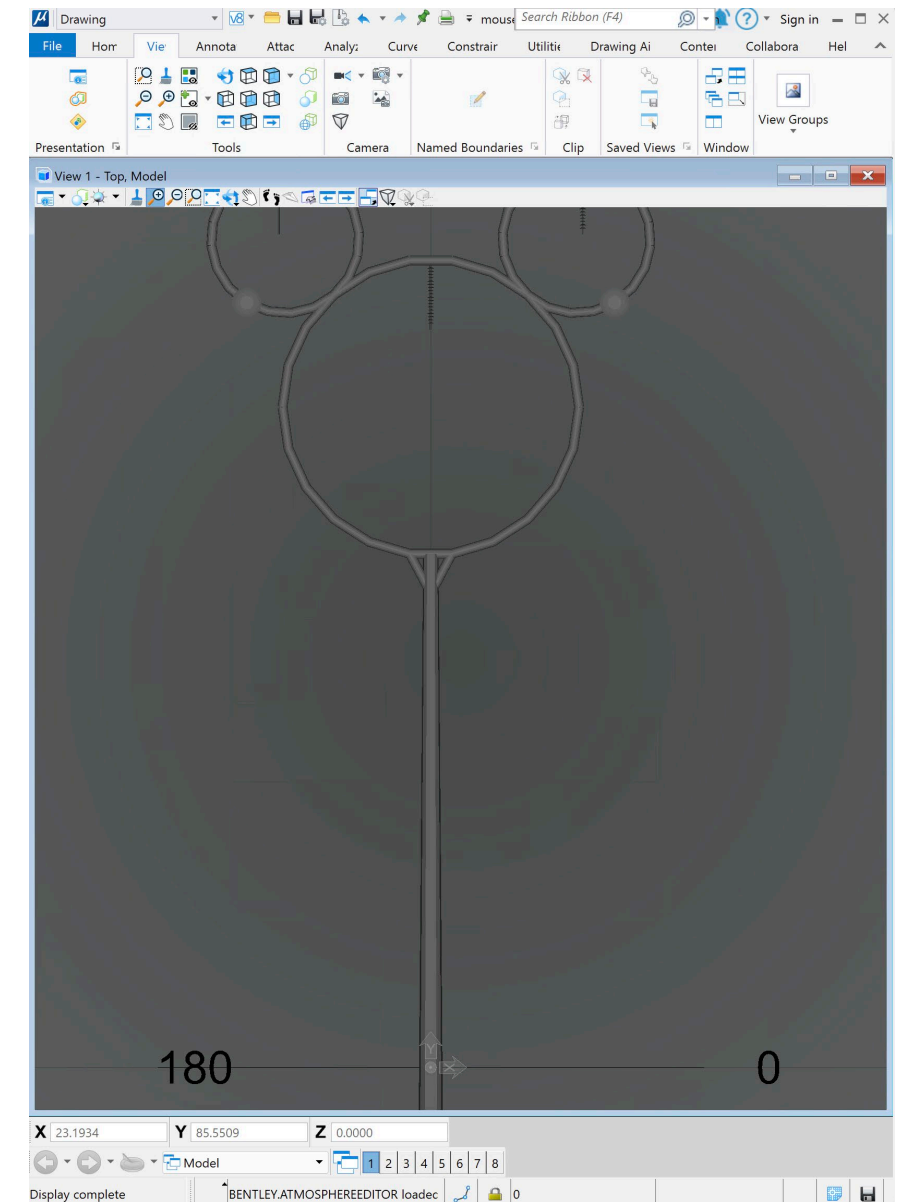
• The non-69kV* files are:

1. tu-1.pol
2. DC Tan-2part insulators.pol
3. DC Tan-2part insulators.#60.pol
4. mouse_ears.pol

• All 4 DXF files exported to C:\support_workspace\McKee Road Line\DXF\:

Source .pol	Output .dxf
tu-1.pol	tu-1.dxf
DC Tan-2part insulators.pol	DC Tan-2part insulators.dxf
DC Tan-2part insulators.#60.pol	DC Tan-2part insulators.#60.dxf
mouse_ears.pol	mouse_ears.dxf

← Prompt



PLS-POLE and TOWER MCP examples (cont.)

> analyze these pol files and make a table showing the maximum usage element and insulator along with other info that may be helpful. sort this table by usage

← Prompt

• I'll analyze all files that have load cases defined (12 models). The others (DC DE PS, tu-1, mouse_ears, DC Tan-2part insulators.#60) have 0 load cases and can't be analyzed.

Let me work through them sequentially.

