Structural Engineering Design and Consulting Services
About Us

"Our mission is to advance the science of safety to address important threats and hazards where our clients live and work."
— Paul Orzeske, CEO

JENSEN HUGHES is a global leader in specialty engineering and consulting services. We are a company of engineers, consultants, and scientists focused on evaluating risks and developing the best, most cost-effective protection, and safety solutions. We offer extensive, practical experience through numerous projects, research, and industry innovation.

With over 1,200 engineers, scientists, and consultants located in more than 70 offices globally, we can provide the expertise you need anywhere in the world.
JENSEN HUGHES has been designing, reviewing and consulting on all aspects of structural and various mechanical, electrical, and plumbing (MEP) codes. Our experts have consulted on building designs to ensure code compliance for local and international projects. Clients utilize our expertise because of our understanding of the code requirements, the requirements purpose and intent, and the follow-up support to ensure the recommendations provided are incorporated correctly.

Structural/MEP Code Compliance Assessments

Our structural and MEP code compliance assessments include the following IBC building code checklist reviews following new construction or building modification/addition:

- Structural Design
- Plumbing Systems and Fixtures
- Electrical System and Equipment
- Mechanical System and Equipment

Our Capabilities

JENSEN HUGHES is dedicated to converting challenging structural engineering problems into smarter, simpler solutions for all the built environment. We employ a comprehensive, start-to-finish problem-solving philosophy founded in smart policy, innovative research, and practical engineering. Our team is built with top experts from policy-makers such as ASCE, AISC, and ACI, researchers from top universities, and renowned practitioners. We apply forward-thinking strategies with you to reveal the most practical structural solution.

The value JENSEN HUGHES brings to our clients includes:

- **Advanced Structural Dynamics and Performance-Based Expertise for Cost-Effective Hazard Mitigation**
  - Our staff includes top structural dynamists adept in linear and non-linear analysis for extreme loadings such as blasts, earthquakes, tornados, hurricanes, fires and floods. We also apply a unique, risk-informed perspective to analyze your structure’s hazard and arrive at cost-effective, practical, performance-based solutions.

- **Strong Relationships with Authorities Having Jurisdiction (AHJs)**
  - We have worked with AHJ’s in conjunction with ASCE, AISC, and ACI to develop sound building codes and standards. We have earned a reputation for professional approaches to projects while maintaining a client focus.

- **Worldwide (Global) Support**
  - JENSEN HUGHES serves our customers globally through offices strategically located in major metropolitan areas. Our team of structural engineering professionals has the capacity to assist from any location on a variety of projects to satisfy the needs of our clients.

Buildings are designed to various code requirements depending on the jurisdiction.

Code compliance starts with the initial conceptual design and continues through the building’s life cycle. Hence, code compliance reviews are recommended during the initial design and at every renovation and/or additions.
Vibration Analysis & Mitigation

Vibrations and noise can be a detriment to the facility’s mission causing loss of productivity as well as physical damage to facilities, components and in the right settings, people. In our ever more precise work, environments, controlling vibration and noise is becoming a critically important design feature; be it a micro-device manufacturing facility, laboratory or hospital.

JENSEN HUGHES has over 30 years of experience controlling vibration and sound to manageable levels. This means measuring vibrations, sound, and even electromagnetic fields, with multi-channel signal analyzers to determine the source and apply the correct mitigation strategies. Vibrations and sounds range from microlevels to levels we can feel that may be offensive and destructive.

Vibration Testing, Analysis, and Mitigation Assessments

Vibration and noise services include:

+ Measurement with portable spectrum analyzers including signal processing to display data
+ Modal measurement and analysis to establish natural frequencies and mode shapes
+ Computer structural dynamics modeling simulation to understand and predict performance
+ Engineering analysis and design to mitigate vibration, sound and EMI effects

Structural Assessments for Fire

With a structure being on fire almost every minute in the US, there is a prevalent need to engineer structures to contain a fire within its original compartment and delay or prevent a structural collapse.

JENSEN HUGHES provides an engineered, performance-based approach towards structural fire safety. The diverse skillset that our engineers, consultants, and scientists is applied to design and evaluate new or existing structure’s performance under any fire scenarios, including those for architecturally exposed steel and use of unique designs or materials that are not covered by or exceed the limits specified by the building codes.

We also provide forensic services to perform structural safety assessments, and determine the extent of the damage and necessary repairs after a fire event.

Vibration and noise services include:

+ Structural fire safety assessment of existing buildings
+ Value engineering to optimize fire protection costs
+ Robust designs to mitigate risk of progressive collapse
+ Coupled fire-thermal-structural analysis
+ Heat transfer analysis
+ Product/assembly fire resistance evaluation and qualification testing
While essential components of construction sites, commercial and maritime operations, cranes and other heavy lifting devices are complex, challenging structures in their dynamic interaction with both environmental and human elements. Several safety measures and procedures are currently in place to minimize construction rigging and lift accidents. However, the planning and execution of any heavy lift during construction still poses a significant risk.

