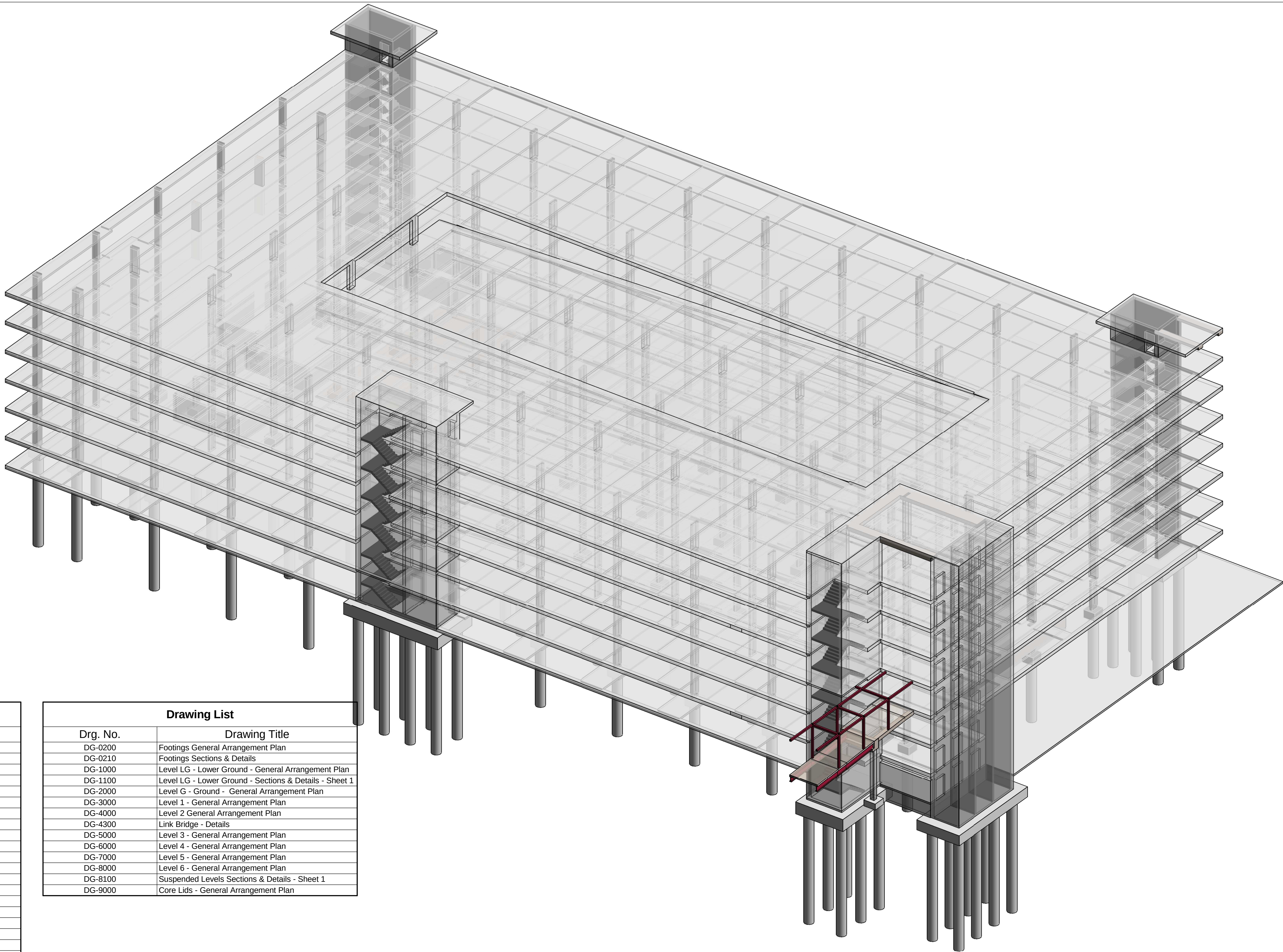


Westmead Hospital - Carpark

Structural Drawings



Drawing List	
Drg. No.	Drawing Title
DG-0000	Cover Sheet
DG-0001	General Notes - Sheet 1
DG-0002	General Notes - Sheet 2
DG-0003	Costing Notes
DG-0004	Costing Table - Sheet 1
DG-0006	Typical Reinforcement Lap & Development Tables
DG-0007	Typical Piling Details
DG-0009	Typical Footing Details
DG-0010	Typical Slab on Ground Details
DG-0012	Typical Suspended Slab Details
DG-0013	Typical Post-Tensioning Details - Sheet 1
DG-0014	Typical Post-Tensioning Details - Sheet 2
DG-0015	Typical Post-Tensioning Details - Sheet 3
DG-0016	Typical Post-Tensioning Details - Sheet 4
DG-0017	Typical Blockwork Details - Sheet 1
DG-0018	Typical Blockwork Details - Sheet 2
DG-0019	Typical Blockwork Details - Sheet 3
DG-0020	Typical Column Details
DG-0021	Typical Wall Details - Sheet 1
DG-0022	Typical Wall Details - Sheet 2
DG-0023	Typical Steelwork Details - Sheet 1
DG-0024	Typical Steelwork Details - Sheet 2
DG-0025	Typical Stair Details

Drawing List	
Drg. No.	Drawing Title
DG-0200	Footings General Arrangement Plan
DG-0210	Footings Sections & Details
DG-1000	Level LG - Lower Ground - General Arrangement Plan
DG-1100	Level LG - Lower Ground - Sections & Details - Sheet 1
DG-2000	Level G - Ground - General Arrangement Plan
DG-3000	Level 1 - General Arrangement Plan
DG-4000	Level 2 General Arrangement Plan
DG-4300	Link Bridge - Details
DG-5000	Level 3 - General Arrangement Plan
DG-6000	Level 4 - General Arrangement Plan
DG-7000	Level 5 - General Arrangement Plan
DG-8000	Level 6 - General Arrangement Plan
DG-8100	Suspended Levels Sections & Details - Sheet 1
DG-9000	Core Lids - General Arrangement Plan



REV	DESCRIPTION	DRAWN	CHECK	DATE
A	Preliminary Issue	KC	NM	06/11/15

Project Status

FOR TENDER

CLIENT:

Health Infrastructure

NSW
GOVERNMENT

Health
Infrastructure

Level 6, 77 Pacific Highway
North Sydney NSW 2060

P: (02) 9078 5427
F: (02) 8904 1377
www.health.nsw.gov.au

PROJECT MANAGER:



Darling Park Tower 2
201 Sussex St
Sydney NSW 2000

P: (02) 8266 0000
F: (02) 8266 9999
www.pwc.com.au

LEAD ARCHITECT:

HDR | RD + MSJ

Lvl 1, 110 Walker Street
North Sydney NSW 2060

P: (02) 9556 2666
F: (02) 9559 3015
askhddr@hdrincollins.com

ARUP

Level 10, 201 Kent Street,
Sydney NSW 2000
www.arup.com

WESTMEAD MULTI DECK CARPARK
Cnr Hawkesbury Road and Darcy Road
Westmead NSW 2145

WESTMEAD HOSPITAL REDEVELOPMENT
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DRAWING TITLE:
Cover Sheet

SCALE:	DOORS NUMBER: 5335	CHECKED: NM
PROJECT NUMBER:	DRAWING NUMBER:	ISSUE:
236482	MSC-ARP-ST-DG-0000 A	

General

- Structural drawings shall be read in conjunction with all architectural and other consultants drawings and specifications.
- Any discrepancies shall be referred to the architect for a decision before proceeding with the work.
- For setting out dimensions refer to architectural drawings. No dimensions shall be obtained by scaling from structural drawings. If in doubt, ask.
- Unless otherwise noted, all levels are given in metres and all dimensions are in millimetres.
- All materials and workmanship shall be in accordance with Australian standards and codes of practice except where varied by the specification and/or drawings. The applicable Standards shall be the referenced Standards current at commencement of construction. These Standards for this project shall be determined by reference to the document history on the Standards Australia website. This determination of applicable Standards shall be carried out during the Tender period and any queries relating to the appropriate Standard shall be raised with Arup during this period.
- The builder shall be responsible for maintaining the stability of the structure until its completion and shall ensure that no part of the structure is overstressed by excessive construction loading or contains "Locked-in" stresses from temporary conditions.
- Each aspect of structural work shall be checked by the engineer after the builder has satisfied himself that it is correct, and before it is concealed. The engineer shall be given 48 hours' notice of inspection being required.
- Determination of design loading for non structural elements such as Glazing, Ceiling & Cladding systems shall be responsibility of the contractor.
- Unless shown otherwise, members shall be detailed to intersect at the centroid lines of sections used.
- Refer to Architects drawings for details of all grooves, fillets, hobs drip grooves & the like.

