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ELEMENT CONSULTING ENGINEERS (Pty) Ltd
A FIFTH DIMENSION IN ENGINEERING

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Project: **CONSTRUCTION OF NEW ASHTON MATERIAL RECOVERY FACILITY**
 Client:



GENERAL NOTES & SPECIFICATIONS

	Name:	ECSA Reg N° :	
Compiled:	SM	-	January 2022
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DRAWING NUMBER

Status:	ELEMENT CE Project Number:	Drw. N°:	Revision:
T	2104161	2104161-S-000	B

Drawing Status:	
D = Draft	C = Construction
P = Preliminary	A = As Built
T = Tender Purposes	

A. GENERAL ENGINEERING NOTES

1. These notes to be read in conjunction with the drawings and project specifications.
2. Engineering drawings and Structural construction notes are to be read in conjunction and reference to the relevant Architectural, Civil & Structural Engineers', Mechanical, Fire & Electrical Engineers' drawings as well as any specifications in the Bill of Quantities. Errors, omissions & discrepancies to be brought to the Engineer attention prior to commencement of work.
3. Information and specification contained on drawings takes preference over information in the Bill of Quantities.
4. Alternative products to those specified may only be used with Engineer's approval.
5. All setting-out dimensions, levels and dimensions to be confirmed by the Contractor on site.
6. Any discrepancies to be brought to the Engineer's attention. Under no conditions are dimensions to be scaled off the drawings.
7. Alternative products to those specified may only be used with Engineer's approval.
8. The Contractor is to provide a triplicate carbonated site instruction book and is responsible that the professional team's instructions are clearly and unambiguously recorded.
9. In instances where any new work is in contact with or ties into existing services or structures, the Contractor is to gather all relevant dimensions and levels and convey to the Engineer and Project Team this information prior to making decisions and proceeding with the work.
10. Provide an isolation joint between all new and existing structures, unless indicated otherwise on drawings.
11. Refer to Architect's drawings for waterproofing details and specifications.
12. Damage to waterproofing materials, drains, pipes and services during backfilling, steel fixing and concreting are to the Contractor's account.
13. The health and safety procedures and regulations are to be implemented on the site and the Contractor is to ensure that these are maintained throughout the contract duration.
14. Dewatering of the site and prevention of damages to existing site environs, elements and equipment is always to be strictly enforced throughout the duration of the contract.
15. All work shall be executed in strict accordance with the latest SANS 1200, 10400, 2001, 1921, 10137, 10160 to 10164 or any other latest SANS (SABS) or specifications which might be applicable for the construction of this project.
16. Design, materials used and method of construction to be in accordance with SANS 10100, 2001, 10137 and 10160 to 10164. The Contractor is to ensure that copies of all the relevant SANS Specifications referred to on the drawings and in the project documentation, shall be available for reference on site.
17. Latest SANS 2001 and relevant SANS 1200 clauses, project specifications and relevant contract documentation to be applied throughout the project duration and any deviation from these to be conveyed to Engineer and Project Team prior to implementation.

18. It is the contractor's responsibility to ensure that he understands and complies with all relevant engineering drawings and specifications and is adequately experienced to undertake all aspects of the work safely.
19. All details and dimensions pertaining to any existing structures are to be confirmed on site by the contractor and the engineer is to be immediately informed of any unexpected aspects pertaining to them.
20. The contractor is, at all times, to be fully responsible for quality control on site ensuring strict compliance with all drawings, details and specifications issued for construction by the professional team.
21. Sealing compounds for the building & construction industry to be in accordance with the requirements of:
 - a. SANS 11077 (2009) sealing compounds for the building and construction industry, two component, polyurethane-base
22. Sika-flex 11FC universal one component polyurethane joint sealant (or equal and approved) may be used on all wall joints and must be applied strictly to the manufacturer's specifications and the correct backing cord should be used where necessary.
23. All proprietary products to be used in strict accordance with manufacturer's guidelines and instructions. Contractor to seek approval from the engineer for any deviation from the prescribed proprietary products.
24. All required core hole positions to be approved by the Engineer prior to commencing. If scanning of rebar is needed, this to take place prior to commencing with the core drill. All core drilled holes and rebar (if applicable) to receive specified surface preparation and be filled, as specified, within 48 hours.

B. FOUNDATIONS AND EARTHWORKS

1. Refer to SANS 2001-BE1 for earthworks specification.
2. As per geotechnical report, foundations and bases are designed for ground bearing capacity of 100 kPa.
3. Final excavation levels and exposed slopes to be inspected and approved by the Geotechnical Engineer prior to the placing of blinding, waterproofing, concrete or geofabric membranes.
4. DCP and Troxler compaction test results, done by an independent, SANAS accredited laboratory, to be done in excavated foundations and submitted to the Engineer for approval prior to placing the blinding layer.
5. All levels relating to foundations are preliminary and are subject to the Geotechnical Engineer's recommendations to achieve the required bearing capacity referred to in item 2. If founding levels

require lowering, the top of the foundations is to be maintained and the blinding (or mass concrete) layer thickened.

6. Due to prevailing ground conditions foundation sizes and reinforcing may require adjusting.
7. A minimum 50mm thick blinding layer, 15 MPa/20mm, to be cast under all reinforced bases and foundations. No blinding layer is required for un-reinforced brickwork footings or mass concrete foundations. Over-excavated foundations to be mass concrete filled (10MPa / 20mm) to the Contractor's cost.
8. All bases and foundations are placed centrally below columns and brickwork unless otherwise shown.
9. Retaining walls, footings and column foundations to be cast directly against the vertical excavated faces unless otherwise shown.
10. Backfilling behind retaining walls to Engineer's approval. Where applicable, backfilling shall be done simultaneously on both sides of walls.
11. All backfilling typically to surface beds and behind retaining walls, to comply with SANS 2001-BE1. Imported approved cohesionless backfill, in layers not exceeding 150mm, to be compacted to between 93% and 98% MOD AASHTO density depending on the material used (approved sand to 100% MOD AASHTO) to be tested by an independent, SANAS accredited laboratory and test results to be submitted to the Engineer for approval.
12. Foundations not to be cast on any non-engineered fill or backfill material.
13. All foundations to have a minimum soil surcharge of 400mm.
14. The top level of all foundations to be at least 400mm below final outside ground level or finished floor level, whichever is the lower.
15. All rising foundation brickwork to have continuous brickwork every course and cavity to be filled to underside of stepped DPC with 15MPa/13mm concrete taking care not to allow any honeycombing.
16. The contractor is responsible for ensuring the safety of all deep excavations and for erecting ready fence and or hoarding around the site to prevent entry after working hours and the general safety of the site at all times.