JENSEN HUGHES offers a unique combination of structural evaluation with risk insights to properly assess site configurations for tower cranes, mobile cranes, and other heavy lift equipment. We provide this service for all construction types, such as commercial sites with tower and mobile cranes, health care facilities, and industrial facilities.

Our experienced engineers can provide services to assess risks in the crane set-up and operations, and consult on how to integrate safety into these aspects.

Crane & Heavy Lift Assessments

Our consulting services range from performing an independent review and risk assessment of all crane rigging and heavy lift operations to engineering the lift plan and site configuration. Specific review features include:

- Structural component reliability and crane or lift equipment stability
- Spatial interference with surrounding buildings, construction equipment, electrical hazards, or underground utilities
- Rigging operator policies and procedures
- Crane response to normal and extreme natural hazards

Complex Structural Engineering

Structural engineering has evolved from the days when the engineer stood beneath the bridge to prove its integrity. While we are happy to apply our structural engineering trade for our clients regardless of the complexity, it is in the atypical scenarios that we excel.

The JENSEN HUGHES Structural Group has over 70 engineers that are experienced in all aspects of structural engineering.

Our clients include architect-engineers, building owners, power utilities, industrial facilities, federal and state government agencies.

Complex Structural Engineering

JENSEN HUGHES has long-standing experience to address problematic structural concerns including the following:

- Noise and vibration control
- Load drop and large strike (e.g., aircraft impact)
- Risk assessment and risk-informed structural design
- Soil and fluid-structure interaction analysis for dynamic motion problems
- Blast analysis and design of structures
- Progressive collapse analysis
- Fire effects
- Forensics & expert testimony
- Performance-based analysis & design
- Natural hazard design for earthquake and wind effects (tornadoes, hurricanes, etc.)
Concerns were raised on the integrity of adjacent steel structures after a substation transformer fire burnt approximately 25,000 gallons of mineral oil in their close proximity. JENSEN HUGHES performed a site walkdown and identified areas of potential damage. Subsequently, material to be tested was selected from potentially affected structures and a testing procedure was developed to obtain better discretization of the damage-affected areas and support subsequent analysis that was conducted.

Benefit to Client - JENSEN HUGHES provided recommendations for repairs in affected structures. Recommended repairs were localized, reducing the cost of the structure replacement and operation downtime.

**Project Description** - A structural design validation consisting of a high level review of design documents to validate their compliance with the specifications. The validation included building dimensions, applied loads and loading combinations, load paths, critical structural elements and serviceability requirements.

The following specifications and requirements were reviewed: Detailed structural specifications, Performance specifications including performance criteria for equipment functionality, Critical construction processes governing the design, required tolerances where they differ from industry standards.

JENSEN HUGHES also reviewed structural design drawings and other documents, such as, reports, calculations, etc. and validated their adequacy, ensured that design drawings define all structural elements, including plans, elevations, sections and details, with adequate cross-referencing. Construction sequences and positions of control/construction joints, details of stairs, plant platforms and façade system support, reinforcing details, computer design/analysis models were also reviewed and validated.

Benefit to Client - Helped the client through the independent third party review process required to obtain construction permits in order to abide to the construction schedule.

**Project Description** - A non-safety portion of a Turbine Building experienced failures of the main steam line supports since 1984. High-cycle fatigue induced failures on piping clamps, clevises, spring hangers, and anchorages. In addition, event transient damage caused the destruction of tube hanger posts and braces.

JENSEN HUGHES built response models, conducted modal tests, and installed a vibration monitoring system to measure responses for diagnosis. The end solution was the removal and replacement of snubbers by visco-elastic dampers.

Benefit to Client - In lieu of conventional costly designs involving system over-stiffening, we provided an innovative yet proven solution using smart technology applied via analytical expertise, reducing the number of supports and saving the client over $2MM.
Project Description - The open web steel truss and roof deck of a large aircraft maintenance repair & operations building was protected with 1 hr. fireproofing instead of the 2 hr. fireproofing required by the local code. An evaluation was performed to:

- Determine the expected and worst-case design fires for various areas of the facility,
- Conduct a computational fluid dynamics (CFD) evaluation to determine temperature exposures to the structural steel,
- Conduct a finite element (FEM) analysis of steel performance under the high heat loads to determine if the 1 hr. fireproofing provided adequate protection to maintain acceptable steel properties (acceptable reduction to yield strength / modulus of elasticity),
- Provide a remediation plan for areas where additional fireproofing needed to be provided to provide acceptable performance under the design exposures.

Benefit to Client - The analysis showed that complete replacement with 2 hr. fireproofing was not required and that selective remediation (mostly on primary structural members) would be adequate. This resulted in substantial cost savings to the client versus the cost of complete remediation.

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Crane Rigging and Lift Assessments at a Healthcare Facility

Project Description - A hospital undergoing significant renovation in Pennsylvania required uninterrupted operation during construction including all active roadways. JENSEN HUGHES was consulted to independently assess potential tower crane and rigging failure modes primarily involving global instability, local structural failure, and spatial interaction or collisions.

