SQVe
Engineering

DESIGN OF BLAST RESISTANT BUILDINGS

ONLINE COURSE ID: ONG-STR-002

Link: https://sqveconsultants.com/ong-str-002
email address: dynamics@sqveconsultants.com

INTRODUCTION

Blast-resistant design is critical in the oil and gas industry because many facilities, such as control rooms, compressor stations, and processing units, operate under high-risk conditions where accidental explosions can occur. The primary goal is to protect personnel and maintain the integrity of critical operations during and after a blast. Control rooms, for example, must remain functional to allow operators to monitor processes, initiate emergency shutdowns, and prevent cascading failures in the plant. Blast-resistant structures also protect essential equipment, pipelines, and electrical systems, minimizing operational downtime, avoiding environmental hazards, and ensuring continuity of production in high-stakes industrial environments.

Designing blast-resistant buildings poses unique structural challenges. Accurately defining blast loads is difficult, as they are highly dynamic and short in duration, requiring advanced nonlinear analysis. Structural materials behave differently under high strain rates, demanding specialized design data. Preventing progressive collapse is critical, since localized failure can compromise the whole facility. Connections and joints are especially vulnerable and need careful detailing. In line of the same, we are pleased to launch an online course **ONG-STR-002**: **Blast resistant design of buildings**. The course will commence from **30-OCT-25**.

The course will begin with an introduction to blast-resistant design, providing an overview of IS 4991 (Part 1): 2024 and UFC-3-340-02, along with key terminologies, fundamentals of structural dynamics, and general principles of blast-resistant design. Participants will learn step-by-step methods for calculating blast loads, followed by an understanding of the effects of blasts on structures and the response of structural elements, including the use of the equivalent Single Degree of Freedom (SDOF) model.

A detailed case study on the blast-resistant design of a shear wall building will be presented. The design process will be explained in a step-by-step manner, covering the front wall, side walls, rear wall, roof slab, roof beams, columns, foundations, etc. Each topic will be supported with fundamental concepts, design principles, and worked-out examples, enabling participants to gain practical and analytical skills for this complex area of design. While the course focuses on oil and gas industry applications, the knowledge gained will also be valuable for the blast-resistant design of buildings in the industries apart from oil & gas.

Detailed content of the training program is mentioned in **Annexure-A** of the brochure.

The entire course will be extremely useful for preparation of in-house working procedure, check-lists, Do's and Don'ts, etc. for design of the blast resistant buildings.

WHAT IS UNIQUE ABOUT THIS COURSE?

The course is designed by the **experienced engineer** (Mr. Bhavin Shah) who has 25 years of experience in the field of structural engineering.

- ✓ The entire course is designed from the **practical aspects** which can be readily used in the real projects.
- ✓ The course is designed to have an **interactive mode** so that the problems / doubts of the participants can be addressed effectively.
- ✓ A WhatsApp group will be created for **quick communication** between the participants and the faculty. The participants will be able to share the discussion points, doubts, queries, etc. in the group. The details in the group will be collated for further discussion in the next session.
- ✓ All the sessions will be **recorded** and recording of each session will be **uploaded at our online portal** next day. If someone miss out the live session then he/she can go through the recording before attending the next session. After going through the recording, the participants can share their doubts/queries in the WhatsApp group, which will be addressed in the next session.
- ✓ **Recording** will be available with all the participants for **180 days**.
- ✓ Certificate for participation will be issued on successful completion of the online course. For successful completion of the course, the participant is required to complete the exercises during the program.
- ✓ The course is designed as a **process of learning together**.

WHO SHOULD ATTEND?