CONCRETE:

1. Refer to SANS 2001-CC1 for all concrete specifications and read in conjunction with project specifications where applicable.
2. Ordinary Portland Cement will be the main binder material used. If other binder material is used i.e. CEM II (A – S); CEM III (A) etc., the type of binder with full disclosure of all its constituents shall be submitted to the engineer prior to the commencement of the work.
3. Cement replacing materials such as GGBS (Ground Granulated Blast Furnace Slag); Corex Slag; Fly Ash; and Condensed Silica Fume; or other approved constituents may be used in maximum proportions of: GGBS (50%); Corex Slag (30%); Fly Ash (30%) & CSF (15%). Please take note that certain types of cement already contain portions of cement replacing materials and the totals must adhere to the percentages mentioned above.
4. The use of Corex Slag and GGBS is not preferred for any water retaining structures. 15% to 30% Fly ASH is recommended for all water retaining structures.
5. Sandstone aggregates will not be approved.
6. Engineer to approve all concrete mix designs in principle prior to commencement of construction.
7. Readymix supplied concrete must be as per SANS 878;
8. Potential Alkali Silica aggregates may not be used in the concrete mix design. In the Western Cape these are: Malmesbury Group (hornfels, spotted hornfels, quartz-albite-epidote, meta-greywacky, quartzite, mylonite, phyllite, sandstone, lava), Cape Granite Suite, Cape Super Group (Ortoquartzite of the Table Mountain group, arkose of the Bokkeveld Group), Quaternary Period river gravels.
9. The water: binder (w:b) ratios to be within the limits below for a **CORROSIVE** environment

Recommendations for concrete exposed to the atmosphere:

Specification for Concrete to be used	Type of environment			
	Non-Polluted	Polluted	Corrosive	Highly Corrosive
Minimum cement content kg/m³	As dictated by Strength requirements	340	380	420
Cement Type	Any cement complying with SANS 50197-1 70% CEM 1 + 30% FA 50% CEM1 + 50% GGBS			
Maximum w:b	As dictated by Strength requirements	0,55	0,50	0,45
Minimum cover to steel	25mm	30mm	40mm	50mm
Minimum strength	As per structural requirements			

10. Slump limits shall be as per SANS 2001-CC1 as duplicated below:

1	2	3	4	5
Type of construction	Slump limits			
	Hand-placed mm		Vibrated mm	
	Max.	Min.	Max.	Min.
Paving and precast units	70	50	50	30
Heavy mass concrete	70	30	50	20
Reinforced foundation walls and footings	120	50	80	30
Slabs, beams, columns and reinforced walls	120	50	80	30
Slabs and industrial floors on the ground	120	70	80	50
Plain footings and substructure walls	100	30	60	20

11. The Contractor is to take six test cubes from each day's casting and from at least every 50m³ of concrete of each grade placed. Cubes are to be carefully marked and cured. An independent accredited lab is to crush three cubes at 7 days and three cubes at 28 days. All results to be clearly referenced and send in an orderly form to the Engineer within 5 days of the due day of testing.
12. Minimum concrete strength at 28 days to be as below, unless otherwise noted on drawings;

ELEMENT	CONCRETE STRENGTH / AGGREGATE SIZE	COVER (mm)
Blinding & Mass concrete	15 MPa/20mm	N/A
Foundations & Bases	30MPa/20mm	50
Columns	30MPa/20mm	40 to links
Walls	30 MPa/20mm	40
Surface Bed Slabs	30MPa/20mm	04
Beams	30MPa/20mm	40 to stirrups
Slabs (suspended)	30MPa/20mm	40
Stairs	30MPa/20mm	40
Piles	As per specialist specifications	

Modulus of Elasticity for concrete to be 28 GPa

13. All formwork/falsework (props) must be in accordance with SANS 2001-CC1.

14. Recommended minimum stripping times are as follows:

Type of structural member or formwork	Type of cement used		
	Portland cement & Portland cement 15	Rapid-hardening Portland cement	Portland Blast-furnace cement
a) Beam sides, walls and unloaded columns	1	0.5	2
b) Slabs with props left underneath	4	2	6
c) De-propping	14	7	7
d) Post tensioned flat slabs	18MPa min. Strength	15MPa min. Strength	15MPa min. Strength
e) Beam soffits with props left underneath, and ribs of a ribbed floor construction	7	3	10
f) Slab props including beam props	10	5	10
g) Cantilevers	14	7	14

15. The contractor shall make provision for the continued support of beams and slabs while the formwork is being removed and / or for back propping of beams, slabs, etc. The propping may be required simultaneously on more than one level directly underneath one another. The requirements for continuous propping and / or back propping shall be calculated to a theoretical model that is acceptable to the engineer, and details shall be submitted for the engineer's approval. Data required for such calculations, e.g. Design loads and structural dimensions, will be supplied by the engineer on request.
16. The removal of formwork/falsework (props): Forms and shoring in the formwork shall remain in place until the concrete has reached at least the strength necessary to prevent plucking of the surface during removal of the formwork and to support its own mass and any loads that might be imposed on it. The Engineer must be consulted before removing any formwork. In the absence of any quantitating data, the periods before striking formwork shall be not less than those given in Table 2 of SANS 2001-CC1.
17. Propping and back propping shall be done/ remain in place until the concrete has reached adequate strength (28-day strength) to sustain all dead and imposed loads; or until all work related to such elements is completed, or unless otherwise approved by the engineer.
18. On continuously reinforced concrete structures, the falsework and supporting formwork shall not be removed before the concrete of the last pour has reached the appropriate minimum age given in table 2 of SANS 2001-CC1 and the appropriate minimum strength (28-day strength) all to the approval of the engineer. Where the structure is constructed in stages, the falsework and supporting formwork shall be removed as specified in the specification data.
19. Concrete may not be dropped through more than 3m;