These failure modes were assessed in terms of risk due to site physical configuration or structural material conditions as well as policies, means, and methods employed by site personnel. Passive or active mitigation strategies to minimize likelihood and the severity of failure were recommended as appropriate by the review team. These include engineering assessments, hoisting policies, engineering controls, etc.

Benefit to Client - By applying our risk prioritization approach for review of crane and construction activities, the owner gained valuable insight and understanding of potential vulnerabilities requiring mitigation for this and future construction projects.

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Vibration Analysis and Mitigation Strategies at an Industrial Facility

Project Description - Main Steam Moisture Separator Reheater drain tank nozzles and associated piping at a commercial nuclear power plant have shown a history of tank wall, nozzle, and pipe weld failures over an approximate four year cycle. Reports reflect weld failures at the top and bottom nozzles of these drain tanks and in the piping systems associated with the level and instrument trees attached to these tanks. The tanks experience high temperature transient conditions of steam dumped into the tanks. Stresses were induced in the piping and nozzles by vibration during the steam dump and other system transients. Time history field vibration data taken with accelerometers at various points of the pipe system configuration were incorporated and used to develop and benchmark a finite element model to evaluate the stress fields in the piping and the tank. The results of these analyses were then used to recommend modifications to eliminate the cracking issues.

Benefit to Client - The modifications eliminated the continuing failures, saving the utility money in repairs and eliminating plant power sale losses due to the plant being off line for repairs.
Complex Structural Engineering

Project Description
- A structural engineering review and evaluation of the Power House (PH) sprinkler system replacement and expansion. The review and evaluation included the ability of the PH steel superstructure to withstand both additional gravity loads from the weight of the installation, seismic, snow and wind loads as defined in the applicable codes. The review and evaluation also included the effect of increased penetrations through the PH concrete base-structure on the structural integrity of penetrated elements. JENSEN HUGHES reviewed structural drawings and performed structural analysis for the roof truss by developing 2D mathematical models, and qualified the structural steel members and connections to the Canadian codes. We also evaluated the adequacy of the reinforced concrete members for the openings based on the total amount of reinforcement provided through the affected sections, and the purpose of the rebar and the amount of rebar to be cut.

Benefit to Client
- Helped the client to demonstrate the adequacy of the PH to withstand the additional loads by performing structural review and analysis for the affected parts of the structure without a need to perform a full-scale structural analysis for the entire building.

Vibration Analysis & Mitigation

Complex Structural Review of a Hydro Plant in British Columbia

Project Description - A structural engineering review and evaluation of the Power House (PH) sprinkler system replacement and expansion. The review and evaluation included the ability of the PH steel superstructure to withstand both additional gravity loads from the weight of the installation, seismic, snow and wind loads as defined in the applicable codes. The review and evaluation also included the effect of increased penetrations through the PH concrete base-structure on the structural integrity of penetrated elements. JENSEN HUGHES reviewed structural drawings and performed structural analysis for the roof truss by developing 2D mathematical models, and qualified the structural steel members and connections to the Canadian codes. We also evaluated the adequacy of the reinforced concrete members for the openings based on the total amount of reinforcement provided through the affected sections, and the purpose of the rebar and the amount of rebar to be cut.

Benefit to Client - Helped the client to demonstrate the adequacy of the PH to withstand the additional loads by performing structural review and analysis for the affected parts of the structure without a need to perform a full-scale structural analysis for the entire building.

Vibration Analysis of a Microelectronic Manufacturing Facility

Project Description - JENSEN HUGHES developed the governing seismic criteria for the electronics manufacturing facility and reviewed the seismic design calculations for all mechanical, electrical, water, and fire protection systems and improved design concepts were provided when necessary.

JENSEN HUGHES also provided vibration engineering consulting services. Before construction, an onsite vibration survey was conducted and a remedial design layout concept for the facility was provided. After tool move-in, an in-structure vibration survey was conducted and necessary vibration mitigation solutions were given.

Benefit to Client - The microelectronics plants which undertook seismic improvements of their manufacturing process equipment and support systems suffered much less significant damage and business interruption.

Use of expert pre-earthquake inspection processes and remediation fixes provide much greater assurance of less damage and loss of manufacturing output. Implementing seismic improvements also promises to reduce insurance rates.

Vibration Analysis and Mitigation Strategies at a Healthcare Facility

Project Description - A new cancer treatment center was proposed near an adjacent railway, causing concern with regard to operation of equipment due to vibration from passing trains.

Vibration experts from JENSEN HUGHES were consulted to perform ground vibration testing to determine impact on critical hospital equipment. Vibrations during train passes were measured and were compared to the tolerance levels of equipment. The equipment items of concern were linear accelerators and a CT scanner.

Benefit to Client - By leveraging the structural dynamics and field measurement expertise of JENSEN HUGHES, the owner received critical validation and recommendations for the proposed installations in addition to significantly reduced their exposure to potentially exorbitant costs for modification or hospital outage time.
Contact us for your evaluation
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Learn more about JENSEN HUGHES at jensenhughes.com

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