Design Loads

Design loads are as follows unless noted otherwise on drawings:

Typical Carpark
Floor Loads:
Super-imposed Dead Loads = 0.5kPa
Imposed Live Loads = 2.5 kPa

Design Wind Loads:
VR = 45 m/s
Where R = 500 years
Region = A2
Terrain Category = 3

Design Earthquake Loads:
Design Category = II
Site sub soil class = C_e
Site Hazard Factor = 0.08
Annual probability of exceedance (BCA Table B1.2b) = 1:500 yrs
Structural ductility factor / Performance factor = 4.50

Fire Resistance Levels

Fire Resistance levels of structural elements have been taken as follows:

Location	Element	Fire resistance level (min)
Car Park	Walls (load bearing)	120/120/120
	Slabs	120/120/120
	Columns	120/-/-
	Beams	120/120/120

Abbreviations

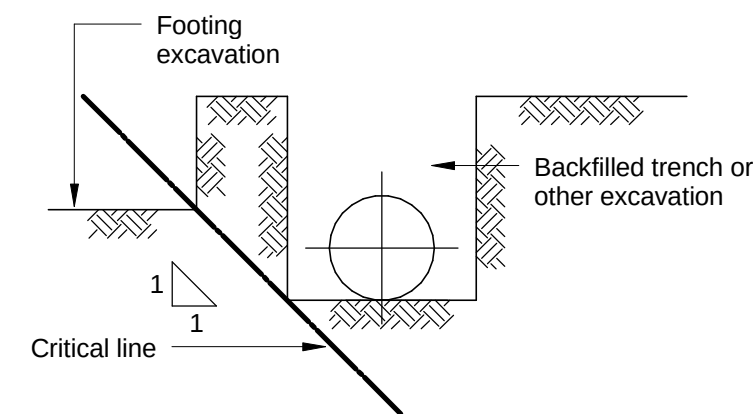
FFL - Finished floor level
SSL - Structural slab level
Gal - Hot dip galvanised
NTS - Not to scale
PT - Pile cap top
PB - Pile cap bottom
NSOP - Not shown on plan
NSOE - Not shown on elevation
UNO - Unless noted otherwise
COS - Check dimension on site

Foundations - Non Cohesive (sandy) Soils

- Refer to the Geotechnical Site Investigation prepared by Douglas Partners, Geotechnical Report 7360600, Jan 2014.
- Foundation materials shall be approved by the Geotechnical Engineer for allowable bearing capacity before construction of footings. This shall be based on the results Of tests carried out under item.
- Compaction shall be measured using a penetrometer in Accordance with AS1289 3.3.
- Penetrometer compaction results required:
Under Footings: 8 blows per 300mm measured from 150mm to 750mm deep
Under slabs: 8 blows per 300mm measured from 150mm to 750mm deep.
- The contractor shall arrange for all penetrometer testing to Be carried out by an approved testing laboratory with all Costs being borne by the contractor. The tests shall be Carried out in accordance with the following schedule:
Under pad footings: 1 test/10m² with min. 1 test/pad
Under strip footings: 1 test/5m length
Under slabs: 1 test/20m²
- Footings have been designed for an allowable working Load bearing pressure noted on drawings but no less than 150kPa.
- All walls and columns shall be concentric with supporting Foundations unless otherwise shown.
- Unless otherwise approved by the engineer, no Excavation shall be carried out closer to footings than a Line extending down from their edge at 45°
- All free draining granular fill material behind retaining walls Shall be of strong durable particles conforming to the Following gradings:
A.S. Sieve size
26.50mm
9.50mm
2.36mm
600 microns
75 microns
- Refer civil works specification & drawings for general fill & compaction requirements if not listed.

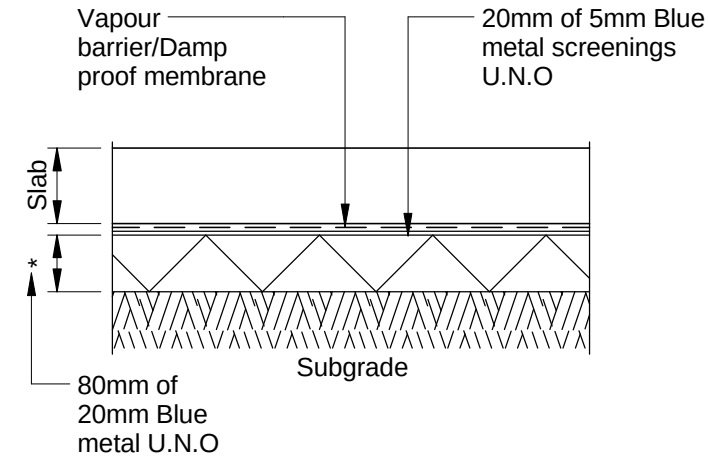
Foundations - cohesive (loamy and clayey) soils

- Foundation material shall be approved by the engineer for allowable bearing capacity before construction of footings.
- Underside of footings in loamy and clayey soils shall be a minimum of 600mm below natural ground level.
- Excavate to firm, dry ground and maintain the excavation in a dry condition. Remove any soft ground as directed by the engineer.
- Where over-excavation in soft ground is required, filling to the correct level shall be with concrete of f_c = 20 MPa U.N.O.
- Footings have been designed for an allowable working load bearing pressure of Noted on the drawings for a 20mm settlement, but not less than 150kPa.
- All walls and columns shall be concentric with supporting foundations unless otherwise shown.
- Blinding of 50mm concrete (f_c = 15 MPa) shall be placed as soon as the footing excavations have been inspected by the engineer.
- Unless otherwise approved by the engineer, no excavation shall be carried out closer to footings than a line extending down from their edge at 45°.



Subgrade

- Natural subgrades shall be proof-rolled with a roller of 70kN minimum static weight, unless otherwise stated in the geotechnical investigation report, detect soft or loose areas. Such areas should be treated in accordance with the Geotechnical Engineer's recommendations.
- Unless otherwise specified the subgrade below base courses for slabs shall be suitable material compacted to 100% std as determined by test AS 1289 5.1.1.1. or 70% minimum density index for cohesionless soils.
- Base shall be approved well graded natural gravel or crushed rock (max. size 40mm) spread and compacted to 98% mod as determined by test AS 1289 5.2.1.1. or 80% minimum density index for cohesion less soils.



Typical Slab on Grade

Piling

- All piling shall comply with AS2159 & the specification. The Piling specification shall take precedence where conflict exists.
- The contractor shall obtain all the necessary approvals from the relevant authorities, and adjacent property owners prior to commencement of work.
- Unless shown otherwise, bored piles / barrettes shall have a minimum socket length of 2 x pile diameter in rock.
- The plan set-out dimensions are at pile trim level. If piling and driving of piles takes place from a different level, appropriate adjustments to the set-out of raking piles, if any, must be made.
- If any pile needs to be trimmed by the piling or excavation contractor for reasons of access etc. such trimming shall be at a level not less than 100mm above the final trimmed level. No such trimming shall take place without the prior agreement of the engineer.
- Top section of bored pier / barrette to be lined if necessary to retain loose material and ground water, and sealed into rock to prevent significant inflow of ground water.
- Unless noted otherwise, centreline of bored pier / barrette shall coincide with centreline of column/wall above. Refer architect's drawings.
- Bored piers / barrettes shall be designed for a maximum eccentricity of 50mm. All bored pier / barrette centrelines shall be checked prior to concrete being poured. If eccentricity greater than 50mm is measured, the engineer shall be notified immediately.
- The contractor is responsible for interpretation of the geotechnical information and for designing a piling system to suit the site.
- Pile groups shall be designed to carry the working loads given in the pile group schedule and to account for negative skin friction due to settlement of the ground. Pile joints shall have structural properties not less than those of the balance of the pile section.
- All piles shall be designed and constructed in accordance with AS2159. Steel piles are not acceptable. Pile durability shall be in accordance with AS2159, section 6 non aggressive conditions. The design of the pile alternatives shall be carried out by a chartered engineer and independently checked by another chartered engineer. A statement signed by both engineers, shall be provided to certify that the design of the piles meets all the requirements of this specification.
- The tender shall include full details of the types of alternative pile proposed. This information shall include, but is not limited to:
 - the geotechnical design criteria used in the pile design
 - the structural design criteria used in the pile design.
- Concrete for the piles shall be tested by project control testing as specified in AS3600 with a minimum rate of testing of one sample per batch of concrete.
- The maximum permissible deviation at cut off level of the center of each completed pile from the correct centre point is 50mm in any direction. The maximum permissible deviation from the vertical at any level of a finished pile is 1 in 75. Allowable tolerance in cut off level is 20mm.
- Pile shall be driven in an order and in such manner that no damage is sustained by previously driven piles or structure.
- The contractor shall record in a manner approved by the engineer, details of the construction of each pile and submit all details to the engineer within 48 hours of the pile being constructed.
- The pile set out positions will be available prior to the commencement of the site work.
- The contractor shall engage the services of a licensed surveyor to setout the piles from the building grid lines setout by the proprietor's surveyors. The contractor shall engage the services of a licensed surveyor to check setout of completed piles. A schedule of survey results shall be forwarded to the engineer on a progressive basis. Any existing setout reference and/or datum which are lost or disturbed during the course of the work shall be established by the contractor at his own cost.
- The contractor shall ensure that the pile driving technique employed does not cause the propagation of damage inducing waves.
- The contractor shall produce a report to demonstrate that the piles have been installed in accordance with these notes and the design requirements.
- Any bored piers / barrettes failing to reach design depth shall be notified to the engineer immediately, and the reasons shall be stated.

