

Building Drawings

Chapter

2

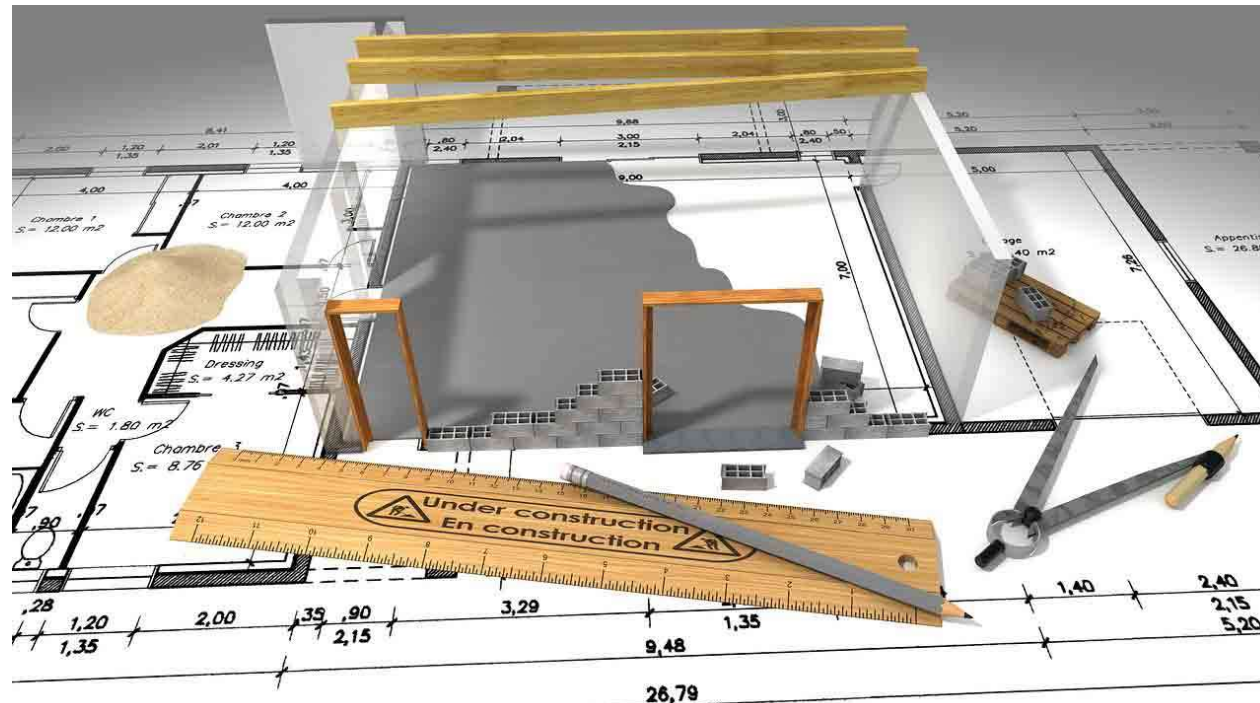
Introduction

Section

1

Definition of Building Drawings

- The drawings that show all aspects of the building. These drawings tell the contractor specifically what to build.
- It consist of a set of plans, elevations, sections, and line diagrams that describe the building site and location, spaces, structure, finishes and installations.



Local regulations

- في فلسطين تتولى نقابه المهندسين تنظيم عمل الشركات والمكاتب الهندسيه بما في ذلك مراجعة واجازة مخططات الابنيه قبل تقديمها للسلطات المحليه للحصول على الترخيص حيث تتم المراجعه وفقا لقائمه معده سلفا توضح الحد الادنى من المخططات الواجب اعدادها في كل تخصص.

