

# SLB - Web-Based Advanced Proxy Modeling Platform

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*Team Members:*

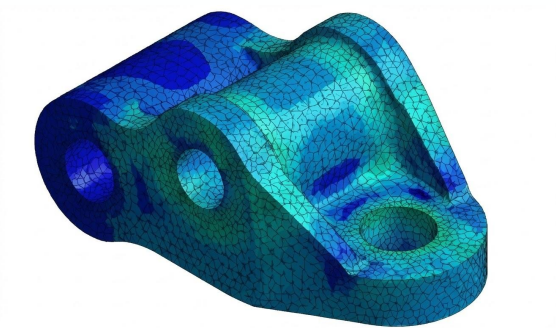
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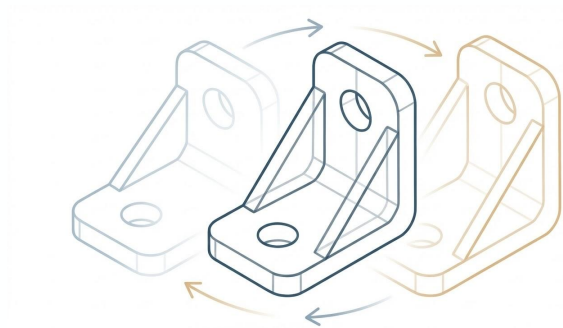
# Background

## High-Fidelity Models (FEA/CFD)



- Slow : Hours to days per simulation
- Resource-Heavy: Requires HPC clusters and expensive licenses
- Expertise-Reliant: Needs dedicated simulation teams

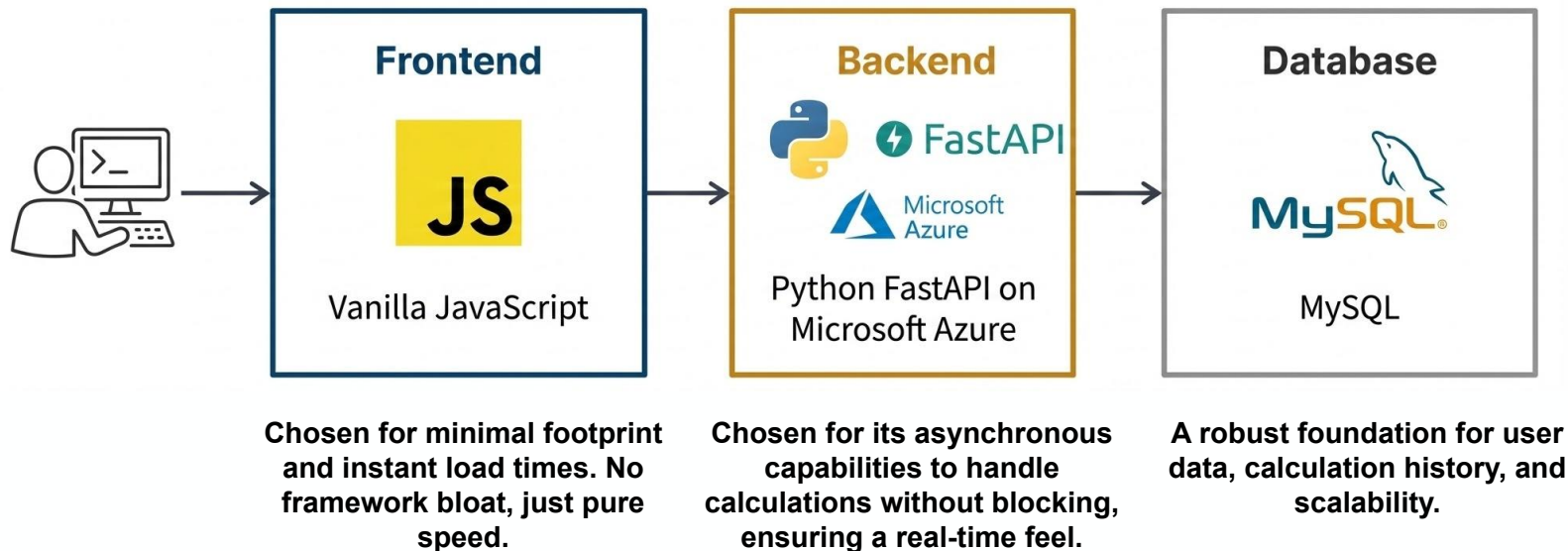
## Early-Stage Design



- Fast : Engineers need rapid feedback to test hundreds of variations
- Accessible: Tools should be available to all engineers, not just specialists
- Lightweight: No need for local software installation