Concrete

- All concrete work shall be in accordance with AS3600.
- Concrete shall be as follows unless noted otherwise on the drawings or specification:
 - Slump: 80mm ±15mm
 - Max. aggregate: 20mm
 - Cement: Type gp
 - The fines ratio which is defined as the proportion by weight of aggregate passing the 1.18mm sieve size to the total aggregate in the mix, must not exceed 0.4.
 - Maximum drying shrinkage strain measured in accordance with AS 1012 Part 13 shall not exceed 650 x 10⁻⁶ at eight.
- See column schedule for slab & column concrete strengths. See wall key plan for wall concrete strengths See foundation plan for footing concrete strengths
- Unless noted otherwise, the characteristic concrete strength and clear cover to the reinforcement (including fitments) shall be as follows:

Element	Grade (Mpa)	Cover (mm)
Columns	40	40
Walls	40	25
Flat Slab (PT)	40	25
One Way Spanning Slab	40	25
Beams - Continuous	40	35
Beams Single Span	40	40
Slab/ Beams cast against damp proof membrane	40	35
Piles	40	75
Pilecaps	40	75
Ground Beams	40	45

Notes:

- Project assessment of concrete strength is required. In addition a minimum requirement of one sample per batch shall apply to concrete in columns and bearing walls and described in the specification.
- In addition to the above, the cover shall not be less than the larger of the maximum aggregate size and the nominal size of the bar or tendon to which the cover is measured.
- Sizes of concrete elements do not include thickness of applied finishes.
- Beam depths are noted first and include thickness of slab if any.
- Construction joints where not shown on drawings shall be located to the approval of the engineer. Tenders shall allow for all such construction joints. Saw joints shall be cut after the concrete has hardened sufficiently that it will not be damaged by the sawing, but before shrinkage cracking can occur.
- All formwork and propping under suspended concrete works shall be to AS 3610 and is to be removed before any masonry is built above. Back propping for formwork to be designed in accordance with AS 3610 and submitted to the Engineer for comments. Camber requirements, if any, in beams and slabs shall be as noted on the drawings.
- Unless otherwise specified the minimum standard of finishes to formed concrete surfaces shall be as follows:
 - Concrete Element or Surface
 - Normal architectural work and surfaces not otherwise specified
 - Civil engineering works
 - Surfaces to be rendered or hidden by other finishes (e.g. footings, rear faces, of retaining walls)
- The tolerance classes to unformed concrete surfaces determined by a straight edge placed anywhere on the surface in any direction are:
 - Class A: maximum deviation from a 3m straight edge - 3mm
 - Class B: maximum deviation from a 3m straight edge - 6mm
 - Class C: maximum deviation from a 0.6m straight edge 6mm
 - Class B shall apply unless shown otherwise on the drawings.
- Unformed surfaces shall be finished by (choose from the following):
 - Three periods of power floating with approved machine, allow sufficient time between periods to allow bleed water to surface and evaporate.
 - Screeding by approved means to finished levels.
 - Machine floating with approved equipment to an uniform smooth texture.
 - Hand float in locations inaccessible to the machine.
 - Steel trowelling to produce a surface free of trowel marks and uniform in texture and appearance.
 - Floating with a wood float.
 - Screeding to level and scoring the surface with an approved tool to produce a coarse scored texture.
- Camber requirements, if any, in beams and slabs shall be as noted on the drawings.
- Cambers shall be checked before and after depropping to determine the deflection of the members under their self weight.
- Provision shall be made in the formwork system for the engineer to vary the specified cambers for subsequent pours on the basis of this information.
- Cure concrete by keeping continuously wet for 7 days or by covering with clear plastic sheeting. Alternatively curing compounds shall only be considered if they are at least 90% efficient after 72 hours.

Reinforcement

- All reinforcement shall be as follows:

Symbol	Type	Designation to AS/ NZS 4671
R	Normal Ductility plain bars	R250N
N	Normal Ductility deformed bars	D500N
SN/RN	Normal Ductilitywelded mesh square or rectangular	D500SN/D500RN
SL/RL	Low Ductilitywelded mesh square or rectangular	D500SL/D500RL
T	"Tempcore" bars or equivalent	D500SL/D500RL

Notes:

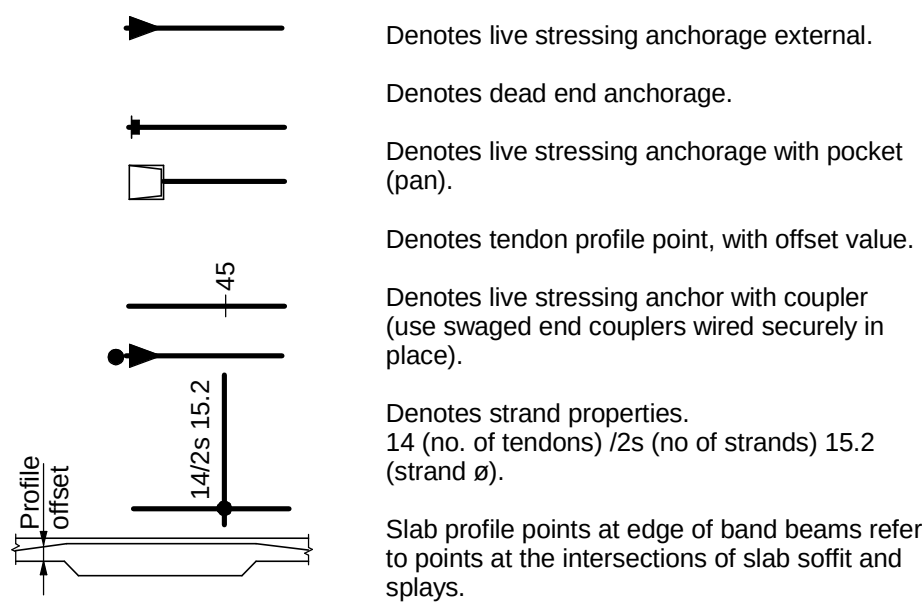
- The number following R, N or T is the bar diameter in mm.
- T bars shall be used for all rebend of pull-out applications
- Steel reinforcement for concrete MUST comply with AS/NZS 4671 or AS/NZS 4672. It MUST be cut and bent in accordance with AS 3600, AS 5100 or AS 2870.
- Clear cover to reinforcement (including fitments) shall be as noted on the drawings. Where cover is not specifically designated, an RFI is to be raised with the engineer.
- No Reinforcement splices shall be made, other than those shown on the structural drawings, without the prior approval of the engineer. Minimum lap for fabric shall be one mesh plus 25mm.
- Welding of reinforcement is not permitted unless shown on the drawings or approved by the engineer.
- Top and bottom reinforcement in slabs shall be supported in both directions at maximum centres of 1000mm.
- Reinforcement to be checked by the engineer prior to pouring. Give engineer 48 hours notice of check being required and allow sufficient time for any remedial work required after checking prior to concrete pour.
- The minimum clear spacing between conduits, cables, pipes and bars to be as required by AS 3600 but not less than three diameters. Conduits in slabs to be placed above bottom reinforcement and below top reinforcement.
- All re-entrant corners and service holes are to have trimmer bars placed diagonally at corners using two bars (1600 long), one tied to the underside of top reinforcement and the other tied to the top of the bottom reinforcement. Trimmer bars to be N12 for slab not thicker than 120, N16 for slabs not thicker than 180, N20 otherwise. U.N.O.
- All hooks, laps and bends shall be in accordance with AS 3600 unless shown otherwise. Laps in mesh shall be made so that the overlap measured between the outermost transverse wires of each sheet is not less than the spacing of the wires plus 25mm.
- Abbreviations used for reinforcement location:

B - Bottom
BB - Bottom Bottom
T - Top
TT - Top Top
EW - Each Way
EF - Each Face
NF - Near Face
FF - Far Face
LV - Bar Length Varies
AP - Alternately Placed
AS - Alternately Staggered

Prestressing

- All prestressing materials and workmanship shall be in accordance with AS 3600.
- Submit all test certificates, calculations and shop drawings to the engineer prior to construction.
- All prestressing strand shall be 12.7mm diameter super grade, stress relieved low-relaxation strand to AS1311 in 70 x 19mm flat ducts, UNO.
- All 12.7mm dia strands shall have a minimum UTS of 184kN relaxation at 2.5% max after 1000 hrs at 70% of breaking load.
- All 15.2mm dia strands shall have a minimum UTS of 250kN relaxation at 2.5% max after 1000 hrs at 70% of breaking load. Mechanical properties of the strands shall be such that the force developed in the tendon at 1% strain shall be 87.5% UTS (min) and strain at failure shall be 6% min.
- All stressing equipment and gauges shall possess current calibration certificates available to the consulting engineer upon request.
- Tendons shall be located in accordance with the drawings to a vertical tolerance of +/-5.0mm.
- Tendons shall be securely fixed in position at max. 1200 centres along the length.
- Tendons shall be securely fixed in position at max. 1200 centres along the length.
- Tendon heights given on the drawings are measured from the soffit of beam to:
 - At anchorages - to centreline of anchor
 - Elsewhere - to underside of duct
- Tendon profiles shall have precedence over other reinforcement and service conduits.
- Stressing of tendons shall proceed in a minimum of two stages, as follows:
 - Stress each individual strand of all tendons to 25% UTS at approx. 24 hrs after completion of pour (f_{cp} = 7MPa minimum).
 - Fully stress tendons when concrete attains -
 - f_{cp} = 22 MPa for 12.7mm dia strands (mono)
 - f_{cp} = 25 MPa for 15.2mm dia or 12.7mm dia strands (multi)
 - Jack tendons to 85% UTS and lock off.
 - Jack central tendons first and work progressively outwards on each side (alternating).
- Tendon position shall be marked on slab soffit by use of embedded plastic buttons at grid and mid-grid locations. Proposed arrangement to be submitted for approval.

- Key to symbols:



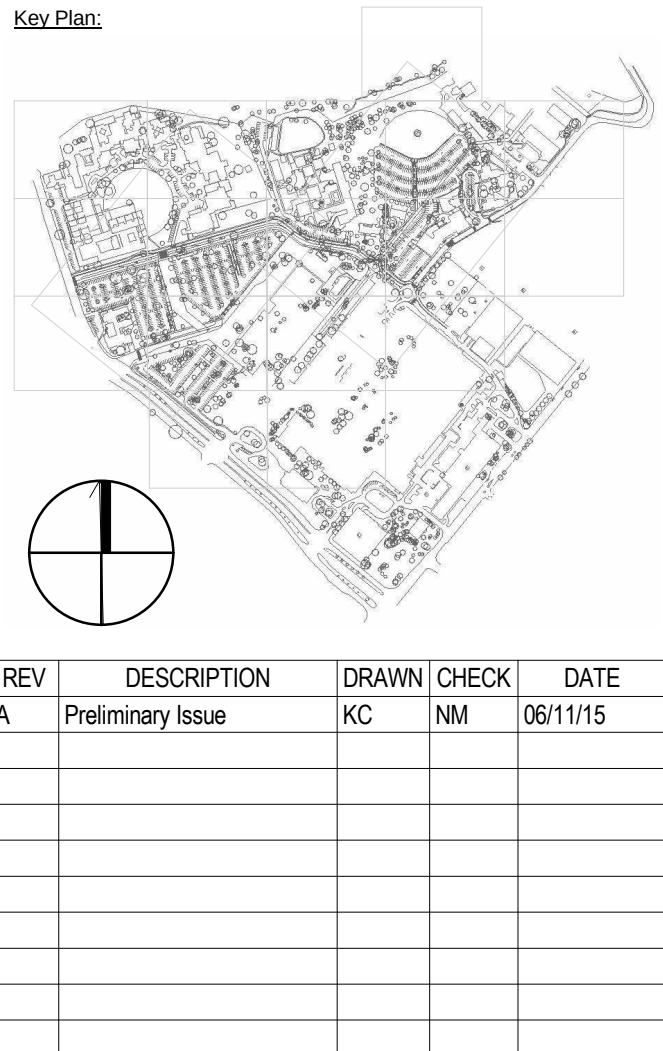
- Final stressing shall first be applied to beam/ band tendons, followed then by slab tendons.
- Alternative staged stressing operations where required shall be as noted.
- Strand extensions shall be recorded following final stressing for submission to the engineer.
- Following approval of the extensions by the engineer strand ends shall be cut off and sealed flush with the surrounding concrete face with a homogeneous cement mix.
- Grouting of tendons shall occur within 7 days of stressing approval.
- Design calculations have been based on a 6mm wedge slip during anchoring of the tendons. The following figures have been used to evaluate friction losses:
 - Friction co-efficient 0.2
 - Wobble factor 0.20 rad/m

Additional Concrete Requirements For Post Tensioning

- All concrete test cylinders shall be site cured under conditions consistent with the concrete pour.
- Maximum shrinkage strain at 56 days, measured in accordance with AS1012 part 13, shall be 650 x 10⁻⁶ microstrain.
- To prevent damage to stressing tendons and reinforcement, concrete pump lines shall be adequately restrained and supported on stools or timber blocks.
- Slurry used to lubricate concrete pump lines shall not be used in any structural member.

External Stressing Pocket Treatment Notes

- Cut back strand ends as far as possible.
- Degrease and wire brush strand ends and anchor pocket and allow to dry.
- Epoxy coat strand ends and anchor.
- Fill anchor pocket with non-shrink grout (Masterflow 870 by MDT or similar) flush with slab.
- Immediately cover grouted pocket with plastic cover securely taped around all four edges to promote moist curing of grout.
- Leave plastic cover on for 7 days minimum.
- Remove plastic and apply acrylic waterproofing membrane, compatible with the specified paint system, extending past the grouted pocket to the exposed slab edge.
- Allow acrylic membrane to cure before application of specified paint system over.



REV	DESCRIPTION	DRAWN	CHECK	DATE
A	Preliminary Issue	KC	NM	06/11/15

Project Status

FOR TENDER

CLIENT: Health Infrastructure  Health Infrastructure	P: (02) 9678 9427 F: (02) 8944 1377 www.health.nsw.gov.au
---	---

PROJECT MANAGER: 	
Darling Park Tower 2 201 Sussex St Sydney NSW 2000	P: (02) 8266 0000 F: (02) 8266 9999 www.pwc.com/au

LEAD ARCHITECT: Lvl 1, 110 Walker Street North Sydney NSW 2060	P: (02) 9556 2666 F: (02) 9559 3015 askhddr@hdrincollinsydney.com
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HDR | RD + MSJ

ARUP

Level 10, 201 Kent Street,
Sydney NSW 2000
www.arup.com

WESTMEAD MULTI DECK CARPARK
Cnr Hawkesbury Road and Darcy Road
Westmead NSW 2145



DRAWING TITLE:

General Notes - Sheet 1

SCALE: 1:1	DOWNS NUMBER: 5335	CHECKED: NM
PROJECT NUMBER: 236482	DRAWING NUMBER: MSC-ARP-ST-DG-0001 A	ISSUE:

Masonry Retaining Walls

- Masonry shall be in accordance with AS 3700 masonry structures.
- Characteristic unconfined compressive strength (fuc) of masonry units to be 15 MPa (fuc = 20 MPa for traditional brick) UNO.
- Mortar shall be C1:L0.5:S4.5.
- Grout for cavity fill shall have a characteristic strength of 15 MPa. Sufficient water shall be added to ensure that the grout flows into and fills all parts of the grout space to minimise segregation the grout shall be thoroughly remixed immediately prior to pouring.
- Ties shall be medium duty in accordance with AS 2699. Minimum 50mm embedment into each leaf.

Cavity width mm	Horizontal Spacing mm	Vertical Spacing mm
80 or Less	600	600
81-110	400	600
110-160	300	600

- Movement joints 10mm wide shall be included in unbroken runs of walls exceeding 8 metres long.
- Height of concrete pour shall be limited to 600mm per 2 hours.
- No backfilling shall be placed behind retaining walls until 14 days after filling cavity.
- All cavities shall be kept clear of mortar, rubble etc.

Non-Load Bearing Masonry

- Masonry shall be in accordance with AS3700 masonry structures.
- Masonry units shall have characteristic unconfined compressive strength fuc = 15MPa (fuc = 20 MPa for traditional brick) unless shown otherwise.
- Masonry unit sizes shall be 190mm high x 290mm long UNO. Thickness as specified on the drawing.
- Mortar to masonry shall be C1:L1:S6 generally. Lime cannot be substituted by chemical plasticisers.
- Mortar joints shall be finished flush with masonry face UNO.
- Masonry units shall be laid in running bond pattern UNO.
- Masonry units shall be minimum Salt attack resistance grade of 'Protected' UNO.
- Movement joints 10mm wide shall be included in unbroken runs of walls exceeding 8 metres long and 4 metres from corners.
- No horizontal nor diagonal chasing of walls will be allowed. Maximum depth of vertical chasing shall be 20mm. Cored or hollow masonry units that are chased shall be core filled.
- Mortar to all retaining walls and load bearing masonry below ground floor level shall be M1:L0.5:S4.5.
- Provide horizontal joint reinforcing consisting of galvanised fabric with two main wires of 3.15mm diameter at 600mm vertical spacing. Also provide reinforcement in the bed joint immediately above and below openings and extending 600mm beyond the opening. Fabric laps shall be 400mm minimum. The above clause applies for all block work whereas for brickwork use the following but only for special projects.
- Provide horizontal joint reinforcement consisting of galvanised fabric with two main wires of 3.15mm diameter to be placed in the three bed joints at the top and bottom of all walls as well as above all openings. The fabric to extend 600mm beyond each side of the opening. Fabric laps shall be 400mm minimum.
- Slabs that are to support masonry shall not be depropped for 28 days minimum.
- Do not load masonry units onto supporting slab until slab is depropped.
- Load all masonry units onto slab prior to laying.
- Load all masonry units onto slab prior to finishing head details.
- All non-loadbearing walls shall have a 20mm compressible joint and sliding wall ties between top of wall and underside of suspended slabs or beams over.

Load Bearing Masonry

- Only load bearing masonry is indicated on the drawings.
- All masonry is to be tied to abutting steel or concrete columns and where relevant provide head restraints attached to underside of structure above.
- Grouting of hollow masonry:
 - Grout shall have the following proportions: 1: 2: 3 (Cement: Sand: 10mm Aggregate) and a slump of 230mm and a compressive strength f'c = 20 MPa unless noted otherwise.
 - Cleanout openings shall be provided at the bottom course in all cores.
 - Cores are to be cleaned of all mortar fins and droppings through cleanout openings before placing vertical reinforcement.
 - Vertical reinforcement is to be placed and tied prior to grouting and cleanout openings are not to be closed prior to inspection by the superintendent.
 - Grout is to be rodded to ensure proper filling of cores and the maximum continuous pour height is to be 2600mm.
- Chasing of load bearing masonry shall only be permitted where approved by the superintendent.
- Only load bearing masonry is indicated on drawings. Refer to architects drawings for non-load bearing block wall locations.
- Provide vertical control joints at maximum spacing of 6 meters & 3 meters from corners.
- Provide the following Slip joint between underside of concrete slan and top of load bearing wall: Granor Graften SJJ-100-50/Wall width or approved equivalent.

Core Filling

- Grout for concrete filling, where required, shall have a nominal composition of C1 : S3 : A2 (10mm coarse aggregate), the grout shall have a slump of 230mm and compressive strength f'c = 15 MPa minimum.
- Walls shall be full height before grouting cores. Cleanout openings shall be provided at bottom course in all cores.
- Before placing vertical reinforcement, if any, cores shall be cleaned of all mortar fins and droppings through cleanout openings which shall not be closed until inspected by superintendent/engineer.
- Grout shall be rodded to ensure filling of cores. Maximum continuous pour height of grout shall be 3600mm.

Structural Steel

- All workmanship & materials shall be in accordance with AS4100. All other materials (such as bolts, washers, straps and ties) which are not specifically indicated on the drawings but required in construction, shall be provided at the builders discretion.
- Steel shall be the following grade unless noted otherwise:

Element	Grade
Plate to AS3678	250
All BHP hot rolled sections to AS3679.1.	300
Welded sections to AS3679.2 300.	300
Square and Rectangular hollow sections to AS1163. UNO.	350
Circular hollow sections to AS1163 up to and including 165mm.	250 UNO
Circular hollow sections to AS1163 168mm diameter & larger.	350 UNO

- Structural steel must comply with AS/NZS 1163 or AS/NZS 3679.1. Acceptable manufacturers of structural steel must hold a valid certificate of approval, issued by the Australian Certification Authority for Reinforcing Steel Ltd (ACRS) or to an equivalent certification system as may be approved in writing by the specifier. Evidence or compliance with this clause must be obtained when contract bids are received.
- At least three weeks prior to the commencement of fabrication submit shop detail drawings for examination by the engineer.
- No steelwork shall be fabricated until final approval of the shop detail drawings has been received by the builder and all review comments on the workshop drawings have been resolved to the engineer's satisfaction.
- All dimensions and levels (including H.D. bolts as constructed) affecting new steelwork shall be checked on site and shown on shop details.
- The builder shall be responsible for providing temporary bracing until the structure and all adjoining masonry is complete.
- All welding shall be special purpose (SP) in accordance with AS1554 using electrode types E48 or W50 minimum UNO.
- Welds shall be 6mm continuous fillet welds unless otherwise noted. Butt welds shall be complete penetration butt welds as defined in AS1554 unless otherwise noted.
- All butt welds shall be subject to 100% testing by ultrasonic or other appropriate methods at the contractor's cost.
- Bolt types and designations shall be as follows:
 - 4.6/s - Commercial bolts to AS1111, snug tightened.
 - 8.8/s - High strength structural bolts, nuts and hardened washers to AS1252, snug tightened.
 - 8.8/tb - High strength structural bolts as above, fully tensioned to AS4100 in a bearing type joint.
 - 8.8/tf - High strength structural bolts as above, fully tensioned to AS4100 in friction type joint with contact surfaces left uncoated.

- All bolts, threaded rods, nuts and washers, (generically termed as bolts), used on the project must meet the performance requirements of AS/NZS 1252-1996; High Strength Steel Bolts and Associated Nuts and Washers for Structural Engineering. The contractor is to provide compliance certificates to the Structural Engineer for each batch of bolts to be used on the project to verify the above. In addition to the above, 6 bolts of each type from each batch of bolts to be used on the project must be tested by a NATA accredited testing facility. Testing for AS/NZS 1252-1996 compliance to be carried out with particular consideration given to the tensile load, proof load-bolts and nuts, hardness for tensile and very large bolts and chemical composition from original heat certificate. If bolts supplied to the project are found not to meet AS/NZS 1252-1996 requirements, the Contractor must remove all installed bolts sourced from the defective batch and replace them with compliant bolts. All holding down bolts shall be as noted above or be made from bars with minimum yield stress 250 MPa with threads to AS 1275 UNO.
- All bolts shall be M20 8.8/S UNO. No steel to steel connection shall have less than 2M16 8.8/s bolts UNO.
- M12 and smaller bolts shall be commercial grade (4.6/s) UNO. M16 and larger bolts shall be high strength snug tightened (8.8/s) UNO.
- The ends of all hollow sections shall be sealed with 3mm end plates UNO.
- All plates shall be 10mm thick UNO.
- All reactions, where shown, are in kN UNO.
- Bracing connections must be capable of carrying full capacity of the brace UNO.
- In all cases where the wall thickness of SHS or RHS is less than 6mm and to which a fin plate is welded, provide a 6mm plate stiffener, width is to be 15mm less than face of section, welded all round.
- All masonry shall be tied to abutting steel columns. Unless specifies otherwise finishes shall be:
 - Internal steelwork generally: Refer to specification
 - External steelwork generally: Refer to specification
 - Members embedded in either leaf or the cavity of external masonry walls: Hot dip galvanised in accordance with AS 4791 or AS 4792. 500g/m2 minimum coating.
 - Bolts, nuts, washers, straps and holding down bolts: Hot dip galvanised in accordance with AS 4791 or AS 4792. 500g/m2 minimum coating.
 - In addition to the finish specified, steelwork in contact with the ground is to be coated with a Interzone 954 HS or equivalent approved, to a minimum thickness of 0.4mm.
 - Exterior fully exposed pin connections: All components, including pins, cover plates, set screws, cleat plates and end plates to be hot dip galvanised (Minimum coating 500g/m²) and then prepared and coated as specified, or as for adjacent steelwork.
 - Fully interior pin connections: Pins, cover plates and set screws to be hot dip galvanised minimum coating 500g/m².

- For galvanised coatings patch field damage and site welds with two coats of a two pack Epoxy Polyamide Zinc-rich paint containing a minimum of 92% zinc dust in the dry film which shall be built up to 75 micrometres minimum.
- All sealed hollow sections shall be galvanised shall have the required vent holes shown on the shop drawings, as approved by the engineer.
- Grout under baseplates to be high strength cementitious non-shrink (Masterflow 870 by Master Builders or equal approved) unless shown otherwise.
- Cold forged sections shall be roll formed from zinc coated high strength "Zinc Hi-Ten" steel strip, conforming to AS1397/G450 Z350 (450MPa minimum yield stress, 200g/m5 minimum coating mass). Sections shall have dimensions equivalent to those shown in LYSAGHT catalogue.
- Purlin cleats shall be in accordance with the manufacturer's standard details except where the top flange of the purlin is between 250mm and 750mm above supporting steelwork 75 x 75 x 8 angle cleats shall be used. Purtrins shall be fixed using approved flanged bolts and nuts.
- Bridging to be in accordance with the manufacturer's standard details.
- Ceiling systems, ductwork etc. to be suspended from purlin's should be fixed with hook bolts through the purlin web. The flanges of the purlin's or girt's shall not be holed.
- Provide 50 x 50 x 3 galvanised angle trimmers to carry sheeting as required at purlin and girt ends. Fix with one no. 14 tek screw per purlin/girt. This will generally require two angles on hips and valleys, one angle on gables and one vertical angle at all corners.
- Open sections on their side with flanges vertically up shall have 10mm diameter drain holes at quarter points in length.
- Where roof bracing spans in excess of 3m, one 6mm diameter sag rod per 3m evenly spaced shall be provided.
- Where non-continuous purlin's are to be cleated from the side of supporting beams, the centre line of the bolt group shall not be more than 50mm eccentric from the centre line of the beam without the approval of the engineer.
- Not all structural steel is necessarily shown on the structural drawings. Refer also to the architects drawings.

- Abbreviations:
- CFW - continuous fillet weld
 - FSBW - full strength butt weld
 - PPBW - partial penetration butt weld

- Composite floor beams shall be constructed in accordance with AS2327.1 - and AS1554.2.
- Shear stud connectors, Studs shall be manufactured from low carbon steel in accordance with AS1443 with a minimum tensile strength after manufacture of 410 MPa. An approved serrated ceramic shield shall be used on each stud. Ceramic shields shall be removed after welding.
- Testing of studs:
 - Trial welding - Before commencing welding, trial welding of three studs to parent metal, of the same thickness as the work proper shall be made by an experienced operator and in the presence of the engineer. Weld tests shall be carried out using the studs specified. If any visual defect in the welds is apparent, the equipment shall be adjusted and a new series of three studs welded. When visually satisfactory welds are obtained, the studs shall be subject to a bend test
 - Bend test - All bend tests shall be done in the presence of the engineer. The bend test requires that the studs shall be struck heavy blows on the side of the head by an engineer's 0.9 kg hammer, the blows shall be directed as near as possible at right angles to the stud's long axis. For all diameters of studs the blows shall continue to be struck until the stud has moved more than 30 degrees from its original position. The welded area of the stud and the stud itself shall show no signs of fracturing. If any of the three test studs fail in the bend test, the test will be considered a failure. Additional tests may be made, but the number of studs welded shall be doubled each time a failure occurs in the three studs tested. Any three studs in such subsequent stud test welding may be selected for the bend test.
 - Random testing - The engineer may at his discretion carry out his own testing of studs on an ad hoc basis. Should a failure occur on any member then a further 5% of studs on that member shall be tested. Any further failure will result in the testing of all remaining studs on that member. All shear studs that fail shall be replaced by a procedure permitted by the engineer at the builder's expense. Shear studs that have been bent during inspection shall be left bent

- Positioning of shear connectors The shear studs shall be positioned accurately as shown on the drawings and to within the positional tolerance of +/- 3mm. The shear studs shall be perpendicular to the surface to which they are attached unless otherwise specified or permitted.
- Panels shall be stored, handled and installed in accordance with the manufacturer's recommendations, including side lap fasteners.
- Decking shall be propped during construction as noted on the drawings, and as required by the manufacturer's printed instructions.
- Panels shall be fixed to the structural steelwork by power activated drivepins 4mm in diameter. Pins shall be located as required by the manufacturer. Shear stud connectors welded through the panels to the steel framework as shown on the structural steel drawings are an acceptable substitute but any shortfall shall be made good by drivepins as detailed above.
- The builder shall prepare shop drawings for the layout of the profiled steel decking for each level of the building. The drawings shall show the location and markings of panels and indicate the locations and extent of temporary propping. The shop drawings shall be submitted to the engineer for examination before fabrication.
- Top of all beams to be unpainted to allow through welding of shear studs.
- Concrete to be placed in such a way that does not compromise the strength & deflection limits of the floor. The design does not allow for loading from extra weight of concrete 'ponding' occurring during a 'mass flood' technique of pouring.
- Composite beam longitudinal shear design checks assume that decking sheet joints are to be fixed by overlapping at beam positions:

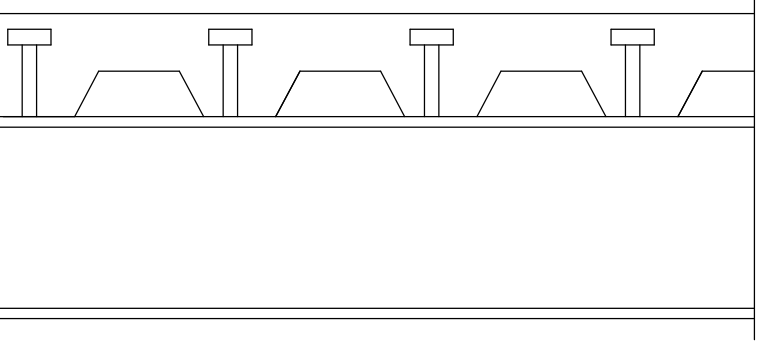


12. Shear stud abbreviations indicated as follows:

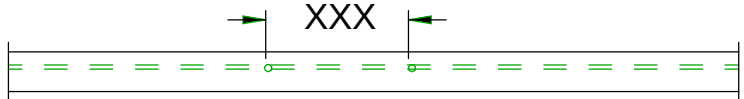
Decking perpendicular:
OPT = one per trough
OAT = one alternate trough
2PT = two per trough
3PT = three per trough
4PT = four per trough

Multiple studs in trough to be placed in line across beam width at 80mm centres.