This course will be useful for following:

- ✓ **Practicing Structural Consultants**
- ✓ **Senior Structural Engineers in the company**
- ✓ **Junior Structural Engineers in the company**
- ✓ **Owner's consultants**
- ✓ **Proof checking consultants**
- ✓ **Research scholars, Academicians**
- ✓ **Post Graduate students in Structural Engineering**
- ✓ **Civil engineering students who are interested in Structural Engineering.**

COURSE FACULTY

Bhavin Shah – Founder & CEO, SQVe Consultants

Mr. Bhavin Shah is passionate about Engineering profession with two decades of experience. He is having a dream for enhancing the engineering profession in different organisations. He completed graduation in Civil Engineering and Masters in Structures from Sardar Patel University. He is having unique experience of working in the specialized firm of civil / structural consultancy which grew as multidisciplinary firm (VMS), large multidisciplinary firm (L&T Chiyoda Ltd.) and owner-based engineering set up (Adani Infra (I) Ltd.). He worked in different organisations at different levels, starting from junior design engineer to CEO. He is Founder & CEO of **SQVe Consultants**.

METHODOLOGY

- ✓ The entire course is designed in the **ONLINE mode** with live sessions.
- ✓ The course will spread over ~**four weeks** with **approximate 50+ contact hours.**
- ✓ During the program, the interaction can be done with faculty and the participants using **WhatsApp**.
- ✓ **Fundamentals and the concepts** will be main focus of the course.
- ✓ The online sessions will be conducted using **ZOOM** software.

COURSE SCHEDULE

Start Date	**30-OCT-25**
End Date	**21-NOV-25**
Total contact hours	**50+ contact hours** (~26 hrs. online + ~24 hrs. for assignment) (Sessions will be arranged on **Monday to Friday** from **8:30 PM to 10:00 PM IST**.)
Details of each session	Please refer subsequent page for details of each session.

FEES FOR THE COURSE**

For participant <u>from India</u>	Cost per participant shall be **15,350 INR** (inclusive of 18% GST).
For participant from <u>outside India</u>	Cost per participant shall be **217 USD.**

****Important notes:**

1. Discount offered:

- **<u>For continuous learner</u>**: If you have attended earlier one course of SQVe Consultants than **5%** of discount will be offered. For prior two courses, **10%** of discount will be offered. For three or more prior courses, **15%** of discount will be offered. To avail the discount, please send us an email at: dynamics@sqveconsultants.com. We will arrange to send an invoice considering the discount for online payment.
- **<u>Group participation</u>** from a company or institute is encouraged to get the discounts on this course. For more details, pl contact us at the above-mentioned email address.

2. Payment in installments:

- Participants have the option to pay the total applicable fees in **six monthly installments**. In this case, the total fee amount will increase by approximately **3%**. For example, if the total applicable fee is **₹15,350**, the monthly installment will be **₹2,635** (i.e., ₹2,635 × 6 = ₹15,810).
- To avail this facility, please drop a message at dynamics@sqveconsultants.com and pl mention your name, email address, WhatsApp number & city. We will create a **subscription plan through Razorpay** with an auto-pay feature.

HOW TO REGISTER FOR THE COURSE?

Please click on the following link and thereafter click on "**Register Now**" button at bottom of the page. You will be directed to the **payment page**. Your registration will be confirmed after receipt of the payment at portal.

https://sqveconsultants.com/ong-str-002

Important notes related to payment gateway:

- ⇨ At this payment gateway, discount and monthly installment options are not activated.
- ⇨ If you are eligible for the discount then, please connect with us through email: dynamics@sqveconsultants.com. We will create separate payment link for the same.
- ⇨ To opt for monthly installment payment option, please drop a message at dynamics@sqveconsultants.com and pl mention your name, email address, WhatsApp number & city. We will create a **subscription plan through Razorpay** with an auto-pay feature.
- ⇨ Payment gateway at the above-mentioned portal is configured only for **Indian participants**. Interested foreign engineers can contact us at the email address: **dynamics@sqveconsultants.com**. An invoice will be shared through **PayPal** for online payment.

Kindly note that there are limited seats.

Your any queries/ doubts related to the online course are welcome at the above-mentioned email address.