# Our Solution: A Platform for Instant Answers

A centralized web-based platform delivering validated physics models in under 0.1 seconds





# Project Roadmap: A 5-Phase Plan

A 14-week plan to deliver a feature-complete application, broken down into key development stages.

1

**Foundation & Planning**  
(Week 1)

2

**Database & Framework setup**  
(Week 2-3)

3

**Core Functions Implementation**  
(Week 4-11)

4

**Feature Integration**  
(Week 12)

5

**Testing, Deployment &  
Documentation**  
(Week 13-14)

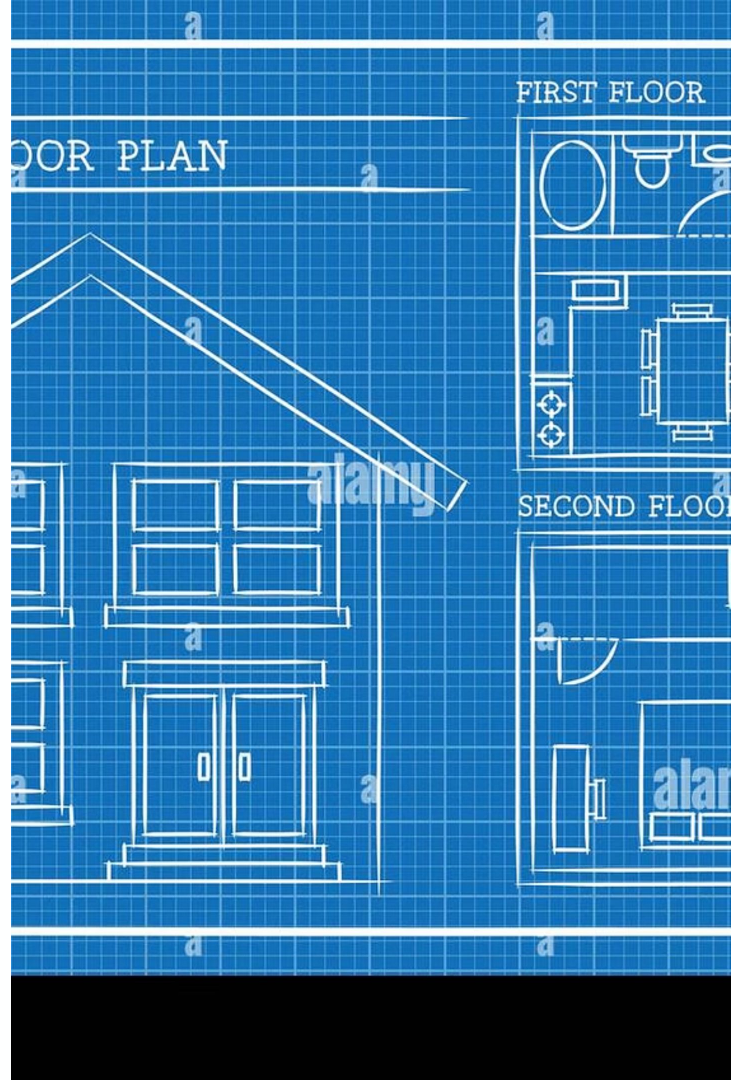
# Phase 1 & 2: Building the Application Backbone

## Phase 1: Foundation & Planning (Weeks 1)

- Set up a Jira Kanban board to manage tasks, workflows, and project progress.
- Defined project requirements, functional scope, and success criteria.
- Selected the technical stack for frontend, backend, and cloud infrastructure.
- Planned weekly milestones and deliverables to ensure structured project execution.