20. Water may only be added to concrete with the written permission of the concrete mix designer and Structural design Engineer. The amount and the influence of the added water to the w:c ratio of the concrete mix must be indicated;
21. On prestressed-concrete structure's, the falsework and supporting formwork shall be removed after the full prestressing force relating to the particular stage of construction has been applied, unless otherwise stated in the specification data.
22. Propping below slabs and beams to be removed as per SANS 2001-CC1 prior to construction of the brickwork. Bricks to be stacked evenly onto slab panel prior to construction of the walls. Construction of walls may commence after concrete has reached its minimum designed 28-day strength and in consultation with the Engineer.
23. All structural engineering drawings to be read in conjunction with the relevant Architectural and Specialist's drawings and discrepancy to be brought to the Engineer's attention.
24. Refer to Architect's drawings for positions of v-joints and drip joints in concrete.
25. Refer to Architect's drawings for positions of rain-water down-pipes and associated equipment, including waterproofing details.
26. All services drawings are to be carefully co-coordinated by the Contractor for details and positions of openings and sleeves required within the structural elements for sewerage, storm-water, drainage, electrical, mechanical and other services. Any clashes and discrepancies to be brought to the Engineer and other relevant parties' attention.
27. No openings/holes, chases, sleeves or recesses, which are not shown on the drawings, may be constructed through any structural member or close to any column, without the written approval of the Engineer.
28. The manner of attaching fixtures to be embedded in the concrete shall be subject to approval by the engineer.
29. Cast-in items to be hot-dipped galvanized, clean, free of oil, dirt or any other foreign material that may impair the bond with concrete. Placing tolerances to SANS 2001-CC1.
30. Beam dimensions shown on plans are:
 - i. Down-stand beams; width of beam (a) x depth of beam (b) including slab depth.
 - ii. Up-stand beams; width of beam (a) x depth of beam (b) including slab depth.
31. Refer to Architect's drawings for the extent of exposed concrete work to have an off-shutter finish.
32. Trafficable ramps in parking areas to have a broom finish unless otherwise shown. All other areas to be mechanically power floated or screeds with steel trowel finish.
33. All specialist's grouts and epoxies to be in strict accordance to manufacturer's specification.
34. Casting procedures, positions of construction joints and methodology to be submitted to the engineer prior to the commencement of work.
35. Unless otherwise shown all columns are placed symmetrically on grid lines.
36. Exposed concrete finish walls, upstands and soffits:

Concrete degree of accuracy 1 as per SANS 2001-CC1.

Finish Smooth: as per SANS 2001-CC1. Shutters to be smooth and clean and treated with an appropriate release agent. Vibration and compaction of the concrete during placement to be done in all areas to ensure a smooth even finish on all surfaces including up stands. All concrete is to be in cured accordance with SANS 2001-CC1 by method agreed with the engineer. Exposed upstands are to be cast in the same pour as the adjoining slab. Tops of concrete slabs are to be smoothed and levelled, or on roofs sloped to falls, and wood floated, to receive waterproofing or screed. After striking the formwork rub down seams and small irregularities with carborundum block avoid scratching the concrete surface during rubbing. Fill any minor honeycombing (<5mm) with SIKA MONO TOP 620 or MCC MULTIFEATHEREDGE 1050 or equal and approved. For honeycombing >5mm but <30mm with SIKA MONO TOP-612 or equal and approved, applied as per the manufacture's specification. Care is it to be taken when applying the repair mortar to not over coat the face of the concrete, the repair mortar is only to be applied to the area being repaired.

37. On vertical concrete element consisting of more than one lift, care is to be taken to seal the underside of the shutter to avoid grout leaking onto previously poured elements.
38. All timber used for shuttering (formwork) is to be either reused, post-consumer recycled, or Forest Stewardship Council (FSC) certified and supplied by merchants who hold valid FSC Chain of Custody (CoC) certificates at time of purchase. Status of FCS CoC certificate should be verified at info.fsc.org.
39. All structural use of concrete to be in accordance with the requirements of:
 - i. SANS 10100-01 (2000): The structural use of Concrete part 1: design
 - ii. SANS 10100-02 (1994): The structural use of Concrete part 2: materials and execution of work.
40. Minimum curing times is as per SANS 2001-CC1 as duplicated below:

1	2	3
Strength class of cement	Minimum curing period d	
	Ambient temperature	
	15 °C and higher	5 °C and lower
42,5 R or higher	3	6
CEM I and CEM II A-S, D, P, Q, V, A, W, T, L, LL, M and blends of CEM I with 20 % or less ground granulated blast-furnace slag or fly ash	7	14
CEM II B-S, P, Q, V, W, T, L, LL, M, CEM III, CEM IV, CEM V and blends of CEM I with more than 20 % ground granulated blast-furnace slag or fly ash	10	20
NOTE When the ambient temperature is between 5 °C and 15 °C, the curing period shall be determined by interpolation between the given periods.		