ANNEXURE - A

ONG-STR-002: CONTENT OF THE ONLINE COURSE

Session no.	Title	Date	Time (IST)
1	**Introduction to blast resistant design** • Why blast resistant design is different than the conventional structures? • Introduction to blast resistant design • Overview of IS 4991 (Part 1): 2024 • Overview of UFC-3-340-02 • Understanding of different terminologies such as arrival time, detonation, charge mass, Close-in detonation, decay parameter, overpressure, positive phase, reflected overpressure, scaled distance, support rotation, etc.	**30-OCT-25**	**8:30 PM TO 10:00 PM**
2	**General principles of blast resistant design** • Attributes of blast resistant design • Blast source • Detonation scenarios • Standoff distance • Scaled distance, Z • Equivalent TNT charge • Performance expectations • Categories of structures • Threat assessment, etc.	**31-OCT-25**	**8:30 PM TO 10:00 PM**
3	**Blast load** • Blast wave propagation • Speed of shock wave • Decay of blast overpressure with time • Blast overpressure history parameters • Simplified blast pressure history • Reading of charts for scaled distance vs different parameters for blast	**3-NOV-25**	**8:30 PM TO 10:00 PM**

Session no.	Title	Date	Time (IST)
4	**Step by step calculations for blast load (Part 1)** • Input – size of building, peak side-on overpressure (Pso), duration (td) • Calculation for shock-front velocity (U), length of pressure wave (Lw), peak dynamic wind pressure (qo) • Calculation for **front wall** – Reflected overpressure, clearing distance, reflected overpressure clearing time, stagnation pressure, front wall impulse, effective duration, etc. • Exercise	**4-NOV-25**	**8:30 PM TO 10:00 PM**
5	**Step by step calculations for blast load (Part 2)** • Calculation of blast load for **side wall** – Equivalent load coefficient, equivalent peak overpressure, Rise time, • Calculation of blast load for **roof** – Equivalent load coefficient, equivalent peak overpressure, rise time, total positive phase duration • Calculation of blast load for **rear wall –** Equivalent load coefficient**,** time of arrival, rise time, equivalent peak overpressure, total positive phase duration • Comparison of calculated blast load parameter with chart • Exercise	**5-NOV-25**	**8:30 PM TO 10:00 PM**
6	**Effect of blast on the structure & response of structural elements** • Effect on above ground structures • Type of structures • Closed rectangular structure – front face, rear face, roof and side walls • Drag coefficient • Overturning of structure • Interpretation of results • Impact on the results by varying different parameters • Properties of materials • Dynamic increase factor • Deformation limits	**6-NOV-25**	**8:30 PM TO 10:00 PM**

Session no.	Title	Date	Time (IST)
	• Support rotation in the flexure members • Allowable deformation parameters, etc.		
7	**Equivalent single degree of freedom (SDOF) model** • Effective mass • Effective stiffness • Deflected shape • Effective time period • Resistance function • Equivalent SDOF analysis • Uniform blast pressure distribution • Elastic SDOF response • Inelastic SDOF response • Peak ductility demand of SDOF system subjected to triangular pulse loading • Gross and cracked moment of inertia • Transformation factors for beams, one way slab and two-way slab, etc.	**7-NOV-25**	**8:30 PM TO 10:00 PM**
8	**Case study for shear wall building design (Part 1)** • Step-by-step calculation for shear wall building • Building performance requirements – deformation limits • **Front wall** - Reflection load | stagnation load • Assume trial wall thickness and reinforcement • Compute bending resistance | For bending tension on the inside face | For bending tension on the outside face • Compute shear resistance • Resistance and permissible response	**10-NOV-25**	**8:30 PM TO 10:00 PM**
9	**Case study for shear wall building design (Part 2)** • **Front wall** – compute SDOF equivalent system	**11-NOV-25**	**8:30 PM TO 10:00 PM**