• Here are the analysis results for all 12 analyzable models, sorted by element usage:

File	Max Element Usage	Element	Governing Load Case	Max Insulator Usage	Insulator	Governing Load Case
DC Tan, Braced Post PS.#7	● 179.17% NG	sp (Steel Pole)	250B Grade B NA+	10.43%	p8 (Post)	250D Grade B NA+
DC Tan, Braced Post, Wood PS	● 126.83% NG	sp (Wood Pole)	250B Grade B NA-	7.25%	p10 (Post)	250D Grade B NA-
DC Tan-2part insulators	● 92.25%	sp (Steel Pole)	250B Grade B NA-	14.70%	d1-B (2-Parts)	250B Grade B NA-

DC Tan, Braced Post PS.#63	● 41.70%	sp (Steel Pole)	250B Grade B NA+	21.08%	sw2 (Suspension)	250B Grade B NA+
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Key findings:

- ⚠ #7 (179%) and Wood PS base (127%) have overstressed poles - NG failures
- ⚠ #62 has a critical insulator failure at 200% on post p5 under Uplift
- All structures fail on the main pole element sp; governing load case is almost universally Rule 250B Grade B
- 7 models had no load cases and couldn't be analyzed (DC DE PS family, tu-1, mouse_ears, DC Tan-2part.#60)

BENTLEY
STUDIOS

PLS

RAGNAROK



RAGnarok example

How do I create a .wir file? I have some points on a curve, but no polynomials.

Subject Re: How do I create a .wir file?

Body Text Variable Width 

The following answer was generated using a stochastic AI and may contain inaccuracies. It must be independently verified before relying on it for engineering. Use this response at your own risk.

Dear Customer,

Thank you for contacting Power Line Systems Technical Support.

You are asking how to create a .wir file, which is the file extension for a cable file in PLS-CADD, when you have stress-elongation data points but not the polynomial coefficients.

PLS-CADD is designed to handle this scenario. You can input your stress-elongation and creep-elongation test data directly, and the software will automatically fit the necessary polynomial coefficients for you.

To do this, please follow these steps:

1. Navigate to **Sections/Cable Files/Create or Edit Cable File**.
2. Within this dialog, you will find options to input your experimental stress-elongation and creep-elongation data points. PLS-CADD will then automatically derive the fourth-degree polynomial coefficients (k0 through k4) that describe the cable's initial and creep behaviors.

For more detailed information on inputting test data and the underlying mechanical model, please refer to Appendix G.1, "Stress-elongation and Creep-elongation Coefficients from Test Data," in the PLS-CADD manual. Sections 9.1.1 and 9.1.2 also provide further context on the initial and final (after creep) mechanical models.

As a general best practice, we always recommend creating a project backup using **File/Backup** before making significant modifications to your project data.

RAGnarok another example

I have a "Potentially Damaging Moment" warning. Can this warning be ignored? Can I get further guidance on how to interpret this warning, and how to eliminate it? |

Subject Re: Potentially Damaging Moment warning

Body Text Variable Width 

The following answer was generated using a stochastic AI and may contain inaccuracies. It must be independently verified before relying on it for engineering. Use this response at your own risk.

Dear Customer,

Thank you for reaching out to PLS Technical Support regarding the "Potentially Damaging Moment" warning in TOWER.

Regarding your questions:

1. Can this warning be ignored? How to interpret it?

The "Potentially Damaging Moment" warning issued by TOWER should not be ignored without review. TOWER does not perform any moment check on the members for design purposes. The moments determined by TOWER are based on an arbitrary member orientation and, as such, may be inappropriate for direct design stress calculations. However, these warnings serve as a crucial means of detecting possible gross modeling errors within your structure.

The warning appears if the "Approximate Moment Use" (calculated as Resultant Moment / (S x Fy), where 'S' is the section modulus from the Angle Properties Table or an estimated value if blank) exceeds 100 percent. Whether a specific instance of this warning indicates a significant issue is ultimately a matter of your engineering judgment. If you deem the value substantial, further investigation and analysis outside the program may be warranted.

Project “RAGnarok”

Bringing the apocalypse to your PLS questions

This supplements support@powline.com, not replaces it. You can still count on the personalized support you are accustomed to.

Ask a question related to PLS software and it provides an answer based on PLS manuals, technical notes, and a database of support team answers. All answers start with:

The following answer was generated using a stochastic AI and may contain inaccuracies. It must be independently verified before relying on it for engineering. Use this response at your own risk.

Why give you an answer that we must warn you may be inaccurate?

- Immediacy: especially if your working hours don't intersect ours
- Head start on where to look for an authoritative answer

Based on an LLM

RAGnarok is a Retrieval Augmented Generation (RAG) enabled Large Language Model (LLM), not a simple connector like an MCP server.

Retrieval Augmented Generation is a technique that analyzes your question and selects relevant documents from our knowledge base to supply context to the LLM.

Domain specific knowledge reduces the odds of hallucinations and typically results in more useful answers.

Note the words “reduces the odds” and “typically”, this is still a probabilistic system.

