CONSTRUCTION MONITORING
WHAT TO LOOK FOR

Construction monitoring isn't a course taught at university or polytechnics, yet it plays a vital role in ensuring the project is completed properly. Engineering New Zealand and the Engineering General Practitioners Group have been working on a general guideline of what to do and what to look out for when going to site.

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HEALTH AND SAFETY

If you see something that is a health and safety concern, you should notify the foreperson. If it is safe to do so, take photos of the problem. When you return to the office, discuss this with your supervisor.

Even though this is not a legal requirement under the Health and Safety at Work Act 2015, it is your obligation under the Code of Ethical Conduct as a member of Engineering New Zealand to take reasonable steps to safeguard health and safety and to report adverse consequences.

BEFORE GOING ONSITE

COVID ADDITIONAL PROTOCOLS

1. You should discuss Covid considerations with the client, your line manager and company Health & Safety manager (if applicable) before heading to site.
2. Prepare a site specific Covid Job Safety Environmental Analysis (JSEA) addendum and submit for approval by your line manager, and/or Health & Safety manager and/or project director and/or operations manager.
3. The Covid JSEA addendum shall include but not limited to the below key considerations:
    - details of the contractor (i.e. who they are, contact person, your host while on site, their site Covid protocol etc.)
    - the reason for the site visit (i.e. by client request or programme driven that cannot be postponed etc.), ask the question: can this site visit be substituted with a virtual one instead?
    - any other colleagues attending site, you will also need to communicate your intended date & time on site to the construction site manager so the number of people onsite can be monitored
    - means of transport (i.e. by company vehicle, private vehicle, taxi / Uber etc.), and ways of mitigating transmission within the vehicle if travelling together (i.e. seated diagonally, wearing a mask and wiping off surfaces after use etc.)
    - communications protocols (i.e. upon arrival and departure, and in case of an emergency)
    - proposed Personal Protective Equipment (PPE) while on site, social distancing standards (i.e. 2 metres)
    - and if applicable lunch venue (i.e. open air "grab and go" type).
    - You will need to thoroughly think about the risks that might be faced throughout the trip, list them on the Covid JSEA addendum, discuss the control measures and residual risks with your Health & Safety manager.
4. Check if you have all the correct PPE (KN95 masks are recommended - your company should have them in regular stock) and some sites may require you to carry out a Rapid Antigen Test, return a negative result before entering site.
5. Arriving on-site:
    - scan the site Quick Response (QR) code, this will ensure you get the notifications if there is a positive case detected and to determine your contact level (i.e. casual or close contact etc.)
    - ask the site manager if everyone is masked before entering site.

6. While on-site:
    - if you see someone that is not wearing a mask on-site, stop work and notify site manager as soon as possible.
    - try to keep interactions with others to a minimum while on-site, and wash hands regularly.

ACQUIRE INFORMATION ABOUT THE PROJECT

1. Identify what stage is being inspected.
2. Look at the plans, identify and mark on drawings what you need to check while onsite.
3. If you're checking someone else's work, always go and ask them what the critical parts are after you have worked through it otherwise there may be things you miss during your check, for example, how close to a surcharge (like a house, driveway, or road) the contractor is cutting for a retaining wall. If the design engineer isn't there, check your assumptions with a senior engineer.
4. Always check your PPE, including sunscreen and sunglasses, is in the car. When looking at white surfaces (like polystyrene pods) you can quickly get sore eyes/snow blindness. When speaking to the foreman before going to the site, ask if you need any particular PPE (e.g. gloves).
5. Take a good torch, often the one on your phone isn't sufficient when you need to be looking in attics, down holes, into pipes etc.
6. Make sure you have a construction monitoring template that you're filling in. If your office doesn't have one, you can download one for free from the Engineering New Zealand website, along with an example of how to fill them in properly.

ON-SITE

ARRIVING ON-SITE

1. Entering the site, stop and take an overall photo of the work. The picture helps identify the project in your photo roll and shows the general state of construction, the weather, number of people working etc.
2. Stop and think: Why am I here? Has some work already been completed and covered up? Is the site safe to enter? Regardless of whether other people are onsite, it may not be safe for you to enter.
3. If a machine is working, you must ensure the operator has seen you before approaching the work.
4. Call the foreman from the site boundary if necessary and make sure that you have completed any sign-in requirements. Doing so helps demonstrate to the builder that you expect everything to be done properly before you look at any work.
5. Look at the job site. Is it clean and tidy? If it's messy then it's an indicator the contractor isn't well organised.