Session no.	Title	Date	Time (IST)
	• Gross moment of inertia | transformed rebar area | location of transformed neutral axis | cracked moment of inertia | effective stiffness | effective mass | effective time period • Comparison of results with chart solution • Check for elastic deflection, maximum deflection, ductility coefficient, etc. • Exercise		
10	**Case study for shear wall building design (Part 2)** • **Side wall** – compute SDOF equivalent system • Gross moment of inertia | transformed rebar area | location of transformed neutral axis | cracked moment of inertia | effective stiffness | effective mass | effective time period • Comparison of results with chart solution • Check for elastic deflection, maximum deflection, ductility coefficient, etc. • Exercise	**12-NOV-25**	**8:30 PM TO 10:00 PM**
11	**Case study for shear wall building design (Part 3)** • **Metal deck sheet Roof slab | In plane loads** • Determine width of composite flange • Reflection load | Stagnation load • Assume reinforcement in first trial • Compute bending resistance • Compute shear resistance • Resistance and permissible response • Compute SDOF equivalent system • Comparison of results from numerical integration and chart • Exercise	**13-NOV-25**	**8:30 PM TO 10:00 PM**

Session no.	Title	Date	Time (IST)
12	**Case study for shear wall building design (Part 4)** • **Side wall | In plane loads** • Reflection load | stagnation load • Assume reinforcement and wall thickness for first trial • Compute bending resistance • Compute shear resistance • Compute SDOF equivalent system • Comparison of results between numerical integration solution and chart • **Roof slab | Out of plane loads** • Calculation of peak load, Fo • Assume slab thickness and reinforcement • Compute bending resistance • Compute shear resistance • Permissible response • Compute SDOF equivalent system • Comparison of results between numerical integration and chart • Roof slab interaction • Perform similar calculation considering the blast load on the short side of the building • Exercise	**14-NOV-25**	**8:30 PM TO 10:00 PM**
13	**Case study for shear wall building design (Part 5)** • **Roof beams | Steel beams** • Load case: blast perpendicular to span of beam | Equivalent load coefficient, equivalent peak overpressure, equivalent peak load, Rise time • Load case: blast parallel to span of beam | Equivalent load coefficient, equivalent peak overpressure, equivalent peak load, Rise time • Trial size – assume size of the beam • Compute bending resistance • Compute shear resistance • Resistance & permissible response • Compute SDOF equivalent system	**17-NOV-25**	

Session no.	Title	Date	Time (IST)
	• Numerical integration solution and comparison with chart • Roof beam connection • Exercise		
14	**Case study for shear wall building design (Part 6)** • **Roof girders | Steel beams** • Load case: blast perpendicular to span of girder | Equivalent load coefficient, equivalent peak overpressure, equivalent peak load, Rise time • Load case: blast parallel to span of girder| Equivalent load coefficient, equivalent peak overpressure, equivalent peak load, Rise time • Trial size – assume size of the beam • Compute bending resistance • Compute shear resistance • Resistance & permissible response • Compute SDOF equivalent system • Numerical integration solution and comparison with chart • Roof girder connection • Exercise	**18-NOV-25**	
15	**Case study for shear wall building design (Part 7)** • **Columns | Steel columns** • Load case: blast perpendicular to span of girder | Equivalent load coefficient, equivalent peak overpressure, equivalent peak load, Rise time • Load case: blast parallel to span of girder| Equivalent load coefficient, equivalent peak overpressure, equivalent peak load, Rise time • Trial size – assume size of the beam • Compute compression resistance • Compute tension resistance • Resistance & permissible response • Compute SDOF equivalent system • Numerical integration solution and comparison with chart	**19-NOV-25**	

Session no.	Title	Date	Time (IST)
	• Column base plate and anchor bolt design • Exercise		
16	**Case study for shear wall building design (Part 8)** • **Foundations** • Assume pile capacities for compression, tension and lateral load • Load case: blast applied to log side of the building| applied peak reflected overpressure, front wall capacity, roof slab (in-plane) capacity, side wall (in-plane)capacity, peak roof overpressure, roof (out of plane capacity), roof beam capacity, girder capacity, column capacity • Least vertical blast load | Least lateral blast load • Front wall foundation • Side wall foundation • Column foundation • Finite element analysis | When to use? | Limitations • Exercise	**20-NOV-25**	
17	**Open discussion | Way forward** • Balance queries from the participants • Discussion related to queries of the ongoing projects, if any • Concluding remarks • Way forward, etc.	**21-NOV-25**	**8:30 PM** **TO** **10:00 PM**

