



**RCC-STR-002 | ONLINE COURSE**

**DESIGN OF  
LIQUID  
RETAINING  
RCC STRUCTURES**

**IS 3370 | IS 456 | IS 11682 | IS 1893**

**STAAD.Pro | RCDC**



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**<https://sqveconsultants.com/rcc-str-002>**

## INTRODUCTION

**Liquid retaining structures (LRS)** are critical for storing or containing liquids such as water, wastewater, chemicals, etc. ensuring safe handling without leakage or structural failure. They are integral to various industries, including water supply, wastewater treatment, process plants, chemical industries, etc. These structures must maintain watertightness and structural integrity throughout their service life, often under demanding conditions.

Challenges in their design include limiting crack-width values to prevent leakage, especially under varying hydrostatic pressures and dynamic loads. Durability is one of the important area for design of LRS structures. Additionally, temperature effects, shrinkage, and differential settlement pose risks of cracking and instability. For earthquake resistant design, the design must account for earthquake-induced sloshing and base shear forces. Proper joint design and quality construction are critical to mitigate leakage risks. Therefore, meticulous design and detailing is required for LRS to ensure durability, safety, and long-term performance.

We received numerous requests for launching the specific online courses for design of liquid retaining structures. In line of the same, we are pleased to launch an online course “**RCC-STR-002 – Design of liquid retaining RCC structures as per IS codes**”.

The course will begin with detailed discussions on IS 3370 (Part 1):2021 & IS 3370 (Part 2):2021 along with crack width calculations. Thereafter, we will perform analysis of individual plates, rectangular tanks and circular tanks using design tables of IS 3370 (Part 4/1/2/3):2021. For the similar geometries, we will generate computer model in STAAD Pro using plate elements. The analysis results from the software will be compared with the design table results. In the process, we will highlight do’s and don’ts related to software applications for FEM. Subsequently, we will discuss in detail regarding seismic loads as per IS 1893 (Part 2):2014 along with amendment of 2022. Manual calculations will be performed to get more insight about seismic loads for LRS. Towards end of the course, we will take up couple of case studies for analysis and design of liquid retaining structures. We will also explore usage of STAAD Pro + RCDC and compare the results with the manual calculations. The entire course will be useful for preparation of in-house work procedure, check list, do’s and don’ts for liquid retaining structures.

The course will commence from **19-DEC-24**. To ensure effective learning and hands-on experience, participants will be engaged in assignment designed to be completed step-by-step as the program progresses. There will be joint online discussions of the documents prepared by the participants as well as specific doubts or queries raised by the participants for each step will be addressed before moving to the next step. The program is designed to encourage maximum interaction with the participants to enable effective knowledge transfer.

Details of each session is mentioned towards end of the document.

## WHAT IS UNIQUE ABOUT THIS COURSE?

- ✓ The course is designed by the **experienced engineer** (Mr. Bhavin Shah) who has more than two decades 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 shared **within few hours**. 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**. Additional six months of access can be purchased with only 10% of total fees.
- ✓ **Certificate** for participation will be issued on successful completion of the online course (to avail the certificate, it is mandatory to submit the assignments as per schedule).
- ✓ 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**. He is pursuing Ph.D. in Structural Engineering related to earthquake resistant design of industrial steel structures. He has conducted similar offline programs for large engineering setup.

## METHODOLOGY

- ✓ The entire course is designed in the **ONLINE mode**.
- ✓ The course will spread over **~one month** with **44+ contact hours** (~24 hrs. online + ~20 hrs. for working on assignments).
- ✓ During the program, the interaction can be done with faculty and the participants using **WhatsApp**.
- ✓ **Fundamentals and the concepts** will be demonstrated through study models in the **software**.
- ✓ The online sessions will be conducted using **ZOOM** software.

## COURSE SCHEDULE

<b>Start Date</b>	<b>19-DEC-2024</b>
<b>End Date</b>	<b>9-JAN-2025</b>
<b>Total contact hours</b>	<b>44+ contact hours</b> (~24 hrs. online + ~20 hrs. for assignment) (Sessions will be arranged on <b>Monday to Friday</b> from <b>8:30 PM to 10:00 PM IST</b> .)
<b>Details of each session</b>	Please refer subsequent page for details of each session.

## FEES FOR THE COURSE\*\*

<b>For participant <u>from India</u></b>	Cost per participant shall be <b>14,750 INR</b> (inclusive of 18% GST).
<b>For students** pursuing Post graduation or Graduation <u>from India</u></b>	Cost per participant shall be <b>11,800 INR</b> (inclusive of 18% GST).
<b>For participant <u>outside of India</u></b>	Cost per participant shall be <b>225 USD.</b>

**\*\*Discount offered:**

- ✓ To avail discounted **fess for student**, the participant shall have official email address of the institute. Please connect with us at email address for more details: [concrete@sqveconsultants.com](mailto:concrete@sqveconsultants.com)
- ✓ **For continuous learner:** 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 connect with us through the above-mentioned email address. We will arrange to send an invoice considering the discount for online payment.
- ✓ **Group participation** from a company or institute is encouraged to get the discounts on this course. For more details, please contact us at the above-mentioned email address.