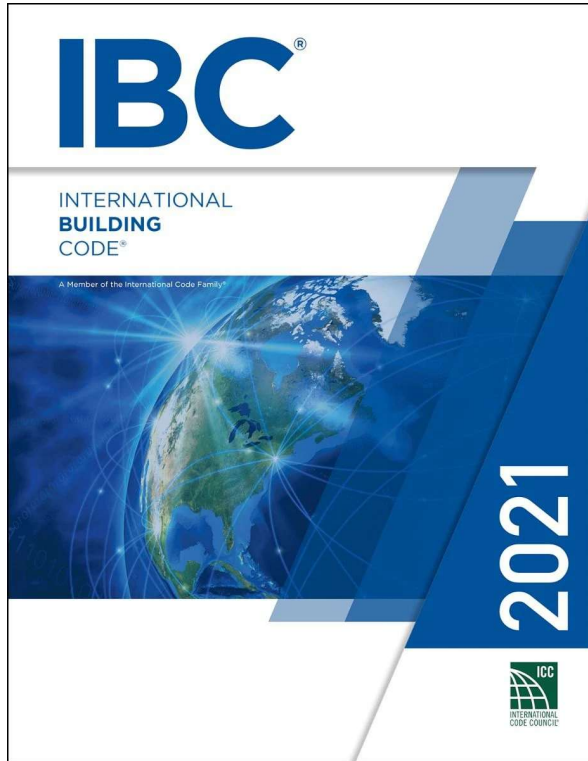


نقابة المهندسين - مركز القدس دليل العمل الاستشاري هيئة المكاتب والشركات الهندسية

الباب الخامس عشر - المتطلبات الإدارية والفنية الواجب توفرها
في مخططات الأبنية لغايات الترخيص

- تراجع السلطات المحليه (البلديات) المخططات للتأكد من مطابقتها لنظام الابنيه وتحديد الرسوم المطلوبه قبل اجازتها.
- تقدم المخططات ايضا للدفاع المدني وسلطة الاثار لمراجعتها وقدم تقدم في بعض الحالات ايضا لوزارة الصحة ووزارة المواصلات لاجازتها.

Local regulations



■ تحديات النظام المحلي وواجه القصور

- سياسه البناء الوطنيه – المرجعيات والكودات
- ضبط الجودة في التصميم والتنفيذ



الأهداف الإستراتيجية:

- توفير كودات هندسية للمباني والطرق والجسور والمشاريع الهندسية الأخرى وفق الممارسات العالمية والاحتياجات المحلية.
- تطوير اعمال الاعمار في المملكة ورفع جودة ونوعية الخدمة المقدمة.
- توفير معايير الاستدامة وكفاءة الطاقة والمياه والبيئة والسلامة العامة للمنشآت.

الأهداف الإجرائية:

- اعداد وتحديث وتطوير المواصفات الفنية والكودات الهندسية للمباني والطرق والجسور والمشاريع الهندسية الأخرى.
- العمل على وضع آلية تطبيق الكودات الهندسية في المشاريع للجهات المعنية.
- ضبط جودة العمل للمشاريع الهندسية.
- العمل على وضع معايير للاستدامة في المباني والمنشآت واستخدامات الأنظمة الموفرة للطاقة.

نظام الابنيه والتنظيم للهيئات المحلية

الحد الأدنى لطول واجهة القطعه (م)	الحد الأدنى للمساحة (م ²)	فئة الاستعمال
40	2000	المناطق السكنية وتقسّم إلى ما يلي: أ. الأبنية السكنية العالية ب. فلل
20	700	ت. سكن أ مرتفع
30	1000	ث. سكن أ
25	1000	ج. سكن ب
18	750	ح. سكن ج
15	500	خ. سكن د
15	300	د. البلدة القديمة
غير محدد	غير محدد	ذ. السكن الريفي
2500	2500	
25	1000	ر. السكن الزراعي
المناطق التجارية وتقسّم إلى ما يلي:-		
1- للتجاري المحلي:		
15	400	2- التجاري الطولي
25	1000	3- المعارض التجارية
22	800	4- المركز التجاري الرئيسي
20	600	5- المركز التجاري الفرعي
المناطق الصناعية وتقسّم إلى ما يلي:		
25	1000	1- الصناعات
20	600	2- مجمعات الصناعات الخفيفة والحرفية
المكاتب		
40	2000	المباني العامة
25	1000	المرافق السياحية



