



# **EFNARC Nozzleman Certification Scheme**

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## **EFNARC C2**

### **Training and Certification Plan**

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## Definitions

**EFNARC C2:** The certificate obtained if an individual complies with the requirements in this document.

**EFNARC C2 Course:** The course that individuals need to attend and pass in order to live up to the requirements to obtain an EFNARC C2.

**Modules:** Different parts and activities included in an EFNARC C2 Course, and required in order to obtain an EFNARC C2.

**Examiner:** A person that is an EFNARC Certified Nozzleman Examiner and is certified by EFNARC to teach at EFNARC C2 Courses.

**Course provider:** An organisation that organises an EFNARC C2 Course. The teaching must however, unless specified in this document, be conducted by an Examiner.

**Employer:** An employer to an individual/s going through an EFNARC C2 Course.

**VR-simulator:** A sprayed concrete virtual-reality simulator used in an EFNARC C2 Course.

**Simulator provider:** An organisation that owns rights to and has units of a VR-simulator that is being used in an EFNARC C2 Course.

**Instructor:** A person, independent from the Employer, assigned by the Course provider or Examiner, who supervises the virtual training and assessment and/or theory exams during an EFNARC C2 Course.

<b>1. Introduction</b>	<b>3</b>
<b>2. Training plan</b>	<b>4</b>
2.1 Aim and execution	4
2.2 Attendee prerequisites and registration	4
2.3 Modules	4
2.4 Training provider accreditation	7
<b>3. Certificate</b>	<b>8</b>
3.1 Obtain the certificate	8
3.2 Certificate validity time	8
3.3 Transfer an EFNARC Nozzleman Certificate to an EFNARC C2	9
3.4 Renewing the certificate	9
3.5 Issue certificate	9
3.6 Price	9
<b>Attachment 1 - Practical session form</b>	<b>11</b>
<b>Attachment 2 - Example document</b>	<b>12</b>
<b>Attachment 3 - VR-simulator specification</b>	<b>13</b>

## 1. Introduction

EFNARC's Nozzleman Certification Scheme was introduced in 2009 in order to set up a qualification for sprayed concrete operators i.e. Nozzlemen. The scheme is based on the training of certified Examiners that managed the assessment of individual Nozzlemen who, after successfully passing the assessment, is awarded an EFNARC Nozzleman Certificate. The EFNARC Nozzleman Certification scheme was endorsed by the International tunnelling and Underground Space Association (ITA). To date, over 500 individuals have been certified.

Under this scheme, individuals were required to complete a theory test, a practical live spraying assessment, and have at least three (3) years of work experience - spraying concrete. The EFNARC Nozzleman Certificate has, therefore, never involved any form of standardised training. Instead it served simply to facilitate the standardised assessment of already experienced operators.

Given the fast development of modern robotic spraying equipment and new purpose tailored mix designs, continuous training is vital in sprayed concrete operations, regardless of whether spraying is conducted by a novice operator or an experienced Nozzleman. The EFNARC C2 has therefore been established to create a standardized qualification framework that combines both training and assessment.

As robotic sprayed concrete is increasingly being used in tunnelling and mining operations globally, the industry needs to attract new talent and provide means for novice operators to be trained and become certified as future Nozzlemen. EFNARC C2 was therefore established to address these growing needs and to promote the EFNARC standard in projects around the world.

The EFNARC C2 also incorporates the latest Virtual-Reality "VR" technology for training and assessment. Using this technology is very efficient, cost effective, and above all ensures a safe training environment. The use of VR enables a clear and objective assessment of individual's performance. EFNARC C2, therefore, maintains consistent grounds of objective assessment for all operators. EFNARC also cooperates with VR training providers to continuously ensure closeness to reality and best practice examples.

The EFNARC C2 is intended to work as a good complement to the existing Nozzleman Certificate and assessments and will fulfil a lot of the needs required by today's tunnelling clients and mining companies around the world.

## **2. Training plan**

### **2.1 Aim and execution**

The aim of the EFNARC C2 Course is to equip novice and experienced Nozzlemen with the necessary knowledge and skills to perform safe, high quality, efficient and cost effective robotic concrete spraying. This will be obtained by EFNARC facilitated training courses including theoretical, virtual and practical elements, involving teaching by professionals with vast experienced from the industry in combination with objective assessments by VR-simulators. Ultimately, the course attendees shall be enabled to practically achieve highest standards in concrete spraying.

### **2.2 Attendee prerequisites and registration**

There are no prerequisites for individuals before attending an EFNARC C2 Course. A basic understanding about underground construction works, machine operations, related risks and concrete technology is advantageous.

The Examiner or Course provider arranging the EFNARC C2 Course shall require a valid identification (e.g. ID-card or passport) and should note at least name, date of birth and nationality of all attendees. The information shall be noted in an attendance list on behalf of EFNARC to execute the issuing of certificates for any of the attendees.

Examiners and Course providers shall be responsible for their own handling of attendees' personal data. Examiners and Course providers shall furthermore guarantee that the handling and transferring of data to EFNARC is performed in accordance with EFNARC's intended purpose of being able to issue, document and oversee personal certificates. Examiners, Course providers and EFNARC also commit to collaborate and, to a reasonable extent, assist one and another around ensuring that international and national data protection regulations and laws are followed.

### **2.3 Modules**

In order to obtain an EFNARC C2 individuals need to pass four (4) Modules included in an EFNARC C2 Course, as well as show that the individual has at least forty (40) days of work experience (Module 5).

The EFNARC C2 Course consists of five (5) days and requires at least forty (40) days of work experience, hence a novice operator may achieve an EFNARC C2 after a total of forty-five (45) work days (i.e., nine weeks) at the earliest. The table below depicts a summary of various modules, days and duration of the entire training. Though all the below EFNARC C2 Course modules are mandatory, the modules can be completed in any order.

## EFNARC C2 - Training and Certification Plan

	<b>EFNARC C2 Course</b>				
<b>Module</b>	1	2	3	4	5
<b>Description</b>	Theory session	Theory exam	Virtual training and assessment	Practical session	Work experience
<b>Duration</b>	Approx. 1 day	Approx. 1 hour	Approx. 3 days	Approx. 1 day	
<b>Day</b>	Day 1	Day 5	Day 2-4	Day 5	
	<b>5 days</b>				<b>&gt;40 days</b>

### 2.3.1 Module 1 - Theory session

An Examiner must hold a classroom lecture including a keynote presentation.

The lecture shall include the following subjects covered during the minimum specified time frame:

<b>Subject</b>	<b>Min. time</b>	<b>Material supplied by</b>
Concrete technology	60 min	EFNARC
Spraying equipment	30 min	EFNARC
Designer expectations	30 min	EFNARC
Application	30 min	EFNARC
Surface finishing and curing	30 min	EFNARC
Standards and testing	60 min	EFNARC
Safety, health and environment	60 min	EFNARC
Local and national rules and regulations for sprayed concrete	According to need	Examiner / Course provider
Q&A	According to need	

### 2.3.2 Module 2 - Theory exam

## EFNARC C2 - Training and Certification Plan

An online theory examination consisting of 30 multiple-choice questions. Individuals must correctly answer at least twenty-six (26) of the thirty (30) questions to attain a pass mark on the exam. The questions will be categorised into chapters and all questions relating to health and safety have to be correct to attain a pass mark.

The online exam can be accessed via a website assigned by EFNARC or can be done in writing by requesting unique exams from EFNARC that are supplied digitally for printing. EFNARC may charge a processing fee for the online exam or the issuing of exams to be printed. The theory examination includes randomly selected questions from the EFNARC database. In this respect, each exam following a specific EFNARC C2 Course is unique.

All examinees, of either written or online exams, shall be supervised by an Examiner or Instructor. Examiners or Instructors are not permitted to offer or provide any assistance related to answering exam questions. However, participants with learning difficulties may have the questions read to them verbally by the Examiner or Instructor.

The Module 2 Theory exam can be attained in multiple languages, including English, Spanish and German. Additional languages can be added upon specific request with a minimum lead time of four (4) weeks. EFNARC may charge a fee for the creation of additional language versions.

### 2.3.3 Module 3 - Virtual training and assessment

The virtual training and assessment shall be performed by individuals passing minimum ten (10) specified scenarios on a concrete spraying VR-simulator, certified by EFNARC (see heading 2.4.2). All attendees shall be granted at least twenty-four (24) hours to pass the training and assessment. Up to two (2) attendees may share one (1) VR-simulator. There are no maximum time limits to perform the Module 3 - the only set criteria is to pass the specified scenarios.

The virtual training and assessment must always be supervised by an Examiner or Instructor in order to ensure that the intended individuals are actually performing the training and assessment themselves. Aside from providing verbal instructions, Examiners or Instructors are not permitted to assist attendees during the training and assessment.

The results and data from the training and assessment shall be accessible online by EFNARC.

### 2.3.4 Module 4 - Practical session

An Examiner must hold a practical session using a robotic spraying equipment and sprayed concrete with a commonly used mix design. The session can be held for maximum eight (8) attendees and shall include the following activities, demonstrated during the specified minimum time frame:

<b>Activity (demonstrated by the Examiner)</b>	<b>Min. time</b>
Pre-application checking	30 min
Startup procedure	30 min
Application procedure	30 min
Shutdown procedure	30 min
Troubleshooting and problem solving	15 min
Health and safety	45 min

On completion of the demonstration, each attendee shall demonstrate that they can carry out the activities safely and correctly. This may be done within a group, as long as it enables the Examiner to evaluate all attendees. All attendees shall however spray a test panel each. The test panel shall be according to EN 14488-1, or another standard applicable where the EFNARC C2 Course is held.

The Examiner shall document each attendee by filling in the form, see Attachment 1 - Practical session form.

### 2.3.5 Module 5 - Work experience

Each individual is required to demonstrate that they have at least forty (40) days of robotic concrete spraying experience. The individual does not need to have any work experience before attending an EFNARC C2 Course. However, having work experience is mandatory part of obtaining an EFNARC C2. An example of a document that provides all the necessary information that demonstrates the experience can be seen in Attachment 2.

## **2.4 Training provider accreditation**

### 2.4.1 Teaching

All instructions shall be provided by an EFNARC C2 certified examiner and shall be in line with the detailed aspects of the EFNARC Nozzleman Certification Scheme. Instructors may be responsible for parts of an EFNARC C2 Course in line with what has been previously specified in this document.

Examiners can be certified just by registering with EFNARC if they attended their examiner's course during or later than 2016. Examiners that attended their examiner's course earlier than

2016 need to show records demonstrating that they have performed at least three (3) Nozzleman assessments before May 2019, or else they will have to retake the examiner's course or attend an equivalent one offered by EFNARC.

#### 2.4.2 VR-simulator

The VR-simulator used in Module 3 shall be certified by EFNARC. This can be achieved by a Simulator provider demonstrating to EFNARC that:

- the VR-simulator has minimum ten (10) predefined scenarios that, together with rest of the technology, fulfil the specification in Attachment 3.
- the VR-simulator is recognised by five (5) EFNARC Examiners, representing at least three (3) different companies, to
  - i) fulfil the specification in Attachment 3 and
  - ii) is suitable as a training and assessment tool for Nozzlemen.
- the VR-simulator can be adapted to include specific procedures requested by EFNARC.
- ten (10) individuals have gone through the training and assessment with the VR-simulator in accordance to the specification in Attachment 3. The training and assessment records shall show that all ten (10) have taken more than eight (8) effective hours on them to complete the scenarios, consuming at least forty (40) m<sup>3</sup> sprayed concrete.
- an independent body like e.g. a university has performed a study demonstrating that the VR-simulator has an acceptable level of validity.

### **3. Certificate**

#### **3.1 Obtain the certificate**

In order to obtain an EFNARC C2 individuals need to demonstrate that they have gone through and passed Modules 1-4 and have the required work experience (Module 5). The Examiner or Course provider arranging an EFNARC C2 Course shall hence keep records of all attendees that have gone through Modules 1-4 and have those records, upon a request of a certificate, available to EFNARC.

#### **3.2 Certificate validity time**

An EFNARC C2 is valid for five (5) years.

#### **3.3 Transfer an EFNARC Nozzleman Certificate to an EFNARC C2**

Individuals that currently have gone through a Nozzleman Assessment and have a valid EFNARC Nozzleman Certificate can also obtain an EFNARC C2 by going through and passing Modules 2-3, as well as showing documentation demonstrating Module 5. No other certificates

or qualifications can be transformed into an EFNARC C2 nor accelerate the process of obtaining it.

### **3.4 Renewing the certificate**

Individuals requesting renewal of an EFNARC C2 need to demonstrate that they have re-done Modules 2-4.

### **3.5 Issue certificate**

Examiners or Course providers shall contact EFNARC or an assigned body in order to request the issuing of an EFNARC C2 to an individual. EFNARC will then evaluate the provided records that shows that the individual has passed all required Modules.

EFNARC requires that the following are supplied and correct upon issuing an EFNARC C2:

- Module 1 eligibility: a digital copy of- or an online attendance list.
- Module 2 eligibility: a digital copy of a written test or the results from an online test showing minimum twenty-six (26) correct answers, where all of the questions relating to health and safety are correct.
- Module 3 eligibility: results and training and assessment data that shows that all necessary scenarios are passed.
- Module 4 eligibility: digital copy of the Practical session form.
- Module 5 eligibility: a digital copy of a document demonstrating proper and minimum required experience.

EFNARC will request payment for a certificate and upon receiving it, issue a stamped version of an EFNARC C2 and send it to the requested address or by email.

### **3.6 Price**

The price for attending an EFNARC C2 Course are individually set by Examiners or Course providers that offer the course.

The price for issuing or renewing an EFNARC C2 is set yearly by EFNARC's Executive Committee. The price for an EFNARC C2 (when this document version was written) is 300.00 EUR.