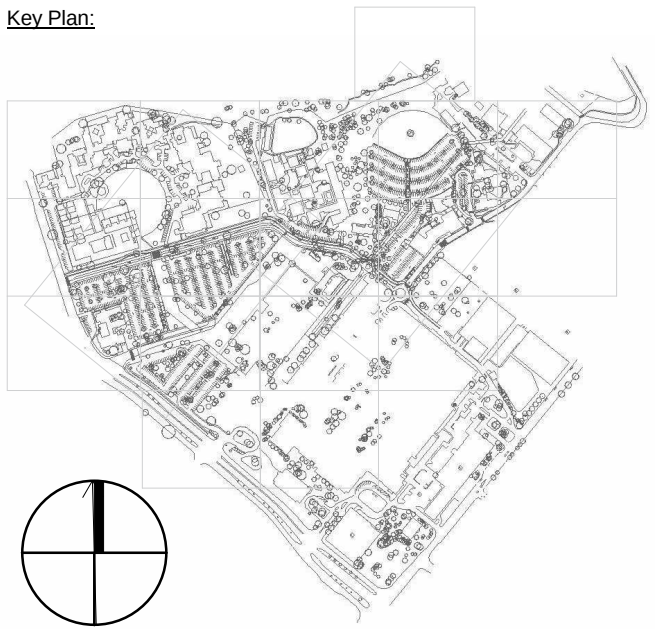
With perpendicular direction all studs to be placed centrally in troughs as follows:



Decking parallel:
<XXX> = studs centres distance central along the beam web thus:



- Holes of maximum dimensions equal to or less than 150mm are not shown on structural drawings. For details of such holes refer to relevant architects drawings and approved builders work drawings.
- All support beams indicated <NC> are non-composite: deck to be fixed to top flange of beam with nominal studs at 1050mm centres U.N.O.



REV	DESCRIPTION	DRAWN	CHECK	DATE
A	Preliminary Issue	KC	NM	06/11/15

Project Status
FOR TENDER

CLIENT:

Health Infrastructure



Health Infrastructure

Level 6, 77 Pacific Highway
North Sydney NSW 2060

P: (02) 9678 9427
F: (02) 8904 1377
www.health.nsw.gov.au

PROJECT MANAGER:



Darling Park Tower 2
201 Sussex St
Sydney NSW 2000

P: (02) 8266 0000
F: (02) 8266 9999
www.pwc.com.au

HDR | RD + MSJ

Lvl 1, 110 Walker Street
North Sydney NSW 2060

P: (02) 9656 2666
F: (02) 9659 3015
ashkdrd@hdrincollins.com

ARUP

Level 10, 201 Kent Street,
Sydney NSW 2000
www.arup.com

WESTMEAD MULTI DECK CARPARK
Cnr Hawkesbury Road and Darcy Road
Westmead NSW 2145



DRAWING TITLE:
General Notes - Sheet 2

SCALE: 1 : 1	DOCS NUMBER: 5335	CHECKED: NM
PROJECT NUMBER: 236482	DRAWING NUMBER: MSC-ARP-ST-DG-0002 A	ISSUE:

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Structural Costing Notes

The following costing notes have been prepared to be read in conjunction with the architectural and building services consultant drawings prepared and issued for the purpose of procuring a Design and Construct (D&C) tender. It is advised and should be recognised by all parties referencing the issued documents that the structural design of the building has been taken to design development (DD) status representing a notional 50% of detailed design completion. The balance of detailed design and documentation are yet to be undertaken and are to be included in the D&C contract.

On this basis, the design herein captures the intent of the structure commensurate with the requirements of the Client's brief, architectural, and building services design at this time, and therefore there will be a component of design development and design resolution through the detailed design phase that may impact or alter the design or design philosophy established to date. Changes to the design should be expected. The documented design should be treated as a best estimate for costing purposes and not an absolute maximum or minimum. Items such as slab and wall penetrations, slab folds, set-downs, and secondary structure may not be fully or adequately captured at this time and suitable allowance based on the Contractors experience should be allowed.

The reinforcement rates and costing data prepared are based on the structure in its PERMANENT CONDITION. Construction staging and temporary works requirements for demolition, temporary stability during or after demolition, insitu concrete, precast concrete, and structural steel erection have not been designed or documented and it is assumed in the design that the construction sequence will be commensurate with the permanent works. An indicative construction sequence is provided to inform the Contractor of our design assumptions. Should the selected construction sequence govern the structural design of the building, allowance should be made for analysis and design of the construction stages, modifications to the permanent works, and required temporary works.

Reference is made to the loading notes that contain the design loadings for the permanent condition, except as noted otherwise. The Contractor shall allow for additional slab thickness, reinforcement, and/or temporary propping for areas that may be considered necessary or proposed for construction staging.

General Considerations

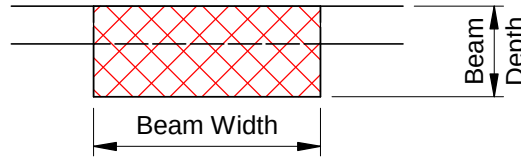
- The drawings, sketches, and costing notes shall be read in conjunction with the Structural General Notes, Structural Specification, Performance Specification for post-tensioned slabs, geotechnical report, and all other relevant documents and reports.
- Preparation of these documents assumes that the Contractor and Subcontractors pricing the works are experienced in the construction of buildings of this nature and the key design and construction items and risks.
- Should any of the documentation be considered unclear or require interpretation greater than considered reasonable, the Structural Engineer should be contacted for additional information or clarification.
- The drawings may not be fully coordinated with the architectural and building services documents due to parallel design development during the preparation of the tender documents. For clarification contact the Structural Engineer or Architect.
- A 3D structural model prepared in REVIT will be issued in IFC format for information purposes. The design drawings have been prepared from the model. Any discrepancies are to be clarified with the structural engineer. The 3D model should not be relied upon for accurate quantity estimation and preparation of bills and quantities.
- The design of temporary works is excluded. The design of all temporary works and selection of erection sequence shall ensure that the permanent works are not overstressed during erection, nor are there any permanent "locked-in" stresses that would not be considered a component of the permanent "in-service" condition. The Subcontractor shall employ a qualified Structural Engineer to undertake the structural analysis and design of the works necessary to confirm the above requirement. Strengthening or modification of the existing framing or permanent works for erection purposes shall be agreed prior by the project structural engineer and architect.
- Material rates provided are not guaranteed but are best estimate based on the design at the time. No design contingency has been included. The contractor is to make an assessment based on their own experience with projects of this nature regarding the risks involved in wastage, additional elements and fixtures for construction purposes, design change and modification, final detailing, and the provision of an appropriate contingency.

Foundations & Substructure

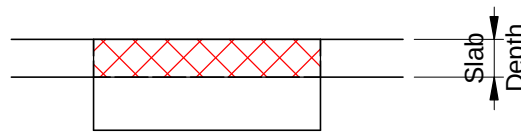
- Foundation information and design parameters are subject to recommendation from the geotechnical engineers subject to the desk studies, site specific investigation, and piles settlement analyses.
- Specific consideration shall be given to the presence asbestos containing materials contamination and its influence on foundation and excavation conditions. We recommend that the Contractor consults the contamination consultant during preparation of pricing to appropriately assess risks and contingencies.
- The current foundation design is based on pile/ foundation settlement analyses by Geotechnical Engineer.
- Over-excavation and provision of mass concrete to achieve required bearing capacity should be considered as part of design and construction contingency.
- Piling platforms, grillages, mats, propping and temporary supporting columns, temporary foundations, and other support and access requirements are not included in the structural drawings. Provision for design and construction shall be made by the Contractor as considered necessary. The loading diagrams provide guidance on existing and designed element capacities.
- Temporary shoring and underpinning may be required in areas adjacent existing buildings where additional excavation is being proposed. This will require further assessment when these areas can be visually inspected by the Geotechnical Engineer. Refer to the drawings for further information and locations.
- The basement is drained and has not been designed for hydrostatic pressure. Refer to the geotechnical report and sub-soil drainage requirements as specified by the hydraulic engineer. All new retaining walls shall be provided with vertical drainage behind the wall and each vertical drain shall be connected at the base to the sub-soil drainage system.