## Phase 2: Database & Framework setup (Weeks 2-3)

- Established the foundational frontend and backend frameworks to support modular development.
- Designed initial API endpoints and created TODO development zones for upcoming features.
- Created and configured the Azure cloud-based MySQL database for persistent data storage and integration.



# Phase 3: Engine, Logic, and GUI Development

## Phase 3: Core Frontend Development (Weeks 4-11)



- Core Calculations Engine
- Five Calculation Use Cases
  - Safety Factor
  - Maximum Safe Pressure
  - Minimum Safe Outer Diameter
  - Maximum Safe Inner Diameter
  - Maximum Safe Axial Load
- Customizable User Input panel
- Real-Time Responsive Results and Graph
- Export Functionality
- Calculation History Storage
- Login Page & Account Services
- User Management
- Interface Theme Switching



## Phase 4 & 5: Finalization & Launch

### Phase 4: Testing & Feature Integration (Weeks 12)

- Unit Testing for Each Function
- UI/UX Cohesion & Theme System Integration
- Computation Results & Graph Integration
- User-Friendly Interface Optimization

### Phase 5: Deployment & Documentation (Weeks 13-14)

- Code Refactoring & Project Structuring
- Deploy on Azure cloud server
- Comprehensive Documentation & Final Report

# Live Demonstration

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# Measuring Success

## Performance Validation

Queued at 21.74 s

Started at 21.84 s

Resource Scheduling

Queueing

DURATION

102.94 ms

Connection Start

Stalled

DURATION

3.10 ms

Request/Response

Request sent

DURATION

0.64 ms

Waiting for server  
response

68.32 ms

Content Download

2.35 ms

- Requirement : <100ms computation latency
- Result: ~60ms Backend Computation

## Accuracy Validation

Test Case: Inverse Calculation Consistency

Forward  
Calculation

Solved for a Safety Factor of  
**10.3919...** with 5MPa of pressure

Inverse  
Calculation

Used the inverse solver to find  
Max Safe Pressure with Target SF

App Result

5,000,000.16 Pa

Error Margin

< 0.0001%

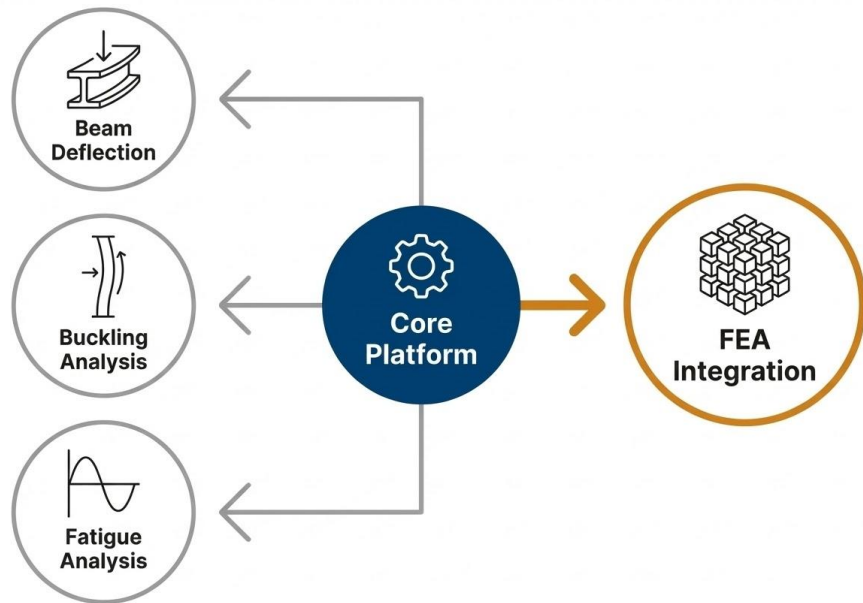
Use Unit tests comparing application output  
against hand calculations derived from Formulas

# Future Works: A Scalable Engineering Suite

The pressure vessel calculator is just the first module on a platform built for expansion

## Expand Calculator Library

- Beam Deflection
- Buckling Analysis
- Fatigue Analysis



## Deep Integration

Integrate with FEA software (e.g., Ansys, PyAnsys) to create a smooth workflow from rapid proxy modeling to final high-fidelity verification



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