## 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/rcc-str-002>

**Important notes:**

- ⇒ There are several modes of payment available at the above link such as net banking, card, UPI, etc. For transferring the amount through Google Pay, please connect with us at following email address. We will share the required details.

⇒ Payment gateway at the above-mentioned portal is configured only for **Indian participants**. Interested foreign engineers can contact us at the email address: **concrete@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.

## SCHEDULE OF THE COURSE : RCC-STR-002

Session no.	Title	Date	Time (IST)
1	<b>Introduction to Water Retaining structures   Detailed Discussion on IS 3370:2021 (Part 1)</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance of Part 1 document</li> <li>• Materials such as Aggregates, Reinforcement, Admixtures, etc.</li> <li>• Exposure condition</li> <li>• Durability requirements</li> <li>• Different types of joints such as complete contraction joint, partial contraction joint, sliding joint, construction joint, etc.</li> <li>• Q&amp;A</li> </ul>	19-DEC-24	8:30 PM TO 10:00 PM
2	<b>Detailed discussion on IS 3370 (Part 1):2021</b> <ul style="list-style-type: none"> <li>• Design of different types of joints</li> <li>• Detailing of different types of joints</li> <li>• Spacing of movement joints</li> <li>• Jointing materials such as joint fillers, water-bars &amp; joint sealants</li> <li>• Construction of floors, walls, joints, etc.</li> <li>• Testing of structure</li> <li>• Q &amp; A</li> </ul>	20-DEC-24	8:30 PM TO 10:00 PM
3	<b>Detailed discussion on IS 3370:2021 (Part 2)</b> <ul style="list-style-type: none"> <li>• Different loads</li> <li>• Limit state design – Load combination, Maximum tensile stresses in reinforcement, Classification of Tightness, etc.</li> <li>• Crack width</li> </ul>	23-DEC-24	8:30 PM TO 10:00 PM

Session no.	Title	Date	Time (IST)
	<ul style="list-style-type: none"> <li>Stresses due to temperature changes</li> <li>Reinforcement detailing: Minimum reinforcement, size of bars, spacing between bars, etc.</li> <li>Reinforcement detailing at wall junction</li> <li>Q &amp; A</li> </ul>		
4	<b>Detailed discussion on IS 3370:2021 (Part 2)</b> <ul style="list-style-type: none"> <li>Calculations for crack widths</li> <li>Crack width in immature concrete</li> <li>Crack width in mature concrete</li> <li>Amendment no. 1 (2024)</li> <li>Identifying important parameters affecting the crack width</li> <li>Case study exercises</li> <li>Q &amp; A</li> </ul>	24-DEC-24	8:30 PM TO 10:00 PM
5	<b>Detailed discussion on IS 3370:2021 (Part 4/Sec1) : 2021</b> <ul style="list-style-type: none"> <li>Plate analysis results for individual plates</li> <li>Different loading conditions and boundary conditions included in the tables</li> <li>Important points to be considered while reading the tables   Do's and Don'ts</li> <li>Manual calculations for few examples using the tables</li> <li>Modelling the same geometry in STAAD Pro using plate elements   Interpretation of results   Comparison with values obtained from design tables</li> <li>Case Study Exercises</li> <li>Q &amp; A</li> </ul>	25-DEC-24	8:30 PM TO 10:00 PM
6	<b>Detailed discussion on IS 3370:2021 (Part 4/Sec2) : 2021</b> <ul style="list-style-type: none"> <li>Design tables for rectangular tanks</li> <li>Single-cell &amp; Multi-cell rectangular tanks</li> <li>Important points to be considered while reading the tables   Do's and Don'ts</li> </ul>	26-DEC-24	8:30 PM TO 10:00 PM

Session no.	Title	Date	Time (IST)
	<ul style="list-style-type: none"> <li>Manual calculations for few examples using the tables</li> <li>Modelling the same geometry in STAAD Pro using plate elements   Interpretation of results   Comparison with values obtained from design tables</li> <li>Case Study Exercises</li> <li>Q &amp; A</li> </ul>		
<b>7</b>	<b>Detailed discussion on IS 3370:2021 (Part 4/Sec3) : 2021</b> <ul style="list-style-type: none"> <li>Design tables for circular tanks</li> <li>Different loading conditions and end-restraint conditions</li> <li>Ring tension</li> <li>Important points to be considered while reading the tables   Do's and Don'ts</li> <li>Manual calculations for few examples using the tables</li> <li>Modelling the same geometry in STAAD Pro using plate elements   Interpretation of results   Comparison with values obtained from design tables</li> <li>Case Study Exercises</li> <li>Q &amp; A</li> </ul>	<b>27-DEC-24</b>	<b>8:30 PM TO 10:00 PM</b>
<b>8</b>	<b>Detailed discussion on IS 11682 – Design of RCC staging for overhead water tanks</b> <ul style="list-style-type: none"> <li>Different shapes of water tank such as rectangular, circular, intze, etc.</li> <li>Layout of overhead tanks</li> <li>Arrangement of columns</li> <li>Shaft type staging vs columns</li> <li>Reinforcement detailing</li> <li>Discussion of draft of IS 11682 – circulated by BIS on 25-NOV-24</li> <li>Q &amp; A</li> </ul>	<b>30-DEC-24</b>	<b>8:30 PM TO 10:00 PM</b>
<b>9</b>	<b>Detailed discussion on IS 1893 (Part 2):2014 – Seismic design of liquid retaining tanks</b> <ul style="list-style-type: none"> <li>Amendment no. 1 (2022)</li> <li>Spring mass idealization considered for seismic analysis</li> </ul>	<b>31-DEC-24</b>	<b>8:30 PM TO 10:00 PM</b>



