Civil Infrastructure Interface Management Plan

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Contents

1.0 Introduction and Background

The requirement for an Infrastructure Interface Management Plan is stated within the Interfaces Management Plan document reference SYS-PLANS/1407021 approved 26th November 2014. That document identifies and characterises the interfaces between CTA Products and describes the approval process and identifies roles and responsibilities in those responsibilities. External interfaces between the CTA and the outside world e.g. connection to the grid are beyond its scope.

To date a lot of work has been done by INFRA PO on establishing and identifying the interfaces during 2014 and 2015 and the various WPs have provided much of the detail required by INFRA. However, several years have passed since establishing the interface data base and much more is known about the project and further details are inevitably required by INFRA to complete their designs.

From a recent review of the Interface Control Database (ICD) and from the results of a questionnaire sent to the telescope teams regarding interfaces revealed the need for further work in several areas to establish accurate design information. The ICDs are to be updated by INFRA to include the current information required using the process previously established.

Sections 2 and 3 below describe the Identification and Approval Process and Section 4 the SharePoint Implementation Process.

2.0 Identification Process

The CTA will put forward a list of top level interfaces that need to be characterised between two CTA products.

The CTA PO are responsible for identifying and listing the top-level interfaces and the Management clearly defines these as three types:

- Logical-interfaces related to online data transfer
- Responsibility interface (physical or software)
- Information-only

All the parameters that define each interface will be considered specifications and shall be included the baseline design of the involved parties

Once the Interfaces have been identified the Product Systems Engineers will provide a list of interfaces to/from their Products to all parties (PO and other Product) using the Interface Database on Sharepoint under a preliminary label.

3.0 Approval of Interfaces

An interface shall be approved once all parties directly involved have approved both its existence and characterisation. The WP systems engineers will indicate they have approved their own side of the interface, and once approved is gained from all parties the CTA Po will change the interface approval status to Approved involving the Project Committee. Until an interface is approved, it will be considered strictly as a working document and no information on its characterisation will be considered fact.

4.0 SharePoint Implementation Process

All processes described above will be implemented on the Interface Control Database on SharePoint. The ICD is a repository that contains all the parameters that characterise all the top level interfaces and is accessible to all CTA members. The data base can be found within CTA Project/Systems Engineering. The CTA PO owns the database and is responsible for maintaining it. The process of adding a new item to the list and stating is approval can be found in the Interface Management Plan is fully described in Section 1.0 of this document.

It is envisaged that the database will be transferred on the CTAO JAMA system.

5.0 Definition of an Interface [1]

An Interface is the boundary where two independent systems interact. Normally something needs to be exchanged. To do this efficiently an agreement is necessary which is accepted on both sides. It comprises the position of the interface, the items to be exchanged and the requirements which have to be respected on either side.

6.0 Definition of an Interface Document [1]

An interface document is a precise and complete list of what was agreed. It needs a date, the responsible persons on both sides and the person who takes care of the installation of the agreed interface specification.

7.0 Acronyms

CAT – Camera Access Tower
CTAN – Cherenkov Telescope Array North
CTAS – Cherenkov Telescope Array South
CTAO – Cherenkov Telescope Array Observatory
CP- Cable Pit (or Cable Turning Pit)
HD Bolts – Holding Down Bolts
ICD – Interface Control Database
INFRA – CTAO Infrastructure
LST – Large Sized Telescope
MH- Manhole
MST – Medium Sized Telescope
RC –Reinforced Concrete
SST – Small Sized Telescope
SAS – Systems and
SE – Systems Engineering

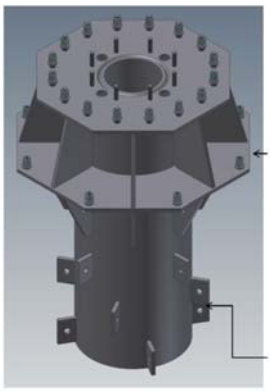
8.0 Interface Identities

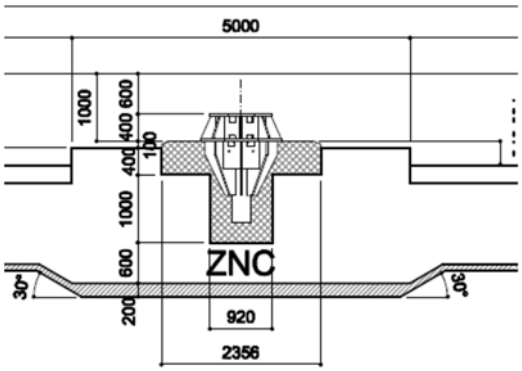
As an aid to understanding the level of information required by INFRA, produced in this section is a summary of typical interfaces for CTAN and CTAS. The listing is not exhaustive and should be used as a guide. A full and comprehensive list of product inputs and outputs are those contained in SharePoint and can be found under Systems Engineering >Interface management>Interface Database

8.01 LST Central pin

Interface – Mechanical connection between the steel sectioned central pin of the scientific instrument and the foundation.