41. Curing and protection: After formwork has been removed (SANS 2001-CC1 4.3.8) and as soon as it is practicable in the opinion of the engineer, all concrete shall be protected from contamination and loss of moisture by one or more of the following methods:
42. COLUMNS: Wet and dry cycles to be avoided. Preferably keep shuttering in place for 7 days. Alternatively wrap up in plastic sheeting immediately upon removal of formwork or spray with a curing compound. Take care with the type of curing compound in areas to be plastered or painted. Product to be approved by the Structural Engineer and the Architect.
43. BEAMS: Wet and dry cycles to be avoided. Preferably keep shuttering in place for 7 days. Alternatively spray with an approved curing compound immediately upon removal of side shuttering. Take care with the type of curing compound in areas to be plastered or painted. Product to be approved by the Structural Engineer and the Architect.
44. SLABS: Wet and dry cycles to be avoided. After formwork has been removed all concrete shall, subject to the provisions of 4.7.14 of SANS 2001- CC1 – (hot weather), be protected from loss of moisture by one or more of the following methods:
- (a) Ponding the exposed surface by means of water (within mortar, soil or concrete kerbs).;
 - (b) Continuously spraying the exposed surfaces with water or making use of mist sprayers; (impractical in windy conditions);
 - (c) The use of an approved curing compound and in accordance with the manufacturer's instructions. Take care with the type of curing compound in areas to be plastered or painted. Product to be approved by the Structural Engineer and the Architect.
45. WALLS: Preferably leave the shutters in place for 7 days or spray with approved curing compound. Take care with the type of curing compound in areas to be plastered or painted. Product to be approved by the Structural Engineer and the Architect.
46. Permissible deviations appropriate to the degree of accuracy I is required for linear dimensions, position, verticality, level, squareness and bow (refer to and SANS 2001-CC1)
47. All exposed corners for columns, slabs, beams and walls to receive 25x25mm chamfers and all columns, slabs, beams and walls in brickwork walls to have no chamfers.
48. Excess concrete such as, burrs, spillage, overcast, etc. Is to be rubbed down smooth and have a similar colour variation between the different concrete elements.

49. Concrete tolerance to be degree of accuracy No. I as specified in SANS 2001 CC1 Table 11-13 as partly inserted below:

A. Reinforcement				
		Permissible deviation		
		III	II	I
1	Spacing between two adjacent bars	± 25	± 20	± 15
2	Longitudinal location of bends and ends of bars	± 40	± 30	± 20
3	Cover to reinforcement (see (e) below)	-0+20	-0+20	-0+10
B. Foundations : Mass and reinforced concrete				
1	Position on plan of any edge of surface measured from the nearest grid line or agreed centre line	± 50	± 35	± 20
2	Linear dimension on plan cast against excavation sides	± 60	± 40	± 20
3	Linear dimension on plan cast against formwork	± 30	± 20	± 1
4	Level of underside of concrete	-40+20	-30+15	-20+10
5	Surface level (i.e. top of foundation) (excluding floor slabs)	-30+15	-20+10	-10+5
C. Elements or components above foundations (including floor slabs)				
1	Position on plan of any edge or surface measured from the nearest grid line or agreed centre line	± 25	± 15	± 5
2	Linear (other than cross section) dimensions	± 30	± 20	± 10
3	Cross section dimensions	-10+20	-5+15	±5
4	Level (deviation from designed level with reference to the nearest transferred datum (TD) of the upper or lower surface, as may be specified, of any slab or other element or component)	-20+10	-15+5	-10+0
5	Verticality, per meter of height Subject to a maximum of :	5 70	5 50	2 30
6	Out of squareness of a corner or an opening or an element such as a column for short side of length i) Up to and including 0.5m ii) Over 0.5m, up to and including 2m iii) Over 2m up to and including 4m	±10 ±20 ±25	±5 ±15 ±20	±3 ±10 ±15
7	Exposed concrete surface: i) Flatness of plane surface ii) Abrupt changes in a continuous surface	10 10	5 5	3 2
8	Exposed concrete surface to be plastered: i) Flatness of plane surface ii) Abrupt changes in a continuous surface	15 10	10 5	* *
D. Cover to reinforcement				
	No deviation from the minimum cover of concrete over reinforcement specified will be permitted.			
E. Location of holding down bolts				
1	The centre line of a holding down bolt from its designated location in plan	*	+3	*
2	The top of the bolt from its designated elevation	*	-3+5	*

* Tolerances not stated and those for bow, camber, and twist, and for slipform concrete and precast concrete will be staged in the project specification where applicable.

Formwork: Formwork shall be so constructed as to ensure that the position of the finished work will be as specified, subject to the relevant: permissible deviation given in relevant table, as applicable.

50. The live loads for which the structures have been designed for are indicated on the drawings.

C. SURFACE BEDS:

1. The Contractor is to provide a detailed Method Statement outlining the construction of surface beds, size of pours, sequence of pours, position of construction joints, proposed saw-cut joints, curing, proposed achieving of finishes, etc. for approval by the Engineer.
2. All surface beds to have a minimum thickness 250micron DPC below them with adequate laps and turned up to the full depth of surface bed as bond breaker against all brickwork on all sides, all to Architectures' details. Top of surface bed level to be a minimum of 150mm above the final outside levels as per SANS 10400.
3. Unless otherwise stated, ensure that reinforced mesh is placed 30mm from top of surface bed.
4. Isolate all columns and walls from the surface bed using 10mm "Jointex" or equal and approved closed cell filled isolation or expansion joints (I.J or E.J.). Once the concrete is set rake out the top 10mm of "Jointex" or equal and approved and seal with approved polysulphide (e.g. SIKAFLEX-11FC or equal and approved) joint sealant.
5. Once the concrete is firmly set, 4 to 48 hours after pouring, commence the saw-cut joints. Joints in finishes to be placed directly over all joints in the surface beds.
6. See standard details for specifications for saw-cut, isolation & construction joints.
7. All backfill to comply with SANS 2001-BE1 and to be compacted in layers not exceeding 150mm to between 93% and 98% MOD. AASHTO, depending on the material used (sand to be compacted to 100% MOD. AASHTO). The Contractor is responsible to provide the Engineer with well referenced compaction test results on a continuous basis as the work progresses, done with a Troxler and by a SANAS accredited laboratory. The number of tests must be done at +/- 1 per 20m² in large areas and +/- 1 per 10m² in smaller areas.
8. All screeds are to be minimum 30mm thick and jointed into panels of maximum size of 4m x 4m. Joints should also be provided over joints in the slab/surface bed below. Joints in screed are to extend at least halfway through the thickness of the topping. The aspect ratio of the panel sizes should be no more than 1:1:2. Tile joints should coincide with the screed joints and sealed with an approved polyurethane sealant.
9. Finishes of surface beds according to the type of covering (tiles, vinyl, concrete, etc.) - see architect's drawings.
10. Slabs to be cast in sections not exceeding 450m²/day to ensure the highest quality finish.