Session no.	Title	Date	Time (IST)
	<ul style="list-style-type: none"> <li>• Concept of impulsive and convective forces</li> <li>• Calculation of Time period and its importance in calculation of seismic loads for tanks</li> <li>• Calculation of base shear &amp; base moment</li> <li>• Impulsive Hydrodynamic pressure</li> <li>• Convective hydrodynamic pressure</li> <li>• Effect of vertical ground acceleration</li> <li>• Seismic design considerations for columns and shaft staging</li> <li>• Q &amp; A</li> </ul>		
10	<b>Detailed discussion on IS 1893 (Part 2):2014 – Seismic design of liquid retaining tanks</b> <ul style="list-style-type: none"> <li>• Manual calculations for seismic loads for liquid retaining tank</li> <li>• Case study exercises</li> <li>• Q &amp; A</li> </ul>	1-JAN-25	8:30 PM TO 10:00 PM
11	<b>Design of cantilever wall   Case study</b> <ul style="list-style-type: none"> <li>• Design of wall which is a part of large tank</li> <li>• Calculation of different loads</li> <li>• Seismic load calculations</li> <li>• Reading data from design tables</li> <li>• Calculations of bending moment, shear forces and axial tension</li> <li>• Design calculations for reinforcement, check for shear, minimum reinforcement, etc.</li> <li>• Reinforcement detailing</li> <li>• Q &amp; A</li> </ul>	2-JAN-25	8:30 PM TO 10:00 PM
12	<b>Design of water tank   Case study (Part 1)</b> <ul style="list-style-type: none"> <li>• Calculation of different loads</li> <li>• Seismic load calculations</li> <li>• Reading data from design tables</li> <li>• Calculations of bending moment, shear forces and axial tension</li> <li>• Q &amp; A</li> </ul>	3-JAN-25	8:30 PM TO 10:00 PM

Session no.	Title	Date	Time (IST)
13	<b>Design of water tank   Case study (Part 2)</b> <ul style="list-style-type: none"> <li>• Design calculations for reinforcement, check for shear, minimum reinforcement, etc.</li> <li>• Reinforcement detailing</li> <li>• Q &amp; A</li> </ul>	6-JAN-25	
14	<b>Design of water tank using STAAD Pro + RCDC (Part 1)</b> <ul style="list-style-type: none"> <li>• Design of above-mentioned tank using STAAD Pro + RCDC</li> <li>• 3D model generation</li> <li>• Load applications</li> <li>• Interpretation of analysis results</li> <li>• Comparison with design tables of IS 3370</li> <li>• Q &amp; A</li> </ul>	7-JAN-25	8:30 PM TO 10:00 PM
15	<b>Design of water tank using STAAD Pro + RCDC (Part 2)</b> <ul style="list-style-type: none"> <li>• Important points to be taken care in RCDC</li> <li>• Design of wall, floor slab using RCDC</li> <li>• Comparison of design results with the manual calculations</li> <li>• Reinforcement detailing</li> <li>• Q &amp; A</li> </ul>	8-JAN-25	8:30 PM TO 10:00 PM
16	<b>Open discussion</b> <ul style="list-style-type: none"> <li>• Discussion on unresolved queries of participants</li> <li>• Discussion on findings of participants for the case study exercises</li> <li>• Way forward</li> <li>• Concluding remarks</li> </ul>	9-JAN-25	8:30 PM TO 10:00 PM

## About SQVe Consultants

**SQVe Consultants** is a company established with a vision of enhancing the engineering profession. The name of the company is derived from first letters of goals of engineering, i.e. **S**chedule adherence, **Q**uality assurance & **Ve** -Value Engineering.

Our ALL services are designed to have maximum of ONLINE interaction with the least OFFLINE interaction.

We look forward for long term association with different organisations for enhancement of engineering profession through our unique services. We also provide mentoring to the structural engineers through one-on-one session. Please get in touch with us for any requirements related to online training related to civi/structural engineering as well as in the area of people management (soft skills).

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

You may contact us at email address : [contact@sqveconsultants.com](mailto:contact@sqveconsultants.com)

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