

Technical Specification

**Transport and Main Roads Specifications
MRTS55 Use of Explosives in Roadworks**

July 2017

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1 Introduction

This Technical Specification describes the requirements for the use of explosives in the construction of road infrastructure Works.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*. Further definitions are defined in Table 2.

Table 2 – Definition of terms

Term	Definition
ANFO	Ammonium nitrate - fuel oil mixture used as explosive.
blast	An explosion which results in the loosening or breaking up of material.
blasting mat	A mat made of rope, rubber strips, polyethylene tube or similar material, placed over a blasting area to prevent blast-generated debris from being scattered.
blasting operations	The drilling, charging and firing operations associated with the blast.
blasting site	The area within the Site where blasting operations occur, together with the immediate surrounding area.
charging	The act of placing explosives in the desired position for firing.
explosive works	The work of manufacturing, handling, transporting and storing explosives, and carrying out the blasting operations.
firing	The act of initiating explosives.
flyrock zone	The zone in which there is a chance of material (eg rock) projectiles occurring as a result of blasting.
misfire	A charge or part of a charge which has failed to explode or ignite.
shotfirer	An authorised person whose responsibility includes preparing, charging and firing explosives. Such person shall hold an appropriate current Queensland Shotfirer's Licence.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AS 2187.1	<i>Explosives – Storage, Transport and Use – Storage</i>
-	National Association of Australian State Road Authorities <i>Explosives in Roadworks – User Guide</i>
-	<i>Queensland Explosives Act and Regulations</i>
-	<i>Queensland Manual of Uniform Traffic Control Devices</i>

4 Liaison with local governments

Prior to the commencement of the explosive works, the following details shall be checked with the relevant Local Government, Police and other emergency service authorities:

- a) permit requirements
- b) permitted hours of blasting
- c) prohibited methods of blasting
- d) the type and maximum amount of explosive per blast
- e) supervision requirements
- f) flyrock control
- g) traffic control
- h) safety requirements
- i) misfire procedure, and
- j) public liability insurance requirements.

The Contractor shall supply the Administrator with a copy of any permit prior to undertaking any blasting. **Hold Point 1**

5 Quality system requirements

5.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5 of MRTS01 *Introduction to Technical Specifications*.

The Hold Points and Milestones applicable to this Technical Specification are summarised in Table 5.1. There are no Witness Points defined.

Table 5.1 – Hold Points and Milestones

Clause	Hold Point	Witness Point	Milestone
4	1. Blasting permit to Administrator		
5.2	2. Explosives handling procedure		Submission of explosive handling procedures (14 days)
11	3. Blasting details		

5.2 Construction procedures

The Contractor shall prepare documented procedures as defined in Clause 5 of MRTS50 *Specific Quality System Requirements* for the handling of explosives.

Procedures shall be submitted to the Administrator not less than 14 days prior to the date when explosives are first to be brought onto the Site. **Milestone** Explosives shall not be brought onto the Site until the Administrator has deemed the procedures suitable. **Hold Point 2**

5.3 Personnel

The Contractor shall, at all times during blasting operations, employ on the blasting site the necessary experienced personnel required by the Act.

6 General safety precautions

All precautions necessary to prevent injury to persons and / or damage to property occurring as a result of explosive works shall be taken with particular regard to:

- a) Ensuring that all persons working within or entering the blasting Site:
 - i. wear safety helmets and high visibility safety clothing, and
 - ii. are fully informed as to what other safety precautions are necessary and the extent of the possible flyrock zone.
- b) Ensuring that firing does not take place until all persons other than the shotfirer have retired from within the flyrock zone to a place of safety, and an approved sequence of warning siren signals has been sounded.
- c) Having in place a system of communication between the shotfirer and other personnel including the Site supervisor and traffic controllers, which system shall be effective during the period from the sounding of the first firing warning siren signal to the sounding of the all clear signal.
- d) Providing an approved shotfirer's shelter which is safely positioned in relation to the blasting site, and ensuring that such shelter is used by the shotfirer at all times when testing electric circuits and when firing.
- e) Where the flyrock zone is accessible to the general public, ensuring that job personnel are stationed outside the flyrock zone, at all accesses, to warn persons of the impending blast and to prevent them from approaching closer than safety permits.
- f) Advising all persons on adjacent lands of impending blasting operations well in advance of each blast (which advice shall include the signals to be used during blasting operations), and ensuring that such persons shall not be exposed to any danger or their property damaged as a result of the blasting operations.
- g) Ensuring that buildings located adjacent to the blasting site are not subjected to excessive vibrations or other damaging effects of blasts by taking measurements and carrying out the inspections specified in Clause 7.
- h) Employing blasting mats if there is any possibility of injury to persons or damage to property resulting from flyrock, and
- i) Where traffic is permitted to pass through the blasting site, employing appropriate signs as listed in the Queensland *Manual of Uniform Traffic Control Devices* to control its movements.

7 Measurements, inspections and records

Inspections of buildings and structures shall be carried out in any area where the maximum peak particle velocity from a blast generated ground vibration is likely to exceed 5 mm/s or the subsequent airblast is likely to exceed 120 dB. Such inspections shall be carried out before and after blasting operations.

Measurements shall be taken of the ground vibration and airblast for each blast at a point in close proximity to the nearest buildings or structures.

Records shall be kept of all inspections and the ground vibration and airblast measurement information for each blast.

8 Manufacture of ANFO explosive

ANFO explosive shall not be manufactured on the Site unless a current Queensland licence for such manufacture has been obtained. Such licence shall be made available to the Administrator for inspection prior to commencement of manufacture of ANFO explosive.

The intended method of mixing ANFO explosive shall be submitted to the Administrator for approval prior to the commencement of blasting operations. Mix-in-bag methods shall not be used.

Prilled ammonium nitrate shall be used in the manufacture of ANFO explosive. Commercial grades of ammonium nitrate shall not be used.

An approved oil soluble dye shall be added to the fuel oil to visibly prove the efficacy of the mixing method.

ANFO explosive shall be mixed daily as required. Unused ANFO explosive shall not be stored on the Site overnight. The unused ANFO explosive shall be either removed from the Site or otherwise disposed of.

9 Storage facilities

Explosives shall be stored in accordance with the provisions of the current *Queensland Explosives Act* and Regulations and AS 2187.1.

Explosive magazines shall be of a standard not less than that specified in AS 2187.1.

Ammonium nitrate storage sheds and diesel oil storage facilities shall be separated in such a way as to prevent the contact of the two materials through spillage or leakage and shall be sited far enough away from the blasting site, and far enough apart to avoid dangerous situations occurring from the impact of flyrock and / or from fire, storm or accident.

10 Shotfirer and assistants

Blasting operations shall be supervised by a shotfirer.

The shotfirer shall hold a current Queensland Shotfirer's Licence which shall be submitted for sighting by the Administrator prior to commencement of the explosives Works.

The shotfirer shall be on the Site at all times during blasting work and shall carry out the charging and firing operations.

All persons assisting the shotfirer shall be experienced in the handling of explosives and trained in their use in roadworks. Unless such assistants hold an appropriate current Shotfirer's Licence, they shall not handle primed charges, make any connections to blasting circuits or carry out any firing.

11 General blasting requirements

The Contractor shall make provision for:

- a) Measurement of vibration and air blast at three separate locations at each blasting Site.

- b) Minimising the effect of blasting by:
 - i. using the lowest charge appropriate to the task
 - ii. reducing the number of holes fired on the same delay
 - iii. delaying secondary blasts
 - iv. reducing the maximum instantaneous charge by using delays with sequential timing
 - v. optimising the length of sub drilling by using air blast and vibration data previously obtained on the Site
 - vi. stemming blast holes with suitable material, and
 - vii. using low energy detonating cord.
- c) Taking into account the matters set out in Clause 9.4.6 of the National Association of Australian State Road Authorities publication *Explosives in Roadworks – User Guide* in relation to minimising the effect of noise and airborne shock waves.

Prior to the commencement of blasting operations, the Administrator shall be presented with details of the proposed drilling patterns, hole charges and methods of blasting, details of safety precautions in accordance with Clause 6 and the program for drilling, charging and firing the blast. **Hold Point 3**

A limited test blast shall be carried out to assess the adequacy of the proposals in respect of:

- a) compliance of the rock fragments with requirements of the Technical Specification, where applicable
- b) the magnitude of vibrations and other possible damaging effects, and
- c) flyrock control measures.

If, in the opinion of the Administrator, the results of the test blast (or any subsequent blast) are not satisfactory, the blast design shall be amended to produce results which the Administrator considers satisfactory.

The blasting operations shall be such that the material below the subgrade, the road batters and other adjacent sections of the Works are left in a stable condition.

Adequate steps shall be taken to avoid excessive blasting and over break.

12 Detailed operational requirements

Free face methods of blasting shall be employed.

If dry drilling of holes, with air flushing, is employed, an effective system of extracting and collecting the dust shall be employed.

Wet drilling of holes may be employed provided that, where ANFO explosive is to be used, measures are taken to protect the ANFO explosive charge from water penetration.

Explosive materials shall not be left distributed indiscriminately about the Site.

Charging of holes shall not commence unless it is practicable to complete the charging and firing on the same day.

Pneumatic loading of ANFO explosive shall not be employed.

Crushed rock ranging in size from 6 mm to 10 mm or other approved fine material shall be used for stemming holes. Coarse aggregate material shall not be used.

Wooden rods only shall be employed for tamping, and for positioning explosives within holes.

Prior to carrying out any blast, offset reference pegs (or other approved markers) shall be placed to delineate the extent of the blast pattern. The actual location, depth, slope, stemming depth, explosives loaded and detonation sequence used for each hole in the blast shall be recorded.

In all blasting operations, a free face (vertical or near vertical) shall be established and maintained. The face shall be free of toe rock and shall have a definite line of intersection with the floor.

Holes shall be drilled at a slope generally parallel to the free face when established.

The Contractor shall employ blasting mats for all blasting operations.

13 Charging / firing requirements

The proposed method of firing shall be included in the blast design required under Clause 11. Unless Local Government By-laws or other conditions dictate otherwise, the preferred method of firing is non-electric. Such non-electric firing shall be effected by means other than the use of a safety fuse.

If electric firing is to be used, the following requirements apply:

- a) The following equipment shall be on site and in good working order during blasting operations:
 - i. a standby exploder
 - ii. a blasting circuit tester, and
 - iii. a rheostat or fusion tester.
- b) When not laid out for use, shotfiring cable shall be wound on a shotfiring cable reel, and
- c) Prior to firing, the shotfirer shall:
 - i. test the operation of the exploder and the continuity of the shotfiring cable, which testing shall be carried out in an area remote from the blasting Site, and
 - ii. test the completed blasting circuit from the safety of the shotfirer's shelter, due precautions having been taken to ensure that all persons have retired from within the flyrock zone to a place of safety.

14 Delayed blast firing

If firing of charged holes is delayed such that, on the day concerned, firing cannot take place during the permitted hours or any extension of those hours agreed to by the Local Government and approved by the Administrator, the following arrangements shall apply:

- a) a responsible person shall be left in attendance at the blasting Site until such time as the firing can take place
- b) sufficient warning signs, red flags and lighting shall be provided for the benefit of persons entering the vicinity of the blasting Site
- c) the charged holes shall be protected so that they cannot be tampered with by any person, and
- d) the Administrator shall be notified of the situation as soon as possible and advice shall be given as to what action has been taken in regard to the delay.

15 Misfires

Should a misfire occur, an appropriate system of signs and red warning flags shall be erected at all accesses to the flyrock zone.

Unauthorised persons shall not be allowed to enter the blasting site until the reasons for the misfire are ascertained, corrective measures have been carried out, and the blast successfully fired.

In the event of any single misfire event, blasting accident, delay to traffic of more than the specified period or if the performance criteria for construction noise, vibration or air quality which relate directly to blasting activities on Site are exceeded, the Contractor shall immediately cease blasting activities until such time as the Administrator has investigated the incident and provides the Contractor with permission to proceed.

16 Blasting accidents

Should a blasting accident occur, which results in injury or death to persons or damage to property, the scene of the accident shall not be interfered with in any way unless it is to save life, relieve suffering, or prevent further damage to property.

As soon as possible after the accident has occurred, the following persons shall be advised of the occurrence and the extent of the accident:

- a) the Administrator
- b) the Chief Inspector of Explosives
- c) the chief executive for the Division of Workplace Health and Safety, as required under the current Workplace Health and Safety legislation
- d) the Officer-in-Charge of the nearest Police Station, and
- e) the Authorised Officer of the Local Government (if such an officer has been nominated by the Local Government).