Insitu Concrete

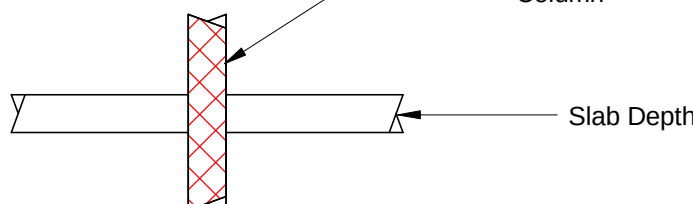
- Beam and band reinforcement and post-tensioning rates include slab depth:



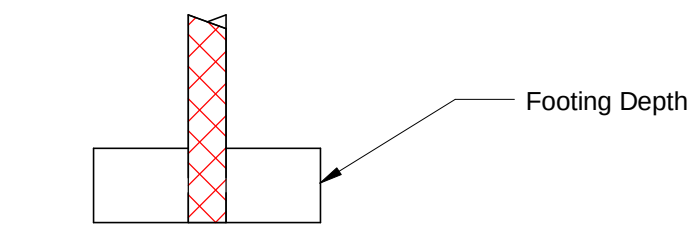
- Slab reinforcement and post-tensioning rates include beam width:



- Column reinforcement rates to include slab depth:



- Column reinforcement rates to include footing depth:



- Reinforcement rates exclude pull-out bars or couplers and lap bars from core walls for slabs, beams, lintel beams, and coupling walls. Allow the following Reid or pull-out bars for slabs at core walls where not otherwise indicated on plan. Note that slab pull-out bars of 16mm diameter require additional care during re-bending to avoid fracture and couplers or Reid bars should be considered. For bars >16mm couplers and L-bars or Reid inserts shall be used.
- Reinforcement wastage on site due to over ordering, supply of spares, or misplacement is not included in the rates. Tie wire and bar chairs are also excluded.
- Support bars and additional cogs required for bar fixing and tying are not allowed and are additional to reinforcement rates.
- Reinforcement rates include anti-burst requirements.
- Rates do not allow for construction joints other than laps in column and wall reinforcement at floor levels.
- Allowance shall be made for concrete upstands and integral falls to the top surface of all exterior and wet-area slab areas including roof, terrace, balcony, loggia, ground floor, plant, and landscaped areas as necessary to accommodate waterproofing.
- Allow 200 thick RC walls to planters 120kg/m3 reinforcement. Control joints at maximum 8m centres and 4m from corners.
- Rebates for cladding fixings, mat recesses, and other threshold details are not shown on the general arrangement drawings;
- Minor services penetrations or routes are not indicated on the structural drawings. The Contractor shall make suitable allowance based on the architectural and building services engineer's drawings.
- Advice from a facade maintenance contractor and cladding subcontractor is required to determine applied loads from abseiling, davit systems, or BMU's. Allowance should be made for reinforced concrete plinths and/or steel anchor points for davit arms or similar systems at roof and other external levels, and for necessary lateral restraints on exterior columns.
- Refer to the Architect's specification for concrete finishes to visible elements.
- Allowance shall be made for accommodating setdowns or folds in the new concrete to accommodate landscaping/planters or space for trees. Reference to be made to the applicable architectural/landscape drawings.

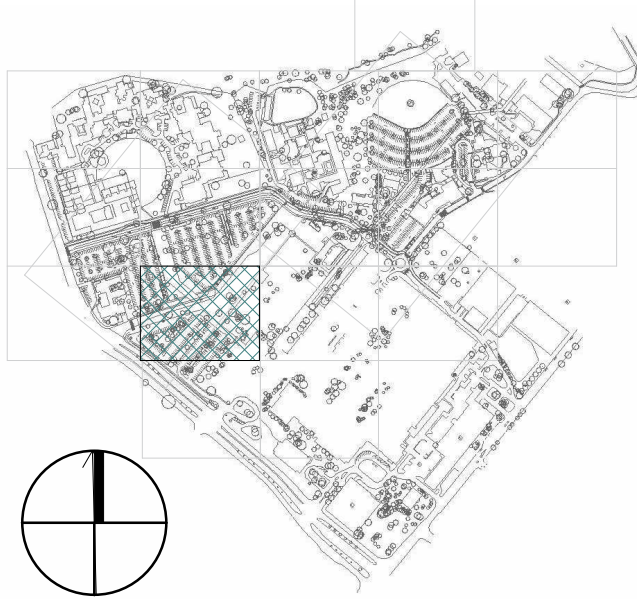
Structural Steel

- Where steelwork connections for expressed elements have not been specifically documented allowance shall be appropriate depending on whether elements are concealed or architecturally detailed. This may include pinned connections, recessed end plates, concealed bolts, cover plates, etc regardless of whether the intent is shown on the structural drawings. Reference is made to the architectural drawings for additional information. Expressed steelwork includes but may not be limited to:
- Steel connection allowance is additional to rates and tonnage provided.
- Allow full contact bearing surfaces for all steel (including composite steel) columns.
- Rolling margins and plate wastage is excluded from beam sizes or tonnage rates provided.
- Corrosion protection and painting specification to be in accordance with the Structural and Architectural specifications.
- Fire protection to all steel elements shall be in accordance with the BCA and fire engineer's requirements for the necessary fire resistance period for structural adequacy. Concrete filled steel columns do not require additional fire protection unless specifically noted on the drawings.
- Permanent metal formwork shall be assumed as Condeck HP 1.0mm bmt with 2 span continuous sheets unless noted otherwise. All propping for wet concrete conditions shall be in accordance with the manufacturer's requirements and is not shown on the structural drawings.
- Web penetrations for services through existing and new steel structure are not always indicated on the Tender drawings. The Contractor shall make suitable allowance based on the architectural and building services documents.

Anciliary Items & Assumptions

- Level LG concrete water tanks, and external surfaces of vertical concrete elements are assumed to have waterproof barriers, tanking, or membranes as specified by the architect for full tanking as necessary.
- Steelwork to support services is not included in the structural drawings. Refer to the building services engineer's specifications.
- Secondary steelwork to support facade elements and components has not been included or designed in all areas. This may include facades, sunshades, entrance canopies, security screens, shutters, awnings, plantroom steelwork supporting louvres and shutters, and roof feature framing. Refer to architects drawings for extent.
- Lifting beams to plant room and lift shafts is by others.
- Access ladders and walkways in plant rooms are by others.
- Miscellaneous enclosures and screens around plant areas including Louvre secondary framing is by others.
- Plant plinths and hobs extents and details are not shown on the structural drawings. Allowance is to be made.
- Structures to suit loading dock such as raised platform, dock levellers etc. are excluded.
- Roof access safety system and/or harness points are excluded.
- Topping slabs and jointing of topping slabs, self-leveling screeds, and other non-structural toppings and finishes are excluded.
- Service pits and trenches within basement including trench slabs to the substation are not shown. Allowance shall be made.
- Structural steel and concrete for landscape packages is excluded.
- Construction loading of floors in excess of stated design loads has not been design for. The Contractor shall allow for increase in areas deemed necessary for staging purposes.
- Construction penetrations required to suit construction methodology such as crane and hoist penetrations etc. are not shown. Provision shall be made for any design modifications and additional requirements such as lap bars and couplers.
- Crane and hoist footings are excluded.
- Slab and edge beam strengthening for screens, tower crane connections, construction loading platforms and other construction items has not been included. Provision shall be made for strengthening or propping.
- Allowance shall be made for lift motor rooms (including floor penetrations), enclosures, and roof slabs not currently shown on the structural drawings.
- Masonry wall details have been provided for typical panels and situations. Any areas outside of the scope of the documents should be queried.
- Materials associated with the making good of bulk excavations due to over excavation of rock breakout are excluded.

Key Plan:



REV	DESCRIPTION	DRAWN	CHECK	DATE
A	Preliminary Issue	KC	NM	06/11/15

Project Status
FOR TENDER

CLIENT:
Health Infrastructure


NSW
GOVERNMENT


Health
Infrastructure

Level 6, 77 Pacific Highway
North Sydney NSW 2060

P: (02) 9078 9427
F: (02) 8904 1377
www.health.health.nsw.gov.au

PROJECT MANAGER:


pwc

Darling Park Tower 2
201 Sussex St
Sydney NSW 2000

P: (02) 8266 0000
F: (02) 8266 9999
www.pwc.com.au

LEAD ARCHITECT:


HDR | RD + MSJ

Lvl 1, 110 Walker Street
North Sydney NSW 2060

P: (02) 9656 2666
F: (02) 9559 3015
askhddr@hdrincollinsydney.com

ARUP

Level 10, 201 Kent Street,
Sydney NSW 2000
www.arup.com

WESTMEAD MULTI DECK CARPARK
Cnr Hawkesbury Road and Darcy Road
Westmead NSW 2145



DRAWING TITLE:

Costing Notes

SCALE: 1 : 1	DOWNS NUMBER: 5335	CHECKED: NM
PROJECT NUMBER: 236482	DRAWING NUMBER: MSC-ARP-ST-DG-0003 A	ISSUE:

Floor Structure

Location	Type	Concrete	Post-Tensioning Steel (kg/m³)	Reinforcement (kg/m³)	Notes
Lower Ground Level	RC slab on ground (Jointed)	S32	-	28	
	Slabs under tank walls (unjointed)	S40	-	55	Refer to Details
Ground Level - Level 05	PT slabs & beams including ramps	S40	26	65	
	RC slab at NE	S40	-	130	Grid: CP12-13/ CPA-CPB
Level 06	PT slabs & beams	S40	26	65	
Core Lids	Refer to Plan	S40	-	110	RC Slab and Beam

Foundations

Type	Size	Concrete	Reinforcement (kg/m³)
Piles	Refer to Footing Plan	S40	60
Pile Caps	Refer to Footing Plan	S40	160

Core Walls

Stair Walls	Level	Thickness	Concrete	Reinforcement (kg/m³)
	LG-02	300	S50	140
	02-Roof	300	S40	120
Lift Walls	LG-02	200	S50	140
	02-Roof	200	S40	120

Columns

All	Level	Size	Concrete	Reinforcement (kg/m³)
	LG-02	See Plans	S50	220
	02-06	See Plans	S40	180

Stairs

Stairs Including Landing	Concrete	PT	Reinforcement (kg/m³)	Notes
	S40	-	120	150 thick throat - Stair master

Cantilever Retaining Walls

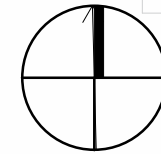
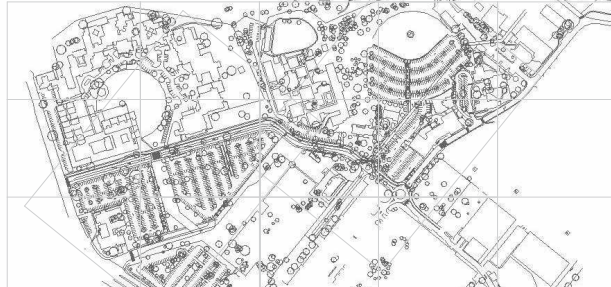
Type	Thickness	Concrete	Reinforcement (kg/m³)
RW1	200	S40	110
RW2	300	S40	110

Note:
Refer to Typical detail on Sheet DG-009 and schedule on sheet DG-1000 for sizes.