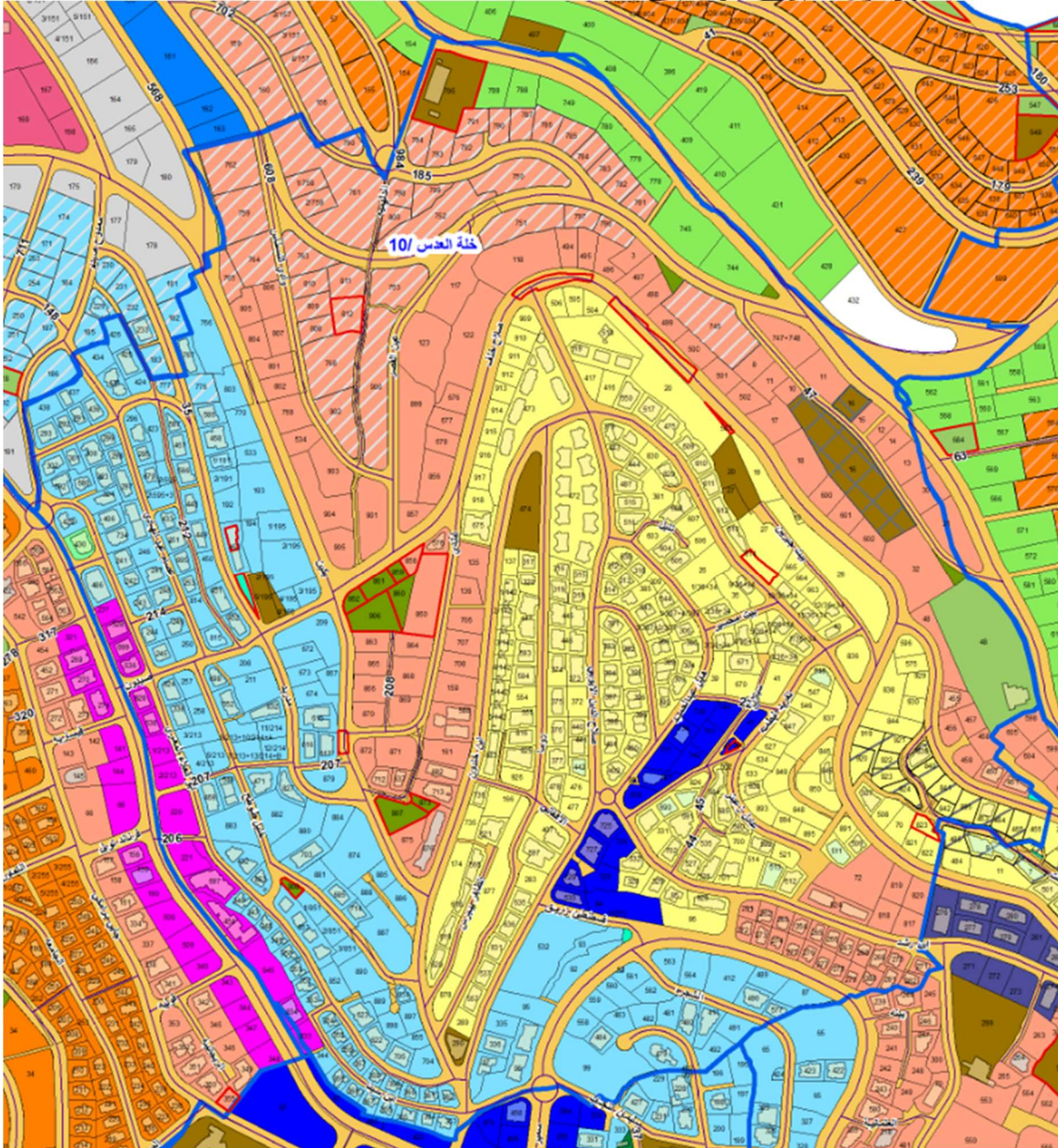
فئة الاستعمال أو المشروع	الحد الأدنى			الحد الأعلى		
	لارتفاع البناء (م)	لارتفاع الأمامي (م)	لارتفاع الخلفي (م)	عدد الطوابق	النسبة للطابقية	النسبة المئوية للبناء
أ- المناطق السكنية وتقسّم كالتالي:-						
الأبنية السكنية العالية	30	12	8	9	32%	36%
فلل	12*	5	5	3	90%	30%
سكن أ مرتفع	25	5	6	7	280%	40%

سكن أ	5	5	5	18	5	180%	36%
سكن ب	5	5	4	18	3	210%	42%
سكن ج	5	4	3	18	3	240%	48%
سكن د	5	3	3	15	3	260%	52%
البلدة القديمة	حسب ما تقرره اللجنة المختصة مع مراعاة أحكام الأبنية المجاورة						
ب- المكاتب	حسب المنطقة التي تقع فيها		18	5	حسب المنطقة التي تقع فيها		
ج- المباني العامة	6	10	10	22	6	216%	36%
د- المرافق السياحية	6	5	10	22	5	180%	30%

* يجب أن يقام الارتفاع للفلل من مستوى الأرض الطبيعية.

* في المناطق السكنية يكون الطابق الأخير طابق كامل لودووف.

Master/ zoning plan



- من ناحية التخطيط والتنظيم تعد المخططات وفقا لنظام الابنيه والتنظيم للهيئات المحليه - 2011 وانظمة التخطيط الخاصة بالبلديات.

Architectural Drawings

Section

2

Background

- Architectural drawings contain required information on the size, and material of all main elements of the structure, as well as their relative position.
- The principal drawings of the structure to be built are often described as being the 'architectural drawings'. All other engineering drawings are made based on the architectural drawings.
- The main items of the architectural drawings for structural engineers are: survey/ topographical Plan; Site plan; Floor plans; Elevations; Sections; Details and in some cases the 3D representation especially in complicated structures.

Land Survey plