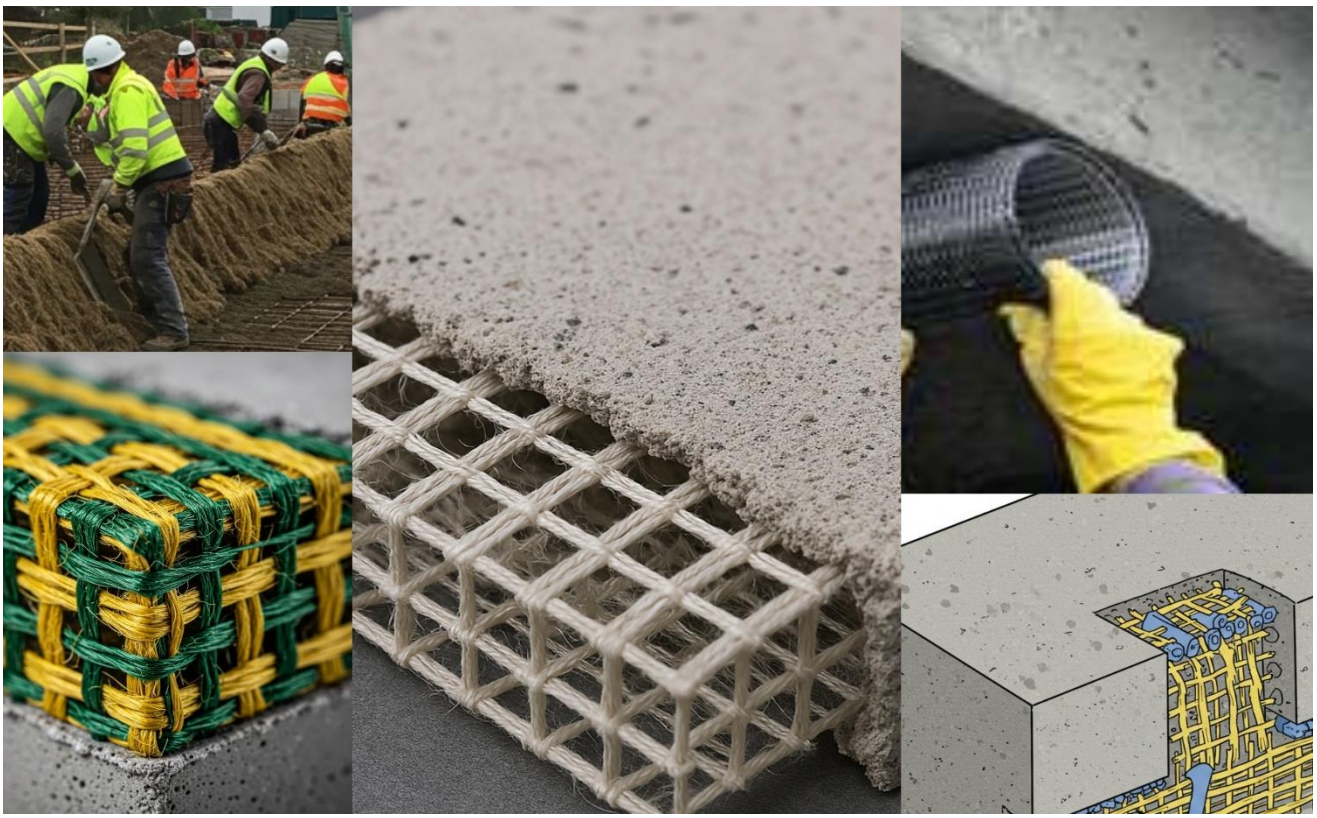
Model Curriculum



MCr Name: Introduction to Textile Reinforced Concrete (TRC)

MCr Code: TIOCES/MCr-0001

MCr Version: 1.0

NSQF Level: 3.0

Model Curriculum Version: 1.0

The Institution of Civil Engineers
309-310, Suncity Trade Tower, Sector 21, Gurugram, Haryana - 122016

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Training Parameters

Sector	Construction
Sub-Sector	Real Estate and Infrastructure Construction
Occupation	Masonry
Country	India
NSQF Level	3.0
Aligned to NCO/ISCO/ISIC Code	NA
Minimum Educational Qualification and Experience	10th Grade Pass OR 10th Grade pass and pursuing continuous schooling OR Previous relevant Qualification of NSQF Level 2 with 3 years of relevant experience OR Previous relevant Qualification of NSQF Level 2.5 with 1.5 years of relevant experience
Pre-Requisite License or Training	NA
Minimum Job Entry Age	16 years
Last Reviewed On	NA
Next Review Date	18th Feb'2028
NSQC Approval Date	18th Feb'2025
MCr Version	1.0
Model Curriculum Creation Date	18th Feb'2025
Model Curriculum Valid Up to Date	18th Feb'2028
Model Curriculum Version	1.0
Maximum Duration of the Course	30 hours

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills.

- Demonstrate a thorough understanding of the fundamental concepts of TRC, including the properties and roles of its key components, i.e. textiles and concrete
- Discuss the advantages and potential drawbacks of TRC compared to traditional concrete in various construction applications
- Identify and evaluate different types of textile reinforcements used in TRC
- Select the appropriate types of textiles based on specific project requirements and applicable criteria
- Discuss the factors that influence the performance and longevity of TRC elements, including environmental conditions and material quality
- Discuss the diverse applications of TRC in construction, emphasizing its versatility and effectiveness in various scenarios
- Cultivate comprehensive knowledge and skills in the process of preparing and forming TRC elements, from material preparation to final construction
- Apply quality assessment techniques for TRC elements, including visual inspections and testing methods, to ensure compliance with required standards
- Follow the relevant safety protocols and best practices for handling TRC materials and mixtures to maintain a safe working environment
- Commit to developing sustainable TRC materials by applying principles that consider environmental footprint and recycling potential
- Acquire a comprehensive knowledge of emerging trends, research and advancements in TRC applications
- Follow cost-effective and durable TRC solutions

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the micro-credential.

NOS/ Module Details	Total Duration (Hours)	Level	Credit
Module 1: Fundamentals of Textile-Reinforced Concrete (TRC)	05:00	3.0	-
Module 2: Textile Reinforcements and Performance Factors	06:00	3.0	-

Module 3: Applications and Construction of TRC Elements	11:00	3.0	-
Module 4: Quality Assurance and Safety Protocols	04:00	3.0	-
Module 5: Sustainability, Emerging Trends, and Cost-Effectiveness	04:00	3.0	-
Total Hours	**30:00**		**1.0**

NOS and Module Details	Theory Duration (hh:mm)	Practical Duration (hh:mm)	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
Module 1: Fundamentals of Textile-Reinforced Concrete (TRC)	02:00	03:00	00:00	00:00	05:00
Module 2: Textile Reinforcements and Performance Factors	02:00	04:00	00:00	00:00	06:00
Module 3: Applications and Construction of TRC Elements	02:00	09:00	00:00	00:00	11:00
Module 4: Quality Assurance and Safety Protocols	02:00	02:00	00:00	00:00	04:00
Module 5: Sustainability, Emerging Trends, and Cost-Effectiveness	02:00	02:00	00:00	00:00	04:00
Total Duration	10:00	20:00	00:00	00:00	30:00

Module Details

Module 1: Fundamentals of Textile-Reinforced Concrete (TRC)

Terminal Outcomes:

- Describe the basic concepts and components of TRC.
- Discuss TRC's benefits and drawbacks versus traditional concrete.

Duration: 02:00	**Duration: 03:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the basic components of TRC. • Explain the properties of textiles used in TRC. • Describe the properties of concrete used in TRC. • Compare the benefits and drawbacks of TRC versus traditional concrete. • Evaluate the overall effectiveness of TRC in different construction applications.	• Demonstrate how to identify suitable textile materials for TRC applications. • Demonstrate how to evaluate the tensile strength of various textile materials. • Demonstrate how to assess the durability of selected textile materials. • Show how to determine the appropriate mix ratio for TRC. • Show how to mix concrete to ensure compatibility with selected textiles.
Classroom Aids:	
Training Kit (Trainer Guide, Presentations), Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements:	
Nil	

Module 2: Textile Reinforcements and Performance Factors

Terminal Outcomes:

- Explain textile reinforcements in TRC and selection criteria.
- Analyze factors affecting TRC performance and longevity.

Duration: 02:00	**Duration: 04:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain how to identify various textile reinforcements used in TRC. • Describe the properties of different textile reinforcements. • Explain the criteria for selecting appropriate textile reinforcements based on project requirements. • Describe the environmental conditions that affect TRC performance. • Explain how to assess the material quality impacting TRC longevity. • Describe how to evaluate the overall performance factors of TRC elements.	• Demonstrate how to select fine-grained aggregates for the concrete mix. • Show how to mix the concrete to achieve a fine-grained consistency. • Demonstrate how to test the concrete mix for effective bonding with textile reinforcement. • Show how to prepare the textile surface for coating application. • Demonstrate how to apply the protective coating to the textile. • Show how to test the adhesion and protection provided by the coating.
Classroom Aids:	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements:	
Scissors/ Rotary Cutters/ Fabric Shears, Rulers/ Tape Measure, Gloves, Safety Glasses, Dust Masks and Safety Boots.	

Module 3: Applications and Construction of TRC Elements

Terminal Outcomes:

- Discuss TRC's diverse construction applications.
- Show the TRC element preparation and forming process.

Duration: 02:00	**Duration: 09:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe the various applications of TRC in construction. • Explain the versatility of TRC in different construction scenarios. • Discuss the effectiveness of TRC compared to traditional materials in specific uses. • Describe the steps involved in preparing materials for TRC. • Explain how to form TRC elements through a step-by-step process. • Describe the final construction steps to complete TRC elements.	• Show how to design formwork to shape the concrete accurately. • Demonstrate how to assemble formwork to accommodate textile reinforcement. • Demonstrate how to position textile layers in the formwork based on design specifications. • Show how to adjust the number of textile layers to meet structural requirements. • Show how to apply the required tension to textiles during installation. • Demonstrate how to adjust textile tension to enhance structural performance and stability. • Demonstrate the process of using Textile-Reinforced Concrete (TRC) to remove carbon footprints in construction projects.
Classroom Aids:	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements:	
Hammer, Saw, Drilling Machine, Screwdrivers, Plywood/ Metal Forms, Mold Release Agent, Level/ Plumb Bobs, Concrete Mixer, Wheelbarrow, Sand Blasting Equipment, Measuring Jars, Digital Weighing Machine, Shovel, Bucket, Trowels, Concrete Vibrator, Gloves, Safety Glasses, Dust Masks and Safety Boots	

Module 4: Quality Assurance and Safety Protocols

Terminal Outcomes:

- Demonstrate quality assessment techniques for TRC.
- Explain safety protocols for handling TRC materials.

Duration: 02:00	**Duration: 02:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe how to perform visual inspections of TRC elements. • Explain the testing methods used to assess the quality of TRC elements. • Describe how to ensure TRC elements meet required standards through assessment techniques. • Describe the safety protocols for handling TRC materials. • Explain the best practices for mixing and handling TRC. • Describe how to maintain a safe working environment when working with TRC materials and mixtures.	• Show how to prepare the concrete mix for casting. • Demonstrate how to pour the concrete to ensure it fully encapsulates textile layers. • Show how to use vibration techniques to remove air bubbles and achieve proper compaction. • Show how to monitor and maintain the recommended temperature and humidity during curing. • Demonstrate the careful removal of formwork to preserve TRC integrity. • Show how to conduct visual inspections and testing methods to verify the TRC element meets specifications and standards. • Demonstrate how to implement safety measures and quality control processes in the application of TRC to ensure compliance with regulatory standards.
Classroom Aids:	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements:	
Level/ Plumb Bobs, Concrete Vibrator, Plastic Sheeting/ Burlap Sacks, Gloves, Safety Glasses, Dust Masks and Safety Boots	

Module 5: Sustainability, Emerging Trends, and Cost-Effectiveness

Terminal Outcomes:

- Discuss TRC's sustainability compared to traditional concrete.
- Discuss emerging trends and cost-effectiveness in TRC.

Duration: 02:00	**Duration: 02:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe the environmental footprint of TRC materials. • Explain the recycling potential of TRC compared to traditional concrete. • Explain the latest trends in TRC materials and technologies. • Describe recent research findings in TRC and their potential applications. • Explain the material costs associated with TRC. • Describe the labor requirements for TRC installation. • Discuss the long-term maintenance benefits of TRC compared to conventional methods.	• Show how to integrate recyclable materials into TRC production. • Demonstrate how to reduce carbon footprint in the production process. • Show how to apply new reinforcement methods in TRC. • Demonstrate the use of advanced materials and innovative design methodologies to enhance TRC performance.
Classroom Aids:	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements:	
Nil	

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training/Assessment Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
M.Sc./ M.Tech/ M.E.	Civil Engineering	2	TRC (Textile-Reinforced Concrete) / Construction	1	TRC (Textile-Reinforced Concrete) / Construction	
B. Tech.	Civil Engineering or Material Science	4	TRC (Textile-Reinforced Concrete) / Construction	1	TRC (Textile-Reinforced Concrete) / Construction	
Diploma	Civil Engineering	5	TRC (Textile-Reinforced Concrete) / Construction	1	TRC (Textile-Reinforced Concrete) / Construction	

Trainer Certification	
Domain Certification	**Platform Certification**
Certified in ToT for MCr: Introduction to Textile Reinforced Concrete (TRC) mapped to MCr Code: TIOCES/MCr-0001, v1.0". Minimum accepted score is 80%.	Recommended that the Trainer is certified for the Job Role: "Trainer (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2601, v2.0". Minimum accepted score is 80%.