REINFORCEMENT:

1. Reinforcement shall be manufactured and fixed to comply with the tolerances as specified in SANS 2001-CC1 and/or the project specification.
2. Reinforcement to be cut and bent in accordance with SANS 10082.
3. Welded mesh fabric to comply with SANS 10240.
4. Refer to SANS 2001-CC1 as well as SANS 920 for all reinforcement manufacture and fixing.
5. Reinforcement is not to be cut, or heat treated without the Engineers approval.
6. The Contractor is to ensure that "Pull Out/Bend out" bars have no kinks once straightened.
7. The contractor shall inspect and approve the fixed reinforcement before the engineer is notified for inspection. (The Engineer shall be given a minimum 24 hours – 1-working day notification prior to his inspection) All reinforcement shall be inspected and approved by the engineer before casting of concrete may commence. The concrete pours are to be scheduled to suit this requirement. All other members of the professional team (e.g. Architect, Mechanical and Electrical Engineers) to have completed their inspections and signed off their works before notifying the Structural Engineer of the needed inspection.
8. All reinforcing/stressing steel is to have a post-consumer recycled content of 90% or greater or be reused. Any additional structural steel is to have a post-consumer recycled content of 60% or greater or is to be reused.
9. It is the contractor's responsibility to ensure that all reinforcement and cover blocks are correctly and accurately fixed, the correct strength, and remain in place during pouring.
10. The engineer will not be responsible for any concrete cast where he was not notified in time to carry out a rebar inspection visit.
11. The following grouts and epoxies are pre-approved. These must be used to all the manufacturer's specifications. Alternative products to be equal and approved.
12.
 - i. For bars grouted vertically into concrete use;
 - a. Hilti HIT-HY 200/RE500
 - b. Sikadur 31
 - c. ABE Epidermix 395
 - d. Pro-struct 618/632
 - ii. For bars grouted horizontally into concrete use;
 - a. Hilti HIT-HY 200/RE500
 - b. Sikadur 31
 - c. ABE Epidermix 395
 - d. Pro-struct 617
 - iii. For bars grouted vertically up-side-down into concrete use;
 - e. Sikadur 31
 - f. Pro-struct 617
 - g. Hilti HIT-RE500

D. BRICKWORK & BLOCKWORK:

1. All brickwork, blockwork, masonry units, mortars and workmanship shall comply with the following specifications:
 - i. SANS 227: burnt clay masonry units
 - ii. SANS 285: calcium silicate masonry units
 - iii. SANS 1215: concrete masonry blocks
 - iv. SANS 10164 and SANS 10400K and SANS2001-CM1: construction of brickwork & blockwork
 - v. SANS 10400 and SANS 10164: specification for brickwork, blockwork, anchors, wall ties & straps
 - vi. SANS 10164 Part I - 1980 Table 1: Class II mortar
 - vii. SANS 28: cavity less than 75mm, (no single wire ties to be used)
2. Loadbearing Brickwork: minimum crushing strength = 14 MPa
3. Loadbearing Blockwork: minimum crushing strength = 14 MPa unless otherwise shown.
4. All other brickwork & blockwork: minimum crushing strength = 7 MPa
5. All brickwork, blockwork and masonry walls shall comply with the following specifications:
 - i. In all load bearing brickwork supply approved NHBRC continuous brickforce in every fourth layer
 - ii. In all load bearing blockwork supply NHBRC/SANS 10400 approved continuous brickforce every second layer
 - iii. In addition, supply continuous NHBRC/SANS 10400 approved brickforce in every layer for the first four layers above and below the top of foundations & slabs, as well as over and below all window and door openings.
 - iv. In all foundation walls, supply continuous NHBRC/SANS 10400 approved brickforce in every layer up to the DPC layer.
 - v. Minimum laps to be 300mm.
6. All brickwork and blockwork wall ties, anchors and straps to be hot-dipped galvanized.
7. All brickwork shall be fixed to concrete & steel columns by means of galvanized 1,6 x 32mm hoop iron shot fixed at every fourth course of brickwork and blockwork every second course built 700mm into brick/blockwork.
8. In cavity walls, wall ties to be embedded in masonry joints at right angles to the brick skins.
9. The number of wall ties per m² of walling shall be:
 - i. 50mm > Cavity: 2,5 ties/m²
 - ii. 50mm < Cavity < 100mm: 3,0 ties/ m²
 - iii. 100mm < Cavity < 150mm: 5,0 ties/ m²
10. At door / window openings and discontinued edges, provide additional wall ties that are spaced at 300mm vertically, or as instructed, or as shown on the drawings.

11. Use galvanized butterfly wall ties of 3,15mm diameter unless otherwise stated.
12. For high-lift grouted walls, ties complying with the requirements of SANS 10164 Part 2 Annex A (14) shall be spaced at horizontal intervals not exceeding 900mm and vertically at centres not exceeding 300mm, with each layer staggered by 450mm.
13. All ties to be embedded to a depth of at least 50mm into the mortar joint of each brick skin.
14. Use 25 x 2.5 vertical twist hoop iron wall ties in all cavities exceeding 55mm but less than 150mm.
15. At the interfaces of brickwork / blockwork and concrete elements the Contractor is to make deep V-joints right through the plaster thickness.
16. Refer to Engineer's drawings for load bearing brickwork and blockwork.
17. For general arrangement (G.A.) and setting out of all brickwork and blockwork refer to Architect's drawings.
18. Refer to Architect's drawings for positions of expansion joints in brickwork / blockwork.
19. All external non-load bearing brickwork / blockwork is to be clear of slab and beam soffits and sides, unless otherwise shown. Minimum 20mm "Jointex", or equal and approved material, to fill the joint. Joint to be sealed on both sides with 2-part polysulphide (inside & outside skin).
20. All internal non-load bearing brickwork / blockwork is to be clear of slab and beam soffits and sides, unless otherwise shown. Minimum 20mm "Jointex", or equal and approved material, to fill the joint and sealed in accordance with the architectural, fire and acoustic engineering specifications.
21. All waterproofing to Architect's details.
22. Tops of cavity walls to be left open to ventilate for as long as possible.
23. Wet all clay bricks prior use.
24. Concrete bricks and blocks to be kept dry prior to being used.
25. Walls on different types of footings and foundations to be separated using movement joints e.g. walls on piled foundations and on strip footings. Stability requirements over joints to be met in all cases.
26. For reinforcement or proprietary steel anchors grouted into brickwork use Hilti HIT-HY 200 injection mortar (with perforated stainless-steel sleeve) or equal and approved.

