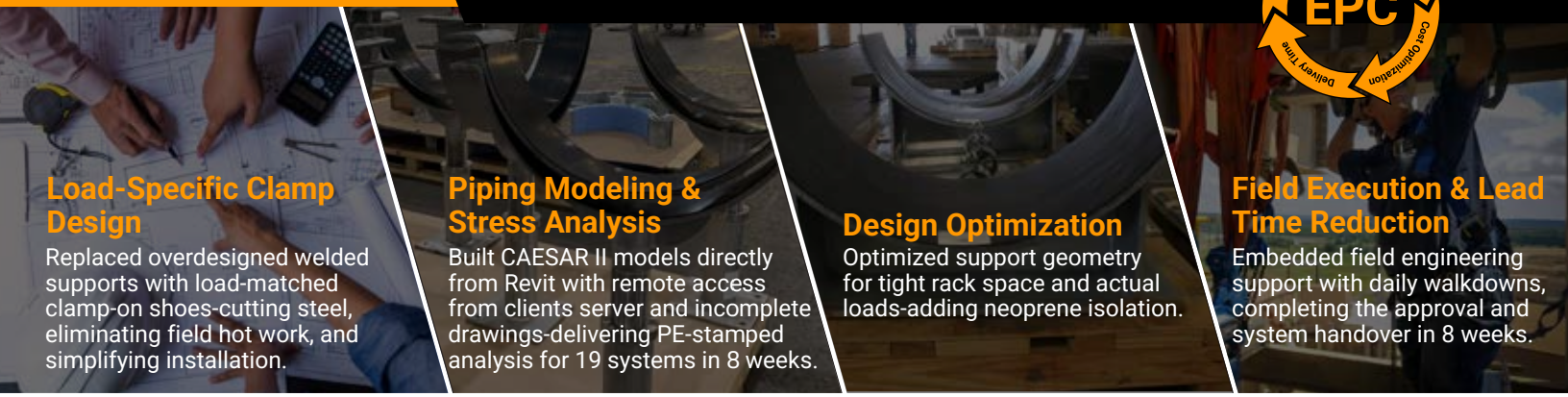
PIPING TECHNOLOGY & PRODUCTS

Semiconductor Case Study



Load-Specific Clamp Design

Replaced overdesigned welded supports with load-matched clamp-on shoes-cutting steel, eliminating field hot work, and simplifying installation.

Piping Modeling & Stress Analysis

Built CAESAR II models directly from Revit with remote access from clients server and incomplete drawings-delivering PE-stamped analysis for 19 systems in 8 weeks.

Design Optimization

Optimized support geometry for tight rack space and actual loads-adding neoprene isolation.

Field Execution & Lead Time Reduction

Embedded field engineering support with daily walkdowns, completing the approval and system handover in 8 weeks.

How Piping Technology Cut Material Costs and Lead Times for $40+ Billion Semiconductor Plant

Background

A $40B+ semiconductor fabrication facility required engineered pipe support solutions for large-bore piping systems (NPS 20”–64”). Early in the execution stage, pipe support design and procurement became a critical path constraint for the project.

Piping Technology & Products (PT&P) was engaged to provide integrated engineering support, including pipe stress analysis (PSA), support redesign, constructability improvements, quicker delivery & reduced cost and later on, for plant walkdowns for faster approval and system hand-over.

Problem Definition

The project faced a combination of design, cost, and schedule challenges that prevented forward progress.

- **Overspecification drove unnecessary cost**
  Pipe supports were designed well above actual operating loads (3–60 kips), increasing steel weight, field weld volume, and fabrication time.

- **Design uncertainty stalled execution**
  Incomplete models, missing node data, and inconsistent drawings left the contractor unable to confidently proceed with support selection or procurement.

- **Dependence on stress validation created a bottleneck**
  Without validated pipe stress analysis, support loads and configurations could not be finalized across multiple systems.

- **Field installation delays became a critical risk**
  Long lead times (14–20 weeks) combined with unresolved design issues directly threatened installation sequencing and overall project schedule.

A deferred submittal was approved to enable re-engineering of **19 systems** based on validated load conditions.

PROJECT SNAPSHOT

PROJECT:

Advanced Semiconductor Fabrication Facility ($40B+ Capital Project)

SCOPE OF WORK:

- Design and supply of 15,000+ pipe supports.
- Pipe sizes ranging from NPS 20” to NPS 64”.
- Pipe stress analysis (ASME B31-compliant) across 19 piping systems.
- Integration of support design with structural steel and pipe rack constraints.

ENGINEERING CHALLENGES:

- Extended procurement lead times (14-20 weeks) impacting construction schedule.
- Incomplete design inputs (missing node data, inconsistent documentation).
- Fragmented, module-based engineering approach increasing risk of misalignment.

TECHNICAL APPROACH:

- Designed load-specific clamp-on supports in accordance with actual load cases and support conditions.
- Developed CAESAR II models from extracted BIM (Revit) data and reconciled drawings.
- Performed PE-stamped stress analysis per applicable ASME B31 code requirements.
- Incorporated elastomeric isolation (neoprene) to mitigate vibration and clamp-pipe interaction.
- Conducted field verification and installation support to ensure compliance with design intent.

RESULTS:

- Reduced support procurement lead times from 14-20 weeks to 6 weeks.
- Lowered material usage and fabrication complexity through load-based design.
- Improved constructability by eliminating field welding and simplifying installation.
- Achieved higher installation quality with on time commissioning through field validation and real-time engineering support.

Engineering Approach

Reverse Engineering & Pipe Stress Analysis

With incomplete inputs, PT&P reconstructed piping system models to establish a reliable design basis.

- Extracted geometry directly from the owner's Revit model through remote access from clients server
- Reconciled discrepancies between isometrics and mechanical drawings
- Developed CAESAR II models for code-compliant PSA
- Established accurate loads, displacements, and support reactions

This step removed design ambiguity and unlocked decision-making.

Load-Based Support Redesign

Validated PSA results enabled a shift from conservative assumptions to load-driven design.

- Replaced overdesigned welded supports with clamp-on pipe shoes
- Sized supports to actual loads rather than maximum load capacities of the support configuration
- Significantly (90%) reduced field welding and hot work requirements
- Reduced material usage, field weld time, and fabrication complexity

This directly addressed cost overruns driven by overspecification.

Design Confidence & Constructability

The new support strategy provided a fully validated and buildable solution.

- Stress-backed designs aligned with actual system behavior
- Configurations fit within pipe rack and structural constraints
- Standardized designs improved manufacturability and delivery time
- Enabled the contractor to proceed with confidence

Field Execution & Schedule Recovery

PT&P supported installation through active field engagement.

- Conducted daily walkdowns to verify installation and fit-up
- Identified and resolved misalignment and missing components early
- Ensured supports were installed per design intent
- Reduced rework, installation time, and system handover and approval times

Results and Impact

The combined engineering and field approach delivered measurable improvements:

Reduced cost by eliminating overspecification and excess material

Unblocked engineering progress through validated PSA and reverse-engineered models

Recovered schedule by reducing lead times from 14–20 weeks to ~6 weeks

Improved constructability by minimizing field welding and simplifying installation