Assessors Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training/Assessment Experience**		**Remarks**
		Years	**Specialization**	**Years**	**Specialization**	
M.Sc./ M.Tech/ M.E.	Civil Engineering	2	TRC (Textile-Reinforced Concrete) / Construction	1	TRC (Textile-Reinforced Concrete) / Construction	
B. Tech.	Civil Engineering or Material Science	3	TRC (Textile-Reinforced Concrete) / Construction	1	TRC (Textile-Reinforced Concrete) / Construction	
Diploma	Civil Engineering	4	TRC (Textile-Reinforced Concrete) / Construction	1	TRC (Textile-Reinforced Concrete) / Construction	

Assessor Certification	
Domain Certification	**Platform Certification**
Certified in ToA for Job Role: MCr: Introduction to Textile Reinforced Concrete (TRC) mapped to MCr Code: TIOCES/MCr-0001, v1.0". Minimum accepted score is 80%.	Recommended that the Assessor is certified for the Job Role: "Assessor (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2701, v2.0". Minimum accepted score is 80%.

Assessment Strategy

This section includes the processes involved in identifying, gathering, and interpreting information to evaluate the Candidate on the required competencies of the program.

1. Assessment System Overview:

- Batches assigned to the assessment agencies for conducting the assessment on SIDH
- The batch allocation Matrix prepared for each month based on previous months' performance of AAs, which determines the quantum of Assessment which can be allocated to each AA for a month
- Post allocation of assessment, Assessment agencies send the assessment confirmation to AB
- Assessment agency deploys the ToA certified Assessor for executing the assessment
- AB monitors the assessment process.

2. Testing Environment:

- A combination of Theory and practical/demonstration test is deployed to assess knowledge and Skill respectively of Learners.
- Assessment is conducted at Training center in in-person/offline mode
- For Skill assessment, environment is simulated to create a realistic Working Environment that should replicate the key features of the workplace. In job roles, where it is difficult to replicate the same, the OJT assessment is implemented.
- During the practical task, trainees are assessed on their workmanship, quality of finished product, time management, etc., based on the performance criteria (PC), knowledge and understanding and their professional and soft skills as specified in the qualification pack.
- Knowledge assessment is done through closed ended questions up to level 4 and from level 5 onwards, it is mixture of open ended and closed ended questions

3. Assessment Quality Assurance levels/Framework

- Assessment criteria are developed for each QP which acts as a guide for developing question set /banks
- Sample questions aligned with Assessment criteria for each QP are developed by AB and validated by industry
- Taking reference of Assessment criteria and Sample Questions, AAs create the question bank which is further validated by AB
- Questions are mapped to the specified assessment criteria
- It is mandatory that Assessor and Trainer must be ToA certified & ToT Certified respectively
- Continuous Monitoring through virtual and In-person mode are conducted to ensure the

assessment is conducted as per stipulated process

- Process and Technical audit of assessment batches by quality team are conducted to avoid the errors in assessment process
- A well -defined comprehensive framework of NON-COMPLIANCE MATRIX is defined and implemented to identify the non-compliance made by assessor and AA and punitive actions are taken correspondingly.
- The capacity building sessions are conducted regularly for assessors and assessment agencies to update them about best practices in assessment

4. Types of evidence or evidence-gathering protocol:

- Post Assessment, the evidences are uploaded by Assessor to assessment agency and further assessment agency to AB as per stipulated TAT
- Evidences are broadly the photographic and video graphic in nature
- Assessment agencies upload the evidence on SIP and detailed evidence on AB digital platform
- Evidences are; NOS wise-Geotagged photographs and videos of Theory Test &Practical Tasks, Attendance sheet, result summary sheet, group photographs.

5. Method of verification or validation:

- The process and technical audit of assessment batches are done by AB
- Attendance of each candidate is verified and it is ensured that only those candidates are assessed by assessors who are meeting the stipulated minimum percentage of attendance
- The result of each candidate is verified, it is verified that that result on SIP are matching with respect to summary sheet submitted by AAs
- Under detailed technical audit for sample of batches, the knowledge and skill assessment results for each candidate is checked in technical aspect.
- All the evidences of batches are preserved on server of AB digital platform

References

Glossary

Term	Description
Declarative Knowledge	Declarative knowledge refers to facts, concepts, and principles that need to be known and/or understood to accomplish a task or to solve a problem.
Key Learning Outcome	The key learning outcome is the statement of what a learner needs to know, understand, and be able to do to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory), and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on-site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on-site.
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work or produce a tangible work output by applying cognitive, affective, or psychomotor skills.
Training Outcome	Training outcome is a statement of what a learner will know, understand, and be able to do upon the completion of the training.
Terminal Outcome	The terminal outcome is a statement of what a learner will know, understand, and be able to do upon the completion of a module. A set of terminal outcomes helps to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
QP	Qualification Pack
NSQF	National Skills Qualification Framework
NSQC	National Skills Qualification Committee
NOS	National Occupational Standards
Hrs	Hours
MS	Microsoft
PPT	PowerPoint Presentations
AI	Artificial Intelligence
SIDH	Skill India Digital Hub
ToA	Training of Assessor
ToT	Training of Trainer
TRC	Textile-Reinforced Concrete