E. STRUCTURAL STEELWORK:

1. All setting out dimensions, levels and detail dimensions are to be checked and confirmed by the Contractor and relevant Sub-Contractor prior to commencement of fabrication. This applies to both works undertaken in the workshop and on site.
2. Refer to SANS 2001-CS1 for Structural Steelwork Specification.
3. A full and comprehensive set of shop-drawings is to be submitted to the Engineer for approval prior to commencement of the fabrication. These shop-drawings will be checked for compliance with

the design intent only and not for layouts and dimensions. No dimensional checks, or checks on cleats, bolts, welds and gussets will be undertaken.

4. All structural steelworks shall be grade S355JR. Cold-formed open steel sections are to have a minimum yield stress of 240 MPa. The Contractor is to acquire tensile strength testing results for each batch of steel from which cold-formed sections are sourced.
5. All cold-formed channels to be hot dipped galvanized or use pre-galvanized sections.
6. The Contractor is to submit a certificate verifying the structural steel grade from the steel manufacturer.
7. All structural steel drawings are to be read in conjunction with ALL the relevant architectural, concrete drawings as well as the Bill of Quantities. Any discrepancy to be brought to the Engineer's attention immediately.
8. The contractor is responsible for the design, erection, maintenance and removal, if necessary, of all temporary bracing and/or propping. Where required due to transport constraints, the Contractor is to submit a proposal for the Engineers approval of the splicing of trusses and larger members.
9. The Contractor/Fabricator to ensure at all times that centres of gravity of members intersect at nodal points, unless the eccentricities are specified on engineer's drawings.
10. It is the responsibility of the Contractor/Fabricator/Supplier to ensure the availability and delivery of products and steel profiles specified and shown on the drawings well ahead of the construction programme to avoid delays.
11. Structural bolts shall be grade 8.8 hot-dipped-galvanized unless otherwise noted.
12. Where slotted holes for bolts occur, the nut shall be hand tightened and a lock-nut be provided unless noted otherwise.
13. Provide cementitious approved non-shrink grout under base plates prior to any loads being applied. Hot dip galvanized laminated finger shaped packing to be provided under base plates.
14. Welding to conform to the SANS 10167 and 1044 specifications:
 - a) Unless otherwise shown, the minimum weld size shall be that of the thickest plate of the connecting plates/elements, so that the connection transfers the full force that can be developed in connecting members.
 - b) Electrodes shall be E7018 when using electric arc welding. The Contractor is to motivate and apply in writing for the approval of any alternative welding process that may be proposed.
 - c) Full element strength must be achieved for all butt-welded elements, splices and spliced joints.
 - d) Only Coded and suitably qualified Welders may undertake welding operations, both under workshop and on-site conditions.
 - e) On-site equipment must always be in good working condition and strict safety procedures must be implemented and maintained.
 - f) To ensure the full strength of the connection the contractor shall design all welds and gussets to achieve the required strength.

15. Quality control on welding shall be as follows:
 - a. All welds shall be inspected using visual aids
 - b. All butt welds : 100% ultrasonic NDT
 - c. All fillet welds : 20% MPI
 - d. Crane / crawl beams : 100% ultrasonic NT
16. The following applies where HSFG bolts are specified and used:
 - a) All the contact surfaces at HSFG bolt splices shall be clean and free from oil, grease, rust, scale, paint or any other impurities at the time of bolting.
 - b) The tightening of high strength friction-grip bolts shall be done according to the turn-of-the-nut method as specified in clause 5.3.1(a) of SANS 10094
or
where HSFG bolts have been specified, the contractor shall use "coronet"-type load indicating washers in conjunction with such bolts.
15. Where slotted holes are provided the nut shall be finger tightened and a lock-nut be provided unless otherwise indicated.
16. Steelwork Paint specification as follows;
 - a) Carefully inspect each coat for misses and carry out dry film thickness (DFT) testing. No single DFT reading may be less than the minimum or greater than the maximum. The mean of the readings shall equal or exceed the nominal.
 - b) All critical areas, edges, welds, etc. to be given extra stripe coats. All coats to be in contrasting shades.
 - c) All work to comply with the project quality requirements and the general preamble.
17. Bolt Paint Specification (applicable if bolts are hot dip galvanised): 3 days prior to the erection of the structural steelwork, all bolts are to be cleaned and degreased. Within 2 days of erection, all bolts are to be coated with 1 coat of Sigmadur Gloss or equal and approved/as per the Architect's specification.
18. Paint Specifications for the bolts (only applicable if bolts are not hot dip galvanised): 3 days before the erection of the structural steelwork, all bolts are to be cleaned and degreased. Within 2 days of erection, all bolts are to be coated with 1 coat of Interseal 670HS or equal and approved/as per the Architect's specification
19. Refer to architectural drawings for final colour and specification of structural steelwork.
20. Specification for intumescent paint for internal structural steel:

Coatings to be sprayed on in the steel fabricators' workshop. All painting to Chemrite Coatings Specification, colour G13 dark grey or equal and approved. The fire rated intumescent specification shall be 90 minutes as per BS476 Part 20/21.

- Preparation Sandblast To Asa 2½.
- Prime Carboline Carbogaurd 880 (100µm) or equal and approved.

- Nullifire - S707 waterborne intumescent coating or equal and approved - thickness to achieve 90min fire rating.
 - Top Coat Carboline Carbothane 134 (40µm) or equal and approved.
21. The products used shall be supplied and applied by an approved applicator, as well as certificates from a certified provider shall be provided to the fire engineer upon completion stating that the paint was applied to the supplier specification and the fire rating was achieved.