Crash Barriers:

See DG-2100 for reference details.
Extents as shown on Architecturals.

Key Plan:



REV	DESCRIPTION	DRAWN	CHECK	DATE
A	Preliminary Issue	KC	NM	06/11/15

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FOR TENDER

CLIENT:
Health Infrastructure
**Health Infrastructure**

Level 6, 77 Pacific Highway
North Sydney NSW 2060

P: (02) 9078 5427
F: (02) 8904 1377
www.hinfra.health.nsw.gov.au

PROJECT MANAGER:


pwc

Darling Park Tower 2
201 Sussex St
Sydney NSW 2000

P: (02) 8266 0000
F: (02) 8266 9999
www.pwc.com.au

LEAD ARCHITECT:

HDR | RD + MSJ

Lvl 1, 110 Walker Street
North Sydney NSW 2060

P: (02) 9956 2666
F: (02) 9959 3015
askhdrd@hdrincosidney.com

ARUP

Level 10, 201 Kent Street,
Sydney NSW 2000
www.arup.com

WESTMEAD MULTI DECK CARPARK
Cnr Hawkesbury Road and Darcy Road
Westmead NSW 2145

**WESTMEAD HOSPITAL REDEVELOPMENT**
Building health. Transforming lives.

DRAWING TITLE:
Costing Table - Sheet 1

SCALE: 1 : 1	DOHS NUMBER: 5335	CHECKED: NM
PROJECT NUMBER: 236482	DRAWING NUMBER: MSC-ARP-ST-DG-0004 A	ISSUE:

Bar Size Designation	f'c25MPa			f'c = 25 MPa				f'c = 32 MPa				f'c = 40 MPa			
	Compression			Tension				Tension				Tension			
	Embedment Length	Lap Splice Category I	Lap Splice Category II	Development		Lap Splice Length		Development		Lap Splice Length		Development		Lap Splice Length	
				Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars
N10	200	400	325	475	350	575	450	425	325	525	400	400	300	475	400
N12	200	500	400	600	450	750	575	525	400	650	500	475	375	600	500
N16	375	650	525	875	675	1100	850	775	600	975	750	700	525	875	675
N20	450	800	650	1175	900	1475	1125	1050	800	1300	1000	925	725	1150	900
N24	550	975	775	1450	1125	1800	1375	1275	975	1600	1225	1150	875	1425	1100
N28	625	1125	900	1675	1300	2125	1625	1500	1150	1875	1450	1325	1025	1675	1300
N32	725	1300	1025	2075	1600	2600	2000	1825	1425	2300	1775	1650	1275	2075	1600
N36	800	1450	1175	2450	1875	3050	2350	2175	1675	2700	2075	1950	1500	2425	1875
Notation Used on Dwgs	Lsc	Lsc, lap		Lst		Lst, lap		Lst		Lst, lap		Lst		Lst, lap	

Bar Size Designation	f'c = 50 MPa				f'c = 65 MPa				f'c = 80 MPa				Column & Wall Vertical Bars		
	Tension				Tension				Tension						
	Development		Lap Splice Length		Development		Lap Splice Length		Development		Lap Splice Length		Lap Splice		
	Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars	Top Bars	Other Bars	Type /X (46db)	Type /Y (52db)	Type /Z (58db)
N10	400	300	475	400	400	300	475	400	400	300	475	400	475	525	600
N12	475	350	575	500	475	350	575	500	475	350	575	500	575	625	700
N16	625	475	775	650	625	475	775	650	625	475	775	650	750	850	950
N20	825	650	1050	800	775	600	950	800	775	600	950	800	925	1050	1175
N24	1025	800	1275	975	925	700	1150	975	925	700	1150	975	1125	1250	1400
N28	1200	925	1500	1150	1075	825	1325	1125	1075	825	1325	1125	1300	1475	1625
N32	1475	1125	1850	1425	1300	1000	1625	1300	1300	1000	1625	1300	1475	1675	1875
N36	1725	1350	2175	1675	1525	1175	1900	1475	1525	1175	1900	1475	1675	1875	2100
Notation Used on Dwgs	Lst		Lst, lap		Lst		Lst, lap		Lst		Lst, lap		/X	/Y	/Z

NOTES:

1. The schedule above includes splice and embedment lengths which satisfy the project requirements and the following criteria.
fy = 500 MPa
Concrete weight = 2400 kg/m³3

2. Tension embedment and lap schedule lengths are based on the following minimum assumptions.

a) Clear distance between bars being developed or spliced is greater than db; or

b) Clear cover to bars is greater than the normal bar diameter; or

c) Minimum c/c spacing between bars is greater than;
Bars Requiring a Splice:
N12 and N16: 75mm
N20 andN24: 100mm
N28 and greater: 125mm
(Subtract 25mm if bar does not need splicing)

d) Minimum clear cover to bar is greater than:
N20 and less: 20mm
N24 and greater: 35mm

Rule (c) may be ignored for longitudinal steel in beams and columns enclosed in ties at the splice or development (detailer to request increased values where the above conditions are not met).

3. Use Category I compression lap splice length (Lcs) at all column and vertical wall splice locations not specifically detailed or indicated otherwise on plans, details or schedules. Category II splices shall only be used if nominated on details, schedules or plans.
Use tension splice for all other splices, unless otherwise shown on drawings.

4. Top bars are horizontal bars places so that more than 300mm of concrete is case in the member below the bar.

5. Where bars of different size are to be spliced, the splice length for all bars shall be that required for the largest.

6. When lightweight concrete is used, the values listed in the table above for tension embedment and tension lap splice lengths shall be increased by 30%.

7. When reinforcing bars are epoxy-coated, the values listed in the table above for tension embedment and tension lap splice lengths shall be increased by 50%.

8. When reinforcing bars are epoxy-coated and lightweight concrete used, the values listed in the table above for tension embedment and tension lap splice lengths shall be increased by 100%.
- | Standard Hooks & Cogs Table | | | | |
|-----------------------------------|---|------------------|------------------|-----------------|
| D500N bar diameter, ϕ_b (mm) | Pin diameter factor, fp (Pin diameter $\phi_p = f_p \phi_b$) | 180° hook a (mm) | 135° hook b (mm) | 90° hook c (mm) |
| 10 | 4 for fitments | 100 | 120 | 140 |
| | 5 | 105 | 130 | 155 |
| 12 | 4 for fitments | 110 | 130 | 155 |
| | 5 | 115 | 145 | 170 |
| 16 | 4 for fitments | 120 | 150 | 185 |
| | 5 | 130 | 165 | 205 |
| 20 | 4 for fitments | 140 | 180 | 220 |
| | 5 | 150 | 200 | 245 |
| 24 | 4 for fitments | 170 | 220 | 265 |
| | 5 | 180 | 240 | 295 |
| 28 | 5 | 210 | 280 | 345 |
| 32 | 5 | 240 | 320 | 395 |
| 36 | 5 | 270 | 355 | 440 |
| 40 | 5 | 300 | 395 | 490 |
| | | | | |
-
- Typical Hooked Development
- Key Plan:
- | REV | DESCRIPTION | DRAWN | CHECK | DATE |
|-----|-------------------|-------|-------|----------|
| A | Preliminary Issue | KC | NM | 06/11/15 |
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- Project Status
FOR TENDER
- CLIENT:

Health Infrastructure



Health Infrastructure

Level 6, 77 Pacific Highway
North Sydney NSW 2060

P: (02) 9078 9427
F: (02) 8904 1377
www.hinfra.health.nsw.gov.au
- PROJECT MANAGER:



Darling Park Tower 2
201 Sussex St
Sydney NSW 2000

P: (02) 8266 0000
F: (02) 8266 9999
www.pwc.com.au
- LEAD ARCHITECT:



Lvl 1, 110 Walker Street
North Sydney NSW 2060

P: (02) 9956 2666
F: (02) 9959 3015
askhdrd@hdrincosidney.com
- ARUP

Level 10, 201 Kent Street,
Sydney NSW 2000
www.arup.com
- WESTMEAD MULTI DECK CARPARK
Cnr Hawkesbury Road and Darcy Road
Westmead NSW 2145
-
- DRAWING TITLE:
Typical Reinforcement Lap &
Development Tables
- | | | |
|----------------------------------|--|----------------|
| SCALE:
1 : 1 | DOHS NUMBER:
5335 | CHECKED:
NM |
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