If this was in the Help menu of PLS-CADD/PLS-POLE/TOWER, would you use it?

Deterministic vs. Stochastic

Deterministic (Traditional Code)

Think of ASCE 10. Given the force in an angle member, you can compute one exact, repeatable answer for member usage. Given the same force and the same angle, ASCE 10 will always give you the same answer.

Our software is deterministic and our MCP servers are deterministic. Make a query twice and you will get the same answer twice. What your AI does with the results returned from our MCP servers is likely non-deterministic.

Stochastic (LLM)

Think of pouring concrete. Even if you use the exact same mix design recipe, the slump, air content, and 28-day compressive strength will vary slightly from batch to batch due to environmental factors, aggregate distribution, and mixing dynamics.

“RAGnarok” is not deterministic.

Non-deterministic systems are problematic for engineering. This is why you don't see a lot of LLM powered design features.

Non-deterministic systems tend to make us (engineers) intensely uncomfortable.

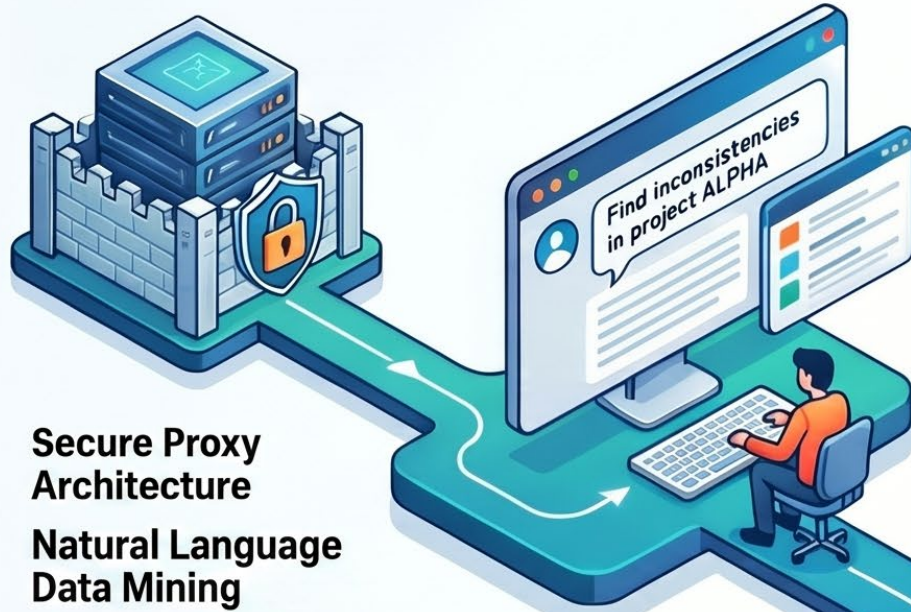
What do you want AI in PLS software to do for you?

AI at PLS: Bridging the Gap Between Intelligence and the Grid

The MCP Secure Gateway



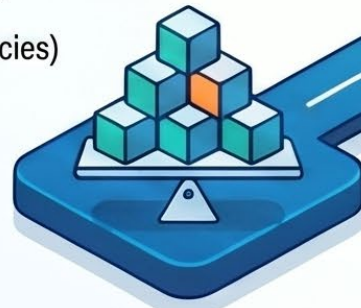
Project "RAGnarok" Support



Secure Proxy Architecture

Natural Language Data Mining

Enables engineers to query complex grid data (e.g., finding specific projects, identifying inconsistencies) using plain English.



Deterministic Results

Server is deterministic; identical queries always return the same, repeatable engineering data.



Immediate Technical Assistance

Prototype LLM trained on PLS manuals provides instant answers to software questions.



PLS Manuals & Support Databases



Context-Aware (RAG) Technology

Uses Retrieval Augmented Generation to supply domain-specific context, significantly reducing AI "hallucinations".



Stochastic Nature

As a probabilistic system, results require independent verification before being used for engineering design.

Feature	MCP Server (Data Connection)	Project RAGnarok (Support LLM)
Logic Type	Deterministic (Repeatable)	Stochastic (Probabilistic)
Primary Use	Querying Grid/Line Data	Technical Support & Manuals
Status	Shipping now in v21.15	Prototype Testing

MCP Details

- Context requirements are minimal

```
MCP Servers
Token counts contribute to /context MCP Tools.

> ✓ PLS-GRID      http 2.4k tokens, OAuth: needs authentication http://127.0.0.1:5010/mcp
  ✓ TOWER         http 1.7k tokens, OAuth: needs authentication http://127.0.0.1:5012/mcp
  ✓ PLS-POLE      http 1.8k tokens, OAuth: needs authentication http://127.0.0.1:5011/mcp
```

- Tested with Microsoft Copilot, Google Gemini, Anthropic Claude

erik@bifrostservices.net