- Infra require the magnitude and direction of design forces to be resisted by the foundation at base plate level.
- Infra require details of HD Bolts and type to include set-out and number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require full details of the base plate, its elevation and grouting or concreting requirements
- Infra require information on bolting requirements i.e. are bolts site-drilled resin anchor type bolts or cast in-situ.
- Infra to provide civil design calculations, specification and detailed drawings for the foundation considering fully the needs of the CTAO Requirement statements.
- Infra to provide detailed reinforcement plan indicating proposed bolt set-out.

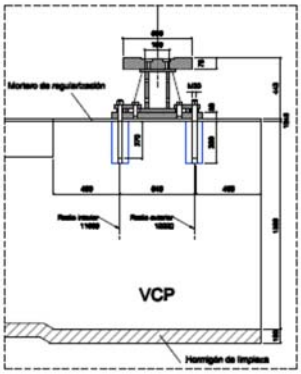


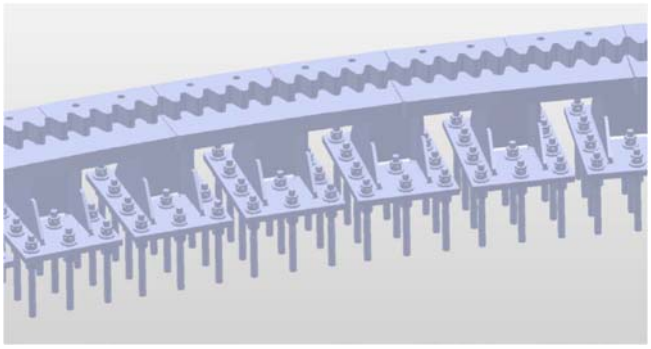


8.02 LST Bogie Rail

Interface – Mechanical connection between the bogie rail and the foundation is made using a complex series of bolts and plates.

- Infra require the magnitude and direction of the design forces to be resisted by the foundation at base plate level.
- Infra require full details of HD Bolts to include type, set-out, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require a comprehensive drawing indicating HD Bolt set out.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by LST bogie rail installation contractor.
- Infra to provide civil design calculations, specification and detailed drawings for the foundation considering fully considering the needs of the CTAO Requirement statements.
- Infra to provide a detailed reinforcement plan indicating proposed bolt set-out.
- The grouting work will be carried out by the Civil Contractor under the construction contract.

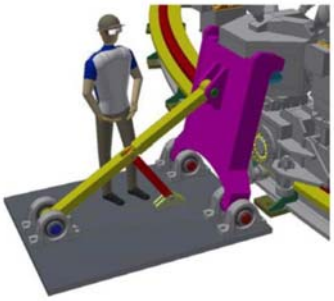




8.03 LST Azimuth Locking System

Interfaces – Mechanical connection between the clamp and the foundation.

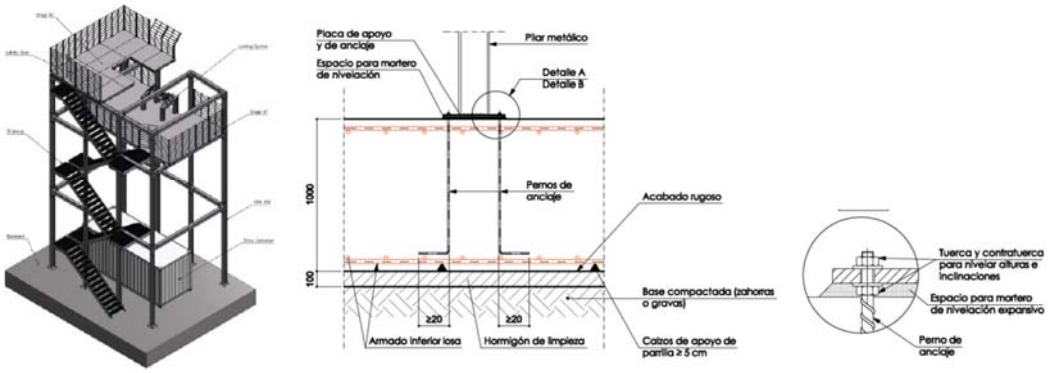
- Infra require details of HD Bolts to include type, set-out, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require full details of the base plate to the clamp and its required construction elevation and any grouting requirements.
- Infra to provide detailed reinforcement plan indicating proposed bolt set-out.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts and that they will be supplied and fitted by the mechanical erection contractor.



8.04 LST Tower

Interface – Mechanical connection between the structure and foundation.

- Infra require the magnitude and direction of the design forces to be resisted by the foundation at base plate level.
- Infra require full details of HD Bolts to include, type, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require comprehensive drawing indicating HB Bolt set out.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by LST mechanical erection contractor.
- Infra to provide civil design calculations, specification and detailed drawings for the foundation considering fully considering the needs of the CTAO Requirement statements.
- Infra to provide a detailed reinforcement plan indicating proposed bolt set-out.



8.05 LST Lightning protection

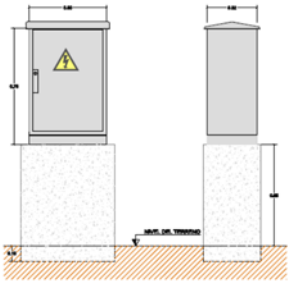
Interface – Mechanical connection between earth grounding lighting protection cable and foundation reinforcement.

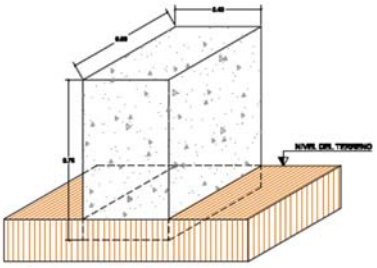
- Infra to supply reinforcement drawings for the foundations to enable the design of the LP earthing arrangement.
- Infra require the LP design, and details of the fixing arrangement at the reinforcement.
- Clarification as to whom is responsible for the fixing of LP cabling to the foundation.

8.06 LST Interface cabinet and Patch Panels

Interface – Detailed requirements between the Interface cabinet and its foundation.

- Infra require full details of the Interface Cabinet and Patch Panels including its location for each LST, orientation, dimensions, mounting height, weight, fixing requirements, input and output cable numbers and diameters and minimum required bend radius.
- Infra to supply fully detailed construction drawing for foundation, ducts and hd bolt details.
- Clarification as to whom is to supply and fit the cabinet.





8.07 Duct to LST Scientific Instrument

Interface – The duct between the LST interface cabinet and the central pin of the LST instrument.

- Infra require information on the number and size of ducts, bend requirements and termination point within the foundation.
- Infra require information on the position and number of any cable pits along the route of the duct.
- Infra shall supply construction details for the routing of the ducts and a reinforcement plan that accommodate the routing of the cast-in situ duct.

8.08 Duct between the LST Camera Access Tower support foundation

Interface – The duct between the LST Camera Access Tower and the centre pin of the LST foundation.

- Infra require information on the number and size of ducts, bend requirements and termination point within the scientific instrument foundation and the camera access foundation.
- Infra require information on the position and number of any cable pits along the route of the duct.
- Infra shall supply construction details for the routing of the ducts and a reinforcement plan that accommodate the routing of the cast-in situ duct.

8.09 LST Drive Control Container & Energy Storage Container.

Interface – The Mechanical connection between the Drive Control Container and the Camera Access Tower foundation

Infra require the following information:

- Dimensions of the steel container.
- The maximum load and the position of load points.
- The precise location and construction elevation of the unit in relation to the CAT foundation and CAT.
- Container support requirements i.e. concrete plinths.
- Entrance steps and handrail requirements.
- Details of the routes of underground power and network cables including entry positions and duct requirements at the foundation.
- Details of safety alarm and security requirements.

Infra to deliver the following information for construction purposes:

- Civil design calculations, specification and detailed drawings for the concrete constructed support plinths for the container and co-ordinated scheme power, data and security ducts

8.10 MST Central tower

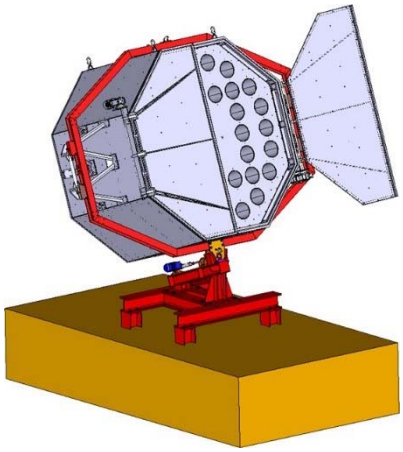
Interface – The mechanical connection between the tower and foundation.

- Infra require the magnitude and direction of the design forces to be resisted by the foundation at base plate level.
- Infra require details of HD Bolts to include set-out, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require details of the base plate for the pin and its required construction elevation.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by MST mechanical erection contractor.
- Infra to provide civil design calculations, specification and detailed drawings for the foundation considering fully considering the needs of the CTAO Requirement statements.
- Infra to provide detailed reinforcement plan indicating proposed bolt set-out.

8.11 MST camera foundation

Interface – The Mechanical connection between the camera foundation and MST camera locking unit

- Infra require the magnitude and direction of the design forces to be resisted by the foundation at base plate level.
- Infra require details of HD Bolts-set out, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by MST mechanical erection contractor.
- Infra to provide civil design calculations, specification and detailed drawings for the foundation considering fully considering the needs of the CTAO Requirement statements.
- Infra to provide a detailed reinforcement plan indicating proposed bolt set-out.



8.12 MST Tower Access Platform.

Interface – The Mechanical connection between the steel access platform of the central tower and the foundation

- Infra require full details of HD Bolts to include bolt set-out, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require full details of the base plate details of the platform and stairway and its required construction elevation.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by MST mechanical erection contractor.
- Infra to provide detailed reinforcement plan indicating proposed bolt set-out.

8.13 MST Internal ladder to Central Tower

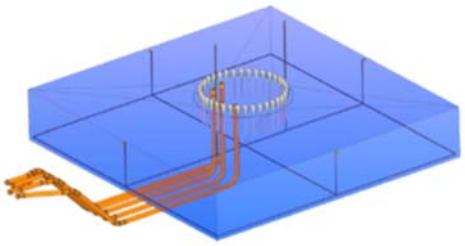
Interface.-. The Mechanical connection between the internal fabricated steel ladder of the MST central tower and the MST foundation

- Infra require full details of HD Bolts to include material specification, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Infra require fabrication details to the bottom of the ladder together with construction elevation related to the top of the foundation.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by MST mechanical erection contractor.
- Infra to provide detailed reinforcement plan indicating proposed bolt set-out.

8.14 Ducts to the MST Central Tower

Interface – The duct between the LST Camera Access Tower and the centre pin position of the LST foundation.

- Infra require information on the number and size of ducts, bend requirements and termination point within the scientific instrument foundation and the camera access foundation.
- Infra require information on the position and number of any cable pits along the route of the duct.
- Infra shall supply construction details for the routing of the ducts and a reinforcement plan that accommodate the routing of the cast-in situ ducts.



8.15 MST Lightning protection

Interface – Earth grounding of the lighting protection cable with the foundation reinforcement.

- Infra to supply reinforcement drawings for the foundations to enable the design of the LP earthing arrangement.
- Infra require details of the LP design, fixing arrangement and details to the reinforcement.
- The fixing of LP cabling to the foundation will be carried out through the construction contract with the civil engineering company or their specialist sub-contractor.

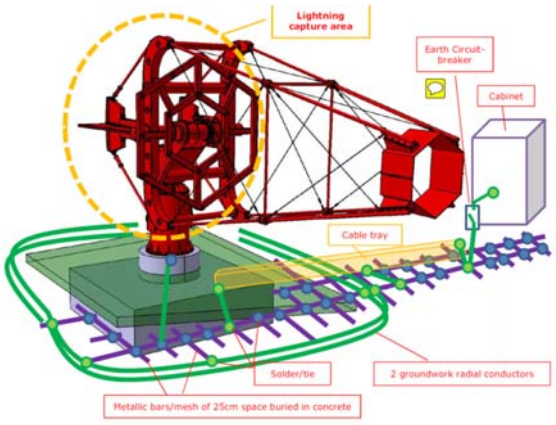


Figure 10 : Telescope concrete slab and earth mesh

8.16 MST Interface cabinet and ducts

Interface – The Mechanical connection between the Interface cabinet and foundation

- Infra require details of the Interface Cabinet including its location for each MST, orientation, dimensions, mounting height, weight, fixing requirements, input and output interconnecting cable routing, numbers and diameters of cables and minimum bend radii.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by MST mechanical erection contractor.
- Infra to supply fully detailed construction drawing for foundation, ducts and hd bolt details.
- Supply of cabinet and civil works to be carried out through the construction package?

8.17 MST Camera Cooling Chiller

Interface – The Mechanical connection between the Chiller unit and the MST foundations

- Infra require details of the MST supply Chiller unit including its location for each MST, orientation, dimensions, mounting height, weight, fixing requirements, input and output cable routing, numbers and diameters of cables and minimum required bend radii.
- Infra require any requirements regarding condensate drainage.
- Infra require confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by MST mechanical erection contractor.
- Infra to supply fully detailed construction drawing for foundation, ducts and HD Bolt details.

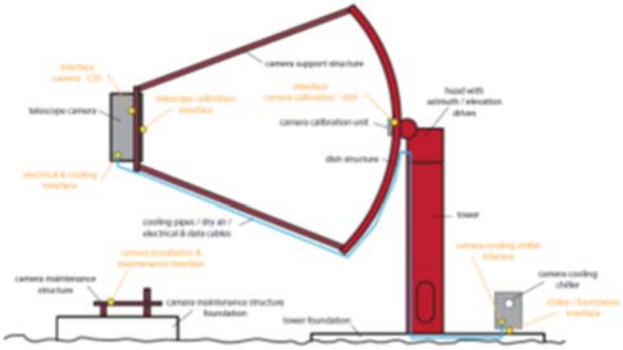


Figure 2.49 – Interfaces of the telescope camera (PBS 7.3) with the remaining telescope assemblies.

8.18 Weather Station structure

Interface - The Mechanical connection between the weather station and foundation together with underground services

Infra require the following information:

- Magnitude and direction of the design forces to be resisted by the foundation at base plate level.
- Magnitude and direction of the design forces transferred by stabilising guidelines.
- Full details of HD Bolts to include type, number of bolts, diameter, length, orientation, embedment depth, construction tolerance and any other requirements.
- Comprehensive drawings of the structure indicating HD bolt set out.
- Details of the routes of underground power and network cables including entry positions and duct requirement at the foundation for the weather station.
- Details of any security fencing requirements.
- Details of any safety and security requirements.

Infra to deliver the following information for construction purposes:

- civil design calculations, specification and detailed drawings for the foundation anchor blocks, access, fencing and underground services.
- Infra to provide a detailed reinforcement plan indicating proposed bolt set-out.

8.19 Raman Lidar

Interface.-. That Mechanical connection between the Lidar containerised and foundation underground services connections lighting and road access.

Infra require the following information:

- Location within the Array.
- Dimensions of the Lidar shipping container together with the size of the footprint when the container is in its open position.
- The maximum load and the position of the point load points for the container closed and open.
- Details of any security fencing requirements.
- Details of the routes of underground power and network cables including entry positions to containers.
- Details of any safety and security requirements.
- Road access requirements, vehicle access, parking and turning.
- Details of any screening to prevent accidental viewing of light emitted from the laser under unforeseen conditions.

Infra to deliver the following information for construction purposes:

- Civil design calculations, specification and detailed drawings for the foundation, access, hardstanding, security fencing, power, data and security ducts.
- A detailed reinforcement plan indicating proposed bolt set-out.

8.20 Fram

Interface.-. The Mechanical connection between the Fram unit, foundation, underground service connections, lighting, and road access.

Infra require the following information:

- Location within the array
- Dimensions of the steel housing or shelter that the Fram is mounted within and the size of the footprint when the unit is in its open position.
- The maximum load and the load points from the unit in its closed and open position.
- The fixing positions for bolting the unit to the foundation.
- Full details of security fencing requirements.
- Details of the routes of underground power and network cables including entry positions and duct requirement at the foundation for the weather station.
- Road access requirements, vehicle access, parking and turning.
- Details of safety alarm and security requirements.

Infra to deliver the following information for construction purposes:

- Civil design calculations, specification and detailed drawings for the foundation, hardstanding, security fencing, power, data and security ducts.
- A detailed reinforcement plan indicating proposed bolt set-out.
- Confirmation that bolts will be site-drilled resin anchor type bolts to be supplied and fitted by supplier of the steel housing.

8.21 Ceilometer

Interface.-. The Mechanical connection between the Ceilometer, foundation and underground service connections, lighting and road access.

Infra require the following information:

- Location within the array.
- Dimensions of the Ceilometer.
- The maximum load and the load point of the cabinet housing the Ceilometer.
- The fixing detail and positions for bolting the unit to the foundation.
- Full details of security fencing requirements.
- Details of the routes of underground power and network cables including entry positions and duct requirement at the foundation for the weather station.
- Road access requirements, vehicle access, parking and turning.
- Details of safety alarm and security requirements.