WHILE ON-SITE

Working with the contractor

1. You must work with the contractor to deliver the best solution. Often, the contractor can offer sound advice on building things practically. Always listen.
2. Just because something works on paper doesn't mean it can be constructed. Listen to the contractor's ideas on making it easier to build and think about how you can make their ideas work, instead of focusing on making them follow your design to the T.
3. Tell the contractor what you're looking at and why. Ask if everything is ready to be inspected and if there's anything, in particular, they would like you to see.
4. The contractor may be incorrect when they tell you something, possibly because the design is not clear, in which case you must be able to explain it. Don't use maths to do so. Visualise how the system is working and the components you're talking about, then give either a practical demonstration or draw out the problem and solution. If you can't do that, you don't understand the design, or the situation, well enough. Tell the contractor you'll come back to them, then return to the office and ask questions until you understand it.

YOUR INSPECTION

1. Tell the contractor what you're looking at and why. Ask if everything is ready to be inspected and if there's anything they would like you to see. Ask the contractor if there are any problems they can see coming up. A good contractor is an excellent ally to getting a job done right.
2. Make sure that you go around the job methodically, marking off what you're inspecting on your plans. If the contractor tries to rush you, or access to a certain area is restricted in some way, there's a good chance they're trying to hide something. Do not sign it off!
3. Take meaningful photos. For example, if you are inspecting a RibRaft slab, get a can of dazzle and write a number next to the items that need fixing. Relate that back to your construction monitoring report when asking for photos. That way, you can see that the contractor has done the work, and it's easy to check off.

4. When inspecting items, take a pencil and dazzle can, write a reference number on the element, and take a photo. That way, you can easily reference it in your report along with the photo.
5. Make sure you file your photos in the correct folder. Having your photographs named with the reverse data at the start is a good tool for more accessible filing later, e.g. 2016-05-26 George 45 footings.jpg
6. Always write up your construction monitoring reports as soon as possible. Ideally on-site.

GEOTECHNICAL

EXCAVATION, CLEARING AND DEMOLITION

1. Document the condition of all items to be salvaged, replaced, or relocated.
2. Ensure you observe the requirements indicating method or means of excavation and compaction etc. (if specified) are being followed by the contractor.
3. Notify the contractor and project manager if rock excavation or other materials not anticipated on the plans or in the quantity take-off are discovered during the work.
4. Notify the contractor and project manager immediately if any abandoned utilities, artefacts or objects of otherwise historical significance are uncovered during excavation.
5. When the contractor is stockpiling materials, check the location is suitable (i.e. not on or adjacent to steep slopes, streams, or compressible soils). Ensure the contractor does not exceed the maximum height and note that the side slopes and perimeters are protected as specified in the consented documents.
6. Check the separation and cover is as needed for stockpiled materials, including topsoil.
7. After demolition, observe the waste materials that the contractor removes are properly transported and disposed of off-site.

PLACEMENT/BACKFILL

1. If the contractor uses on-site soils for placement/backfill, check they are free of debris or organic content such as weeds, grass.
2. Check the type and grade of materials for placement/backfill to verify the content and gradation is as specified in the consented documents.
3. Check all material certificates provided by the contractor to verify they are according to the specifications and/or submittals. Provide the originals to the project manager and file copies for your records.
4. Spot check the depth of the lifts during placement/backfill of materials.

COMPACTION TESTS (REFER NZS 4431 FOR DETAILS)

1. Compaction tests for soils are usually specified as a percentage of the maximum density as determined by, or in accordance with, a standard ASTM proctor test (sometimes referred to as a moisture-density test).
2. Indicate the location of the test sample on the site plan if you require more than one sample on the project.
3. The test results should indicate the soils plastic and liquid limit and the related plasticity index.
4. Only qualified professionals (independent laboratory) should complete field compaction tests using a calibrated nuclear test gauge and other equipment as set out in the Fill Specification.
5. Document field test results and track the date, location and depth of all tests completed.
6. Notify the contractor and project manager of any failed compaction tests and observe the retesting of any failed work.

SOIL MOISTURE CONTENT

1. The moisture content of the material in the field should be within a specified percentage of the optimum moisture content for compaction.
2. The contractor is responsible for directing the wetting or drying of the material to meet the specified range prior to compaction. Never direct the work of the contractor to meet the specification.
3. Notify the contractor and project manager if the moisture content is not within the optimum range.

METHOD AND FREQUENCY OF TESTING

1. The number of tests required at each location is usually specified. If not, notify the project manager.
2. Testing requirements for compaction may indicate the number of tests per square meter for each layer of material. Compaction testing once every 1,000m3 for each lift of material placed is typically acceptable if the contract documents do not state this. If in doubt, check with a senior engineer.
3. Proctor tests (compaction curve) should be prepared for each type and grade of material proposed for the project (including hardfill).

SUB-GRADE WORKS

1. Carefully read the geotechnical and lab reports before works begins and note the location of bores, type of soils and recommendations for compaction.
2. Watch for any changes or discrepancies in the soils (color, texture to feel, etc.) placed and notify the contractor and project manager if you spot any.
3. Verify the material is spread uniformly in successive layers and, when compacted, meets the specified depth. Check that each lift does not exceed the specified depth.
4. Watch the wetting of the material surface before it's compacted and note the moisture content of the soil during field density tests. Be aware of the sensitivity of the optimum moisture content and meeting compaction requirements.
5. Observe the sub-grade while it's undergoing compaction by heavy equipment, note any movement (pumping or rolling) or deflection of the soil, and notify the contractor and project manager.
6. Observe the placement and overlapping of geogrid or geofabric (if used) as specified in the consented documents

PROOF-ROLL TESTING

1. The contractor typically performs a roll test just before the approval of the sub-grade. The test consists of driving a fully loaded dual axle truck within each traffic lane and observing any sub-grade rutting, pumping, or deformation.
2. While walking alongside the truck, observe any signs of deformation or rutting and notify the contractor and project manager.
3. Document any areas that fail the roll test. The contractor needs to rework and them and have them retested.

FIRE

The Society for Fire Protection Engineers has produced construction monitoring guidelines that provide recommended service levels for projects. We recommend that you read the document and familiarise yourself with how it affects your job before going on-site.

1. Before attending the site, review the documentation on what system(s) you are observing for familiarity with the make and installation requirements. The New Zealand Building Code clearly states that the system shall comply with tested standards.
2. The usual issues arise when inspecting passive fire protection systems because of limited consenting details. The Fire Engineers scope should be clear from the outset as site instructions need to come from the appropriate source.
3. Ensure you have had health and safety training and remember roof space areas may be considered confined spaces, so caution is advised.

PASSIVE FIRE PROTECTION SYSTEMS

Construction monitoring of passive fire protection consists of reviewing architectural features, including fire/smoke walls, floors and connection details, and services penetrating these elements. General parameters for review of these systems are noted below and consider material typologies.:

1. Concrete walls and floors
2. Lightweight timber-framed plasterboard systems:
    - The screw types used are as per manufacturer's requirements.
    - Check the screw spacing follows the manufacturer's specifications.
    - Check screws have not cut into the plasterboard.
    - Check the joint gaps between sheets are no greater than 5 mm.
    - Ensure no screws are located in the top track on any deflection head walls.
3. Service penetrations:
    - Check the passive fire systems are fit for purpose and the contractor has installed them as per the manufacturer's specifications.
    - Check fire separation construction – any defects?
    - Check the fixing details and joinery between the elements matches those on drawings
    - Check the tolerances in the design match those on-site.
4. Fire/smoke doors: Check to ensure doors close and latch shut in case of a fire door.

ACTIVE SYSTEMS

1. Check the contractor has installed the fire alarm systems as needed throughout the building. Close to completion, participate in fire alarm witnessing tests to ensure the system operates as intended.
2. Check fire doors are in the correct places and check that they close and latch shut. You should only undertake this check once the contractor has installed all floor linings to ensure the carpet does not prevent the door from closing.
3. Check the smoke doors are at least 43 mm thick solid core doors, and labels have been provided.

4. Check that any hold-open devices allow the door to close and shut when disconnected from the power supply.
5. Check automatic doors continue to work when disconnected from the power supply. This check can be as easy as turning off the switch located at the top of the door.

STRUCTURAL

FOUNDATION/MASONRY WALLS

1. Always check the cut height of a bank. You can use the level/clinometer on your mobile phone to measure the slope – just sight along the top of your phone.
2. Never believe that:
    - the hole is deep enough without checking it yourself
    - the contractor has gone into rock unless you can see the rock and you can see the rock in the spoilings.
3. When inspecting concrete foundations and footings, ensure the contractor has installed chairs to support the mesh and rebar. The contractor should have cleaned out the site and squared off the trench edges. Having rubbish or loose pieces of polystyrene in the foundations is unacceptable.
4. Ideally, the contractor will have lined the foundation with DPM (Damp Proof Membrane) or site concrete.
5. An easy way to establish side clearance is to have the contractor install chairs against the side walls.
6. Ensure the slab is a suitable thickness if a specific system is installed within it, e.g. 120mm thick if there is hydronic heating within the slab.
7. The setback of the steel is critical when building retaining walls. The steel should be tied back to a solid support so it cannot move during the pour. Tell the contractor it's good practice to do so if it's not tied back. Mention it in your site report and take a photo! Doing so can save you if the steel moves during a pour and the contractor hasn't tied it securely.
8. Ensure all control joints are as per the approved plans. If there is a reason for the change, all parties involved in the project need to be informed.

BEAMS, COLUMNS, PORTAL FRAMES

1. When checking steel beams, measure them. Steel yards can deliver the wrong sized beams, and it can be difficult to see they are the wrong size without a tape measure. If you're checking a UB or UC, measure it and check the measurements against the specified beam.
2. When inspecting connections, take a pencil, write the beam number on the connection, and take a photo. That way, you can easily reference it in your report along with the photo.
3. Check the washers. Washers on timber are always square. Washers on steel are always round. These must be correct for the connections to work as intended.
4. Check the contractor has appropriately tightened the nuts. As a basic test, try them by hand. Make sure they aren't tight enough to crush the timber.
5. Check that the contractor has correctly installed portal frames connections. It is common for the contractor to cast bolts in the wrong position. They frequently try to fix that by bending them into place. That is unacceptable. Sometimes there will be cut slots in the baseplate for the same reason, and you may need to redesign the connections at that point.
6. Some contractors forget to tighten the nuts, and you can pull bolts out by hand. If that occurs, demand a reinspection.

EARTHWORKS

1. Check to see that no shortcuts have been taken, e.g. an existing fence retained to save cost, resulting in a new location of retaining walls.
2. Check cuts and fills are at the required level as stated on the plans. You can check heights from the datum shown on the approved plans. Sometimes contractors assume the height is correct when using a more convenient datum point, resulting in inaccuracies and potential district plan breaches.
3. Check that trenches over 1.5m deep have been shored or benched.
4. Check that service trenches are in the location as shown on the plans. All services must have a minimum separation if installed in the same trench.
5. Check sediment and erosion controls as per the erosion sediment control plan (ESCP).

TIMBER STRUCTURES

1. Plumbers and electricians often cut big holes into studs and beams to run cables and pipes. Keep an eye out for them. If they are on-site, ask them if they will have to drill through studs or beams. If done incorrectly, the contractor may be required to undertake on-site strengthening, and in some cases, amendments to the bracing schedule may be necessary.
2. Ensure all timber is of the correct treatment and stress grade as stated in the approved plans.
3. Ensure timber has not been exposed to the weather for more than six weeks as treatment and integrity of the timber may be affected.
4. Ensure the contractor has installed tie-down connections correctly. These frequently include corners or wall ends, at the base of lintels, beams, and bracing systems. In fire-rated systems, it may be necessary to have a connection on each side of every stud in the firewall.
5. Check the increased stud sizes for higher walls are installed correctly per the approved plans.
6. If the design requires a wind beam, ensure the contractor installed it per approved plans.
7. Check beam sizes and timber types. In some situations, a contractor may install a different kind of engineered timber that may not meet the requirements of the approved design.
8. Check steel connections are suitable for the corrosion zone and height to the ground. Type 314 Stainless is required for connections in Corrosion Zone D, if within 600mm of the ground and in timber with copper-based treatments.

CONCRETE STRUCTURES

1. Check the bars are the correct size and grade—find out how to find the difference between HD500 and HD300 grade reinforcing.
2. For precast units, check all connections and starter bars are consistent. You don’t want to crane in the element only to find an issue.
3. Ensure the contractor has installed all steel reinforcing for in-situ concrete as per the approved documentation.
4. Ensure control joints are at required locations – typically 6m maximum spacing. Check that the connectors through the joints are de-bonded round bars. Contractors will frequently try to use standard deformed reinforcing.

STEEL STRUCTURES

1. Ensure all steel is fabricated as per the approved documentation, including all connections and service holes.
2. Visually check exposed steel is primed and coated as per the approved documentation. Often a supplier will have provided a PS3 for the coating, and you should retain a copy of that document.
3. Ensure timber packing is separated from the steel with DPC or an alternative thermal break
4. If within an external wall of a roof structure, ensure that thermal bridging is accounted for to prevent condensation within the structure.
5. Confirm the contractor has installed end caps on the upright rebar.

TIMBER POLE RETAINING WALLS

1. Ensure holes are drilled to the specified depth of approved plans before pouring concrete
2. Ensure all timber elements are of the correct treatment, stress grade and size of the approved plans.
3. Ensure that drainage and drainage metal is installed behind the wall. Check the drain has been wrapped in filter fabric and drains towards the sump.
4. Galvanised steel in contact with treated timber (for example, an anchor passing through the wall) should be wrapped in tape and greased to avoid electrolysis where it may come into contact with the timber.

CIVIL/ EARTHWORKS

1. Check sediment and erosion controls are installed as per the erosion sediment control plan (ESCP).
2. Check silt fences are toed in, and there are safety caps on posts.
3. The contractor should replace sediment controls at the end of day. Check they look as if that has happened.
4. Check a vehicle wash is in place and dirt isn't being tracked on the roads.
5. Check the vehicle access point is stabilised and clean.
6. Check safety fencing and site sign in control, diversion bunds in place
7. Check that QA documentation is progressively completed for earthworks and services trenching.

STORMWATER/ WASTEWATER

1. Check QA documentation of trenching bedding and backfill material.
2. Progressively confirm trench and back fill is as per design drawings.
3. Check drains are sighted and laid at the correct gradient
4. Check benching of completed manholes is smooth specified finish.
5. Pipe penetrations are smooth specified finish
6. Check manhole lids are secured and level, check inside for spacers and smooth grout finish

BUILDING SERVICES GENERAL

1. Confirm number of site visits allowed in the fee proposal with the internal project manager and agree on a preliminary plan / timeline of these site visits.
2. Communicate the intended site visits to construction site manager and ask to be notified when about to reach the construction milestone i.e. pre-lining of walls and ceilings installed.
3. Coordinate with building trade as required to ensure access to carry out your inspections.
4. Develop a trade Interfaces matrix to identify coordination required with other trades.
5. Ensure inter-trade coordination has occurred, including spatial coordination and trade interfaces. You can do this by asking the foreman what other trades have been involved and how they're communicating with each other.
6. You need to receive shop drawings prior to manufacture and/or installation on site.
7. Look at the general safety of installation and operation on site. Report to the foreman any logical safety hazards found during site walk through to reduce workplace injuries. Also note those hazards in your construction monitoring report.
8. Check the quality of installation in open ceiling (exposed) areas. For example, check for any ceiling loose equipment or hanging out cabling, pipes or cable trays requiring leveling.
9. Check the quality and timing of pre-manufacture submissions especially supplier's certificate of compliance for technical equipment submission.
10. Check whether the contractor has installed seismic restraint of equipment and reticulated services. Note, requirements of NZS4219 need to be fully followed and certified by the contractor and their seismic specialist.
11. Incorporate fully integrated testing, witness the tests, and allow sufficient time for remedial action and scenario testing.
12. Ensure there is fire sealing of any service penetrations to fire rated walls or floors.
13. Self-verification via recorded internal quality assurance processes prior to presentation for review/signoff/completion.
14. Check installation against shop drawings and/or design drawings to ensure installed does not deviate from design.
15. Visually inspect and randomly measure and verify sizes and setouts of ductwork and pipework.
16. Check the correct specified equipment and materials are used. Alternative equipment or material shall not be accepted unless by Engineer's approval.

MECHANICAL SERVICES

1. Check passive fire treatments are installed as per design drawings and specifications. Fire damper or fire transit box penetration shall be sufficiently provisioned on wall or floor slab - usually larger than ductwork size to house fire dampers / fire transit box and required clearances from manufacturer. Fire collars shall also be checked as installed to requirements.
2. Check if control wirings are provisioned in walls or ceiling void. Check if controller cut-outs on walls are sufficiently provisioned.
3. Check installed ductwork and pipework are not damaged between inspections. This is especially important with exposed ductwork and pipework for aesthetics.

4. Ensure required vibration isolation and noise treatment as indicated on drawings and specifications are provided.
5. Ensure the mechanical condensate connection point is coordinated between the mechanical trade and hydraulics trade.
6. Ensure Mechanical trade, Building Management System (BMS) trade and Electrical for Mechanical trade are fully coordinated on power and control requirements. Please refer Switchboards section under Electrical Services for Mechanical Services Switch Board (MSSB) general requirements.
7. Witness and keep record of pipework pressure testing and system commissioning.
8. Ideally, commissioning results shall be reviewed before carrying out final site inspection.
9. Ensure sufficient servicing / maintenance space have been provisioned. Also ensure sufficient valves or unions are provisioned so equipment can be repaired or serviced independently without disruption to operations of other areas within the building.
10. Ensure sufficient security measures are installed for security sensitive spaces of the building i.e., security bars within ductwork wall and / or roof vents - typically applicable to Police, Defence, Justice, Ministry of Foreign Affairs and Trade (MFAT) and Correctional buildings.

HYDRAULICS SERVICES

1. Carry out an inspection of substructure drainage pipework before visual access is no longer available i.e., before concrete pour.
2. Check overflow relief gully is installed as per NZ Building Code requirements.
3. Check all fixtures are provided with isolation valves that are easy to reach, can be operated without a tool and clearly labelled in case of a water leak.
4. Check all drainage provisions in-ground or in-slab are temporarily capped off to prevent debris from falling into them. Also ensure there is no sharp edges with pipework provisions in wall or floor that can be highly hazardous.
5. Ensure sufficient inspection openings or cleaning eyes have been provisioned as per design drawings and specifications. Y9ou need to communicate and confirm the requirements with the contractor early on, as these can be very difficult to incorporate at later stage of the construction.
6. Ensure correct insulations are installed on the pipework as per design drawings and specifications.
7. Ensure all pipework is clearly labelled as per design drawings and specifications.
8. Ensure correct pipework gradient is installed, measure and verify on site.
9. Ensure sufficient servicing / maintenance space have been provisioned. Also ensure sufficient valves or unions are provisioned so equipment can be repaired or serviced independently without disruption to operations of other areas within the building.
10. Ensure adequate visual and sound alarm provisions and automatic water isolation provisions for drainage pumps in case of malfunction.
11. Check backflow prevention device(s) is appropriate for the agreed hazard level with local council or local water utilities authority i.e., Watercare, has been installed as per drawings and specifications. Also ensure commissioning results and certificates are on record.

ELECTRICAL SERVICES

General

1. Orientate and space adjacent outlets (power, data, audio visual [AV]) equally.
2. Check the position of wall mounted switches at the specified location and ensure they're levelled at equal heights.
3. Check the separation and crossing of cables between services is to AS/NZS 3000 standards requirements
4. Ensure life safety and fire rated cabling been installed where required.

Substation

1. Check the substation location is acceptable. There needs to be heavy vehicle access, transformer loading areas, ventilation, noise/hum, clear of building and air intakes. Check with the designer on exact requirements.
2. Check and coordinate with the substation designer to confirm supply size and protection at supply point.

Switchboards

1. Ensure the size of the switchboards are suitable/ sufficient for its intended location including the clearances requirements are met.
2. Ensure there are enough spare spaces in the (new and/or existing) switchboard as indicated on the single line diagram or distribution board (DB) schedule.
3. Is there adequate, unrestricted access to the switchboard in accordance with AS/NZS3000. Ensure:
    - switchboard's manufacture and quality.
    - sufficient quantities of exits are provided in accordance with AS/NZS3000
    - is the switch room required to be fire rated and/or sprinklered?
    - ventilation has been included (natural and/or mechanical)
    - the switchboard has satisfied arc fault containment requirements.
4. Check if any DB's are located adjacent to egress paths/corridors and require smoke seal or smoke stop cupboard doors
5. Switchboard Review

    Are the following minimum details provided for all switchboard reviews as per the single line diagram:

    - Busbar rating
    - Pole capacity
    - Fault current level
    - Ingress Protection (IP) rating
    - Switchboard form (typically exclude i and h suffix)
    - Corrosive environment
    - Top or top and bottom cable entry
6. Check Residual Current Device (RCD) protection been provided for appropriate circuits (10mA or 30mA depending on the application)

7. Check all protection device settings are as per the design
8. Check communication interfaces been installed i.e., BMS, DB's

General Power and Reticulation

1. Check cable trays installed are as per the original design, i.e., size, spare space, positioning, coordination with other services etc.
2. Check all power outlets are installed in the positions as per the design (installation heights as indicated on layouts), including any specific General-Purpose Outlet (GPO) mounting requirements (i.e., skirting duct, pendants, floor boxes, disabled access, etc.)
3. Check the separation and crossing of electrical cables relative to other service cables as per AS/NZS 3000 requirements
4. Ensure all outlets installed are labeled or colour-coded showing circuit number, RCD protected, essential, non-essential, UPS, cleaners etc.) as required.
5. Ensure all socket outlets mounted on skirting/floor mounted trunking are installed correctly and neatly as per design drawings

Lighting

1. Check luminaire ordered or installed are as per specification. Review details as:
    - Luminaire Type
    - Control Gear
    - Accessories (i.e. louvres, diffusers, drop glass etc.)
    - Mounting details
2. Ensure all light fittings are installed in exact position as per lighting design layout
3. Co-ordination of lighting with plant equipment in plantrooms on site when required

Lighting Controls

1. Ensure all lighting control systems installed are functional and operating correctly as required (including commissioning)
2. Ensure all lighting control panel buttons are labeled, as required.

Emergency Lighting

1. At the start, check what emergency lighting system have been installed (i.e., single point, centralised/monitored system etc.) to the specifications
2. Ensure all emergency lights and illuminated exit signs are installed in the correct position as per emergency lighting design layouts
3. Ensure control systems installed, including test facility are functional as required (including commissioning)
4. Ensure all emergency test facilities are installed within the DB control panel, as required.
5. Ensure emergency lighting circuits are labeled within the distribution panel.
6. Ensure emergency lighting within each room and/or space is supplied from the nearest local lighting circuit.

COMMUNICATION SERVICES

1. Ensure lead-in communication cabling is of the correct type (fibre or copper) and terminated in the correct demarcation location
2. Ensure the size of the communication rack is suitable/ sufficient for its intended location including clearances requirements for ease of access and maintenance
3. Check ventilation/cooling requirements for server room been coordinated (Uninterrupted Power Supply [UPS] included).
4. Check all data outlets installed are in the positions as per the design (installation heights as indicated on layouts), including any specific outlets mounting requirements (i.e. skirting duct, pendants, floor boxes, disabled access, etc.)
5. Ensure a cabling management system is implemented within the communication rack for a tidy and neat finish including labelling (inside and outside of the rack). The contractor must neatly route all cabling leaving the rack onto a dedicated data cable tray.

PRACTICAL COMPLETION

Make sure that you have copies of at least the following:

1. Contractor's Producer Statement PS3 for supply and installation of all building services
2. Certificate of Compliance (CoC) for electrical works, electrical for mechanical works, electrical for hydraulics works.
3. CoC for backflow prevention devices and installer PS3
4. Mechanical commissioning test results of all ventilation and air conditioning systems and all air terminal flow measurements
5. Electrical commissioning test results including emergency lighting and resistivity tests of all circuits
6. Hydraulics commissioning test results including backflow prevention devices & pipework pressure testing
7. CoC & gas certificate(s)
8. PS3 and PS4 seismic restraint producer statements and design documentation
9. PS3 for building services control works
10. Electrical certificates as required by the Electric Act and Electricity regulations.

AND the following additional requirements for project close out:

1. As-builts completed (as per installed on site) and Operations and Maintenance (O&M) Manuals submitted for approval
2. Contractor warranty and equipment manufacturers' warranties
3. Ensure all issued Consultant Advice Notices (CAN's) have been resolved and completed
4. Outstanding defects / responses to previous site visit report(s)