F. CORROSION PROTECTION OF STRUCTURAL STEELWORK

H1 General

1. The hot dip galvanized coatings shall conform in every respect to the standards contained in the South African National Standards, SANS 121 (ISO 1461) Hot dip galvanizing coatings on fabricated iron and steel articles and SANS 32 (EN 10240) Internal and/or external protective coatings for steel tubes, Hot Dip Galvanizing specification for products other than continuously galvanized sheet and wire as well as the SANS1200HC or latest edition of the relevant specification.
2. All pre-hot dip galvanized sheeting shall be minimum grade Z275 to SANS 4998:2007 Continuous hot dip zinc coated carbon steel sheet or structural quality and all wire to SANS 675:2009: Specification for coated fencing wire.
3. The galvanizer shall be an accredited member of the Hot Dip Galvanizers Association Southern Africa (HDGASA) and shall issue a certificate of conformance to ISO 10474 or if registered as a South African Bureau of Standards (SABS) Mark Scheme Galvanizer, a SABS certificate of conformance. (A list of approved members is available on the Association web site, www.hdgasa.org.za).
4. All structural steel shall be minimum grade of S355JR (350WA) and shall be certified with a Silicon content between 0.15% and 0.23% and Phosphorus content <0.02%. The contractor to supply the certificate as proof of the above requirements prior to the manufacturing of any structures.
5. For this project all steelworks to be:
 - 5.1. Hot dip galvanized as well as hot dip galvanized and painted (duplex) – refer to the architect's drawings for extent and paint specification.
6. It is the contractor's responsibility to ensure that all steel to be hot dip galvanized shall be designed and fabricated in accordance with ISO 14713: 2011 Part 1: General principles of Hot dip Galvanizing and ISO 14713: 2011 Part 2: - Design for hot dip galvanizing.
7. The hot dip galvanizer shall provide a quality management plan detailing inspection procedure, which will include inspection of steel prior to galvanizing, inline inspection during surface

preparation and galvanizing and final inspection prior to dispatch. Where fabrication defects are identified prior to galvanizing, e.g. burrs, poor welding or excessive weld spatter, such components shall be placed on hold and a non-conformance report submitted to the fabricator.

8. Double end dipping shall be permitted provided that it will not result in distortion of the product and an acceptable surface finish of the coating is achieved.
9. Bolts and nuts of gr 4.8 and gr 8.8 shall be hot dip galvanized to SANS 121 (ISO 1461) and high tensile fasteners from grade 10.9 and above, shall be hot dip galvanized in conformance to ISO 10684. The hot dip galvanizer shall issue a certificate of compliance with this requirement. All fasteners shall be supplied by a SABS approved manufacturer.
10. Zinc electroplated (electro-galvanizing) bolts and nuts are not acceptable.
11. All welds to be full length seal weld.
12. Any coating repairs undertaken on the galvanizer's premises or later on site, e.g. touch up of small-uncoated surfaces (black spots), shall be strictly limited both in dimension and quantity as stipulated in the relevant SANS 121 (ISO 1461) specification.
 - 12.1. Uncoated areas and defects shall be repaired according to the site repair instructions below of this. The repaired surface shall not be accepted or dispatched until the repaired surface coating has cured.
 - 12.2. Where coating defects exceed the specified permissible limit, which qualifies for touch-up repairs after galvanizing, affected items shall be rejected and re-galvanized or, if applicable, a repair method may be approved in writing by the engineer.
 - 12.3. Final inspection: Following satisfactory completion of the final inspection and provided prior arrangements have been made as per clause 1, the galvanizers' inspectorate shall issue a certificate stating that the applied coating conforms to the requirements of SANS 121 (ISO 1461) or SANS 32 (EN 10240) as applicable.
13. Quality surveillance:
 - 13.1. For the purpose of carrying out quality surveillance, the engineer or its QA / QC Consultant shall be granted access to any part of the galvanizer's premises relevant to the work being carried out, at any reasonable time. The galvanizer shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.
 - 13.2. The Engineer may remove any reasonable samples of materials to be used in the coating application. Rejection of the sample will place a hold on the use of material of the same batch number and may lead to rejection of all that batch of material and the reworking of any components that have already been coated with rejected material.
 - 13.3. The Engineer may carry out reasonable destructive tests to ascertain compliance with the specification. The contractor, to the satisfaction of The Engineer and at no additional cost, shall repair areas thus damaged.

13.4. The cost of quality surveillance will be borne by the Engineer, except where surveillance results in rejection of the work or when notice by the contractor results in a fruitless trip, in which case the contractor shall carry the cost of surveillance.

14. Handling and storage:

14.1. Handling: All coated components shall be handled using soft slings or specially positioned lifting points provided for such handling.

14.2. Loading and off-loading: All hot dip galvanized and/or duplex coated components to be transported shall be loaded on suitable dunnage and lashed to avoid chafing and steel to steel contact. Plastic "Spaghetti strips" must be used to protect smaller items of steel and angles (5mm spaghetti plastic coil). Coated steel shall be secured on the truck preferably with nylon securing straps. Where chains must be used, suitable rubber insertion pads must be placed between the coated steel and chains at all contact points.

14.3. Cover: Coated items shall be stored under cover where possible. Items not stored under cover shall be stored in such a manner as to avoid retention of water and allow good circulation. Items shall be stored on timber or on trestles fitted with timber to raise the product to at least 100mm off the ground.

14.4. Stacking: Items shall be stacked using timber packaging or other approved means to avoid coating-to-coating contact. Sufficient bearing area of packing shall be used to avoid damage to coatings.

15. Site repairs/defects/uncoated areas:

15.1. Any coating repairs undertaken on the galvanizer's premises or later on site, e.g. touch up of small-uncoated surfaces (black spots), shall be strictly limited both in dimension and quantity as stipulated in the relevant SANS 121 (ISO 1461) specification.