ANNEXURE - B

About SQVe Consultants

SQVe Consultants (SQVe) is a company established with a vision of enhancing the engineering profession. Name of the company is derived from the first letters of major goals of engineering, i.e. **S**chedule adherence, **Q**uality assurance & **V**alue **e**ngineering. For success of any project, it is required that all these goals are considered simultaneously in the projects. However, in today's fast track projects, it is indeed difficult to address all the goals in the design engineering cycle simultaneously. We believe that for achieving these desired goals, there are many developmental activities (off-project) required in the organisations for continual improvement. Our all services are designed to assist different organizations to achieve the engineering goals. We intend to collaborate with the different organisations for long term basis and aim towards enhancing the engineering profession through our unique services. Our values are Innovation, Commitment & Integrity.

Your partner for achieving engineering goals!

We look forward for long term association with different organisations for enhancement of engineering profession through our following unique services.

- ✓ Training on customised areas as per specific requirements of the company
- ✓ Consultation on the areas related to structural engineering
- ✓ Induction training program for new joiners in the company
- ✓ Improvement in Quality Assurance of the company
- ✓ One-on-one training sessions for structural engineers, etc.

For more information, please get in touch with us for scheduling the free call to understand the details.

For more details, please refer website: https://sqveconsultants.com

You may contact us at email address: contact@sqveconsultants.com

⇨ **Self-paced mode of learning (11 packages):**

Get access to 247 recorded sessions with 370+ contact hours. There are 11 specialized packages are created from 16 unique online courses:
https://sqveconsultants.com/recorded-sessions

⇨ **Get access to free e-books:**

1. Design of gravity columns:
   https://sqve-academy.thinkific.com/products/digital_downloads/ebook-str-001

2. Comments on draft of IS 1893 (Part 4):
   https://sqve-academy.thinkific.com/products/digital_downloads/ebook-str-002

⇨ **Get access to three e-books of Er. J. D. Buch:**

https://sqve-academy.thinkific.com/courses/ebooks

⇨ **Individual online courses (self-paced mode of learning):**

RCC-STR-003: Foundation engineering (Part 1) Link for more details: https://sqveconsultants.com/rcc-str-003

RCC-STR-002: Design of liquid retaining structures Link for more details: https://sqveconsultants.com/rcc-str-002

ONG-STR-001: Design of Pipe-rack for oil & gas industry:

https://sqveconsultants.com/ong-str-001

DYN-STR-001: Design of machine foundations:

https://sqveconsultants.com/dyn-str-001

STEEL-STR-007: Design of PEB structure:

https://sqveconsultants.com/steel-str-007

STEEL-STR-008: Design of PEB structures with cranes:

https://sqveconsultants.com/steel-str-008

STEEL-STR-005: Design of steel structure as per American codes:

https://sqveconsultants.com/steel-str-005

STEEL-STR-006: Design of connections for steel structures: https://sqveconsultants.com/steel-str-006

EQ-STR-004: Push-over analysis, P-delta analysis, Nonlinear dynamic analysis, Response spectrum analysis: https://sqveconsultants.com/eq-str-004

RCC-STR-001: Comparison of design results of RC between STAAD Pro, RCDC & ETABS: https://sqveconsultants.com/rcc-str-001

Visit online store of SQVe Academy:

https://sqve-academy.thinkific.com/collections

Join our telegram group for technical discussion related to structural engineering (9K+ engineers): https://t.me/structuralengineering1

Register at our portal to receive the regular updates, participate in technical discussions, etc.: https://sqveconsultants.com/register

Link for joining WhatsApp community of SQVe Academy: https://chat.whatsapp.com/JHSph6kemaGJLMasodebhW

Link showing playlist of member-only videos:
https://www.youtube.com/playlist?list=UUMOwkjEFL_gGDE6peoapW8Few

You are welcome to join the channel at following link:
https://www.youtube.com/channel/UCwkjEFL_gGDE6peoapW8Few/join

To decide appropriate online courses for your specific requirements, feel free to connect with us through email address: contact@sqveconsultants.com

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