Infra to deliver the following information for construction purposes:

- Civil design calculations, specification and detailed drawings for the foundation, access, security fencing, power, data and security ducts.
- A detailed reinforcement plan indicating proposed bolt set-out.

8.22 Illuminator

Interface – The Mechanical connection between the Illuminator and foundation.

- Infra require the overall dimension of the hardstanding area required for operation of the illuminator.
- Fencing requirements.
- Details of the routes of underground power and network cables including entry positions and duct requirement.
- Details of safety alarm and security requirements.

8.23 Tie in to UG Services

Water, power and data

Interface – CTAO point of connection point with existing service

- Identify tie-in points with co-ordinates, owner of service, establish suitability, licences required and use of licensed contractor for carrying out work on the supply.
- Establish any supply requirements to Scientific Instruments.

8.24 Fire Fighting Equipment

Interface – Infrastructure and Operations

- Hardstanding positions and shelter requirements for firetrucks and equipment.
- Water and power requirements.
- Need for hydrants for filling fire trucks.
- Winterising requirement for hydrants – CTAN only.

8.25 Fencing

Interface.-. Infrastructure and Operations/safety

- Fencing requirements local to Scientific Instruments, agree standard of fencing required.
- Height of fencing and access requirements for personnel and vehicles.
- Safety and Security requirements.
- Access requirements.

Technical Building, Data Control Building, Switch Rooms, Security Buildings etc

The design criteria have not been established for these buildings and therefore is outside the scope of this document.

8.0 Glossary

For the purposes of compiling this document the following definitions are used:

Base plate – a steel plate that is part of the Structure and is fixed down to a foundation using holding bolts.

Building – A construction comprising of walls and a roof

Foundation – a construction of mass reinforced concrete at substructure level and includes, concrete slabs and plinths. Each CTAO structure and building requires a foundation and a means of safely transferring the loads from the superstructure to its foundation. In the case the case of a structure this will be done through the baseplate and anchor bolts arrangement

Reinforcement – Carbon steel reinforcing bars used in foundation works (Rebar). May also be in the form of standardised carbon steel welded mesh reinforcement.

Substructure –General term meaning any foundation below base plate level or below ground level

Superstructure – General term meaning any structure above base plate level or above ground level that is not a building

Scientific Instrument – the telescope, or other above ground instrumentation including its supporting structure but excluding the foundations.

Structure – a construction of steel members bolted to a foundation via a baseplate.

LP – Lighting Protection….

Ground Level - the generally accepted base level of the site

Elevation - a height in metres relating to a site survey datum

Earthing - a earthing system or grounding system connecting specific parts of the installation with the Earth's conductive surface for safety and functional purposes.

Duct – a buried network of circular PVC conduits in which data and electrical cables are laid out. Ducts may be bundled together and often protected by concrete. Ducts shall include swept bends to suit cable requirements and draw ropes to allow installation of cables

Trench -a narrow excavation of the ground to enable the placement of a cable pr ducts. Relating to foundations these are usually referred to as foundation excavations

Requirement Statements – These are the project specific science requirements that can be found in JARMA.

Drainage – A means of collecting and disposing of storm water or foul water

Potable Water - Drinking water

Raw Water- Used for construction or washdown purposes only

Hardstandings – Area of storage usually formed in compacted stone or concrete. Mau be temporary or permanent

Parking – Formal areas constructed in stone, concrete or bituminous material

Private Roads – Means of access to CTA Observatory assets that a only for the use of authorised personnel

Public Roads - Means of access that are for the use of everyone.

Forces – Horizontal, vertical and overturning forces relevant to the design of the foundation. These forces should be derived from FEA for the Scientific Instrument

Holding Down Bolts – Used to anchor the baseplate to the foundation using designed cast-insitu bolts of site drilled resin anchor bolts.

Cast in-situ - In terms of a foundation these are usually bolts and other metallic assembly's that are fixed within prior to the concrete pour. These items become integral with the concrete.

Holding Down Bolts - These may be individual cast-in situ HD bolts or an assembly of bolts that may be contained with steel tubes or cones. HD Bolts may also be directly installed into concrete using resin anchor bolts using diamond drilling techniques.

Manhole - Is a covered chamber giving maintenance access to an underground utility.

Cable Pits – are interconnected covered chambers used to install underground cables installed in ducts.

Construction elevation - a height above or below an agreed datum.

Construction contract – the site works that is to be a carried out the Civil Engineering Construction