15.2. Any uncoated areas, modifications, transportation and erection damage, shall be repaired by abrading with 80 grit sand paper and painting with "Zincfix", "GalvPatch" or equal and approved twin pack zinc rich epoxy paint, achieving an overlap of 5mm onto the surrounding sound zinc coating and to a minimum thickness of 100µm. When a duplex coating system has been specified, the DFT of the repair coating shall be equal to that of the surrounding hot dip galvanized coating in terms of SANS 121 (ISO 1461). Steel shall not be accepted until the repaired surface has cured. Furthermore, in priority and as approved by the Engineer:

15.2.1. Black steel utilized in modifications with hot dip galvanized steel shall be dispatched for hot dip galvanizing. Any areas that are to be subsequently welded should either be masked prior to hot dip galvanizing or suitably cleaned of zinc in order to prevent possible weld metal embrittlement or zinc residue inclusions, prior to welding on site.

15.2.2. Alternatively, black steel utilized in modification with galvanized steel shall be abrasive blast cleaned to Standard SA 2½ to obtain a surface profile of 40 to 70 microns. Once the surface profile has been inspected and certified, apply zinc thermal sprayed coating to a minimum thickness of 120µm.

15.2.3. Alternatively, black steel utilized in modifications with hot dip galvanized steel shall be abrasive blast cleaned to Standard SA 2½ per International Standard ISO 8501-1 – 1988 to obtain a surface profile of 40 to 70 microns. Once the surface preparation has been inspected and certified, apply one coat of Zincfix, GalvPatch or equal and approved twin pack zinc rich epoxy paint, achieving a overlap of 5mm onto existing sound hot dip galvanized coating where black steel is welded to hot dip galvanized components. Dry film thickness shall be 100µm. When a duplex coating system has been specified the DFT of the repair coating shall be equal to that of the surrounding hot dip galvanized coating.

15.3. Where site modifications by means of welding of a hot dip galvanized surface is required, all traces of the hot dip galvanized coating shall be ground-off prior to welding. Removal of the zinc coating from surfaces to be welded is necessary in order to prevent possible weld metal embrittlement or zinc residue inclusions. Repair to be done to all welds as per above instructions.

H2 DUPLEX COATING (HOT DIP GALVANIZING PLUS PAINT)

This specification covers the painting of hot dip galvanized steel other than sheet and wire. The requirements for the painting of hot dip galvanized sheet are contained in ISO 12944 Parts 4 and 5.

1. For paint colour and specification refer to the Architect's specifications.
2. All hot dip galvanized steel to be painted shall be certified as conforming to the required hot dip galvanizing quality standard, prior to painting.
3. Painting shall take place as soon as possible (preferably within hours) after hot dip galvanizing, preferably at the galvanizing contractor's premises. If this is not feasible for practical reasons and only on written approval of the Engineer, painting on site is acceptable. However, all paint work shall be in accordance with no 4 below and section I: Corrosion Protection: Paint.
4. Code of Practice for Preparation and Painting Hot Dip Galvanized Steel:
 - 4.1. Surface preparation shall be done by sweep blasting for this project. Chemical cleaning shall only be done on written approval of the Engineer and be for pre-galvanized sheeting. Preparation shall be conducted in accordance with HDGASA 01-1990 - Code of Practice for Surface Preparation and Application of Organic Coatings.
 - 4.2. **Warning:** Sweep blasting shall be undertaken strictly in accordance with the procedures as specified in the code of practice, with particular reference to the selection of the appropriate abrasive, blasting nozzle pressure and angle of deflection of the blasting media. Failure to do so will result in damage of the hot dip galvanized coating.

4.3. A hold or witness point should be established after sweep blasting has taken place before painting is commenced where the contractor to give the Engineer 48 hours' notice for inspection.

4.4. Painting procedures shall comply with the requirements contained in, HDGASA 02-1990 - Specification for the Performance Requirements of Coating Systems.

4.5. Quality control procedures in duplex coating

Quality control in duplex coating should be carried out at the following stages:

4.5.1. Before commencing work, to check removal of sharp edges, weld spatter, slivers and similar mechanical interference with the application of organic coatings.

4.5.2. After cleaning, when the surface must be tested to ensure that it is "water-break" free.

4.5.3. During and after each coat of paint to ensure that the paint is uniformly applied to the correct wet film or dry film thickness as appropriate, in accordance with the manufacturer's recommendations.

4.5.4. Gloss, uniformity and absence of craters, fish eyes, blisters, runs, sags and other visible defects.

4.5.5. Total coating dry film thickness determined by an electromagnetic gauge calibrated on a similar hot dip galvanized but unpainted surface. Alternatively, the gauge may be calibrated on smooth polished steel plate, then the thickness of the hot dip galvanizing (without paint) can be measured. The mean of at least 10 hot dip galvanized thickness readings is then deducted from total layer thickness over steel to obtain the average thickness of paint.

G. TEMPORARY SUPPORT WORK

1. It is the contractor's responsibility to always ensure the adequacy of temporary support work. This responsibility to include, inter alia, lateral bracing, warning signs and public protection measures.
2. Support work to remain in place until new support beams are in place and caulked and in the case of new cast in-situ concrete support, cured for a minimum of 14 days.

H. STRUCTURAL TIMBER

1. Gang nailed roof trusses to be designed by Mitek or equal and approved. Mitek is to inspect erection of the roof trusses, sign off that they are satisfied with the erection and provide A19/Form 3&4 roof certificate.
2. All roof trusses are to be tied down by means of galvanised hoop-iron built in securely at least 6 brick courses below wall plate as per SANS 10400.

3. All South African pine timber specified is to be grade 5 unless specified otherwise.
4. Galvanised steel strap anchors shall be taken up over the top of the rafter or tie beam, bent down on either side and nailed down from both sides, or galvanised roof ties shall be made up of two strands of wire which shall be taken up on either side of the rafter beam, twisted together so as to have no slack, but not so as to overstrain the wire, and the free ends then nailed down to prevent untwisting. Refer to SANS 10400.
5. Any roof truss, rafter or beam shall be fixed to any wall by using one of the following types of anchors:
 - 5.1 Type A: two strands of 4mm galvanised steel wire;
 - 5.2 Type B: 30mm x 1.2mm galvanised steel strap;
 - 5.3 Type C: 30mm x 1.6mm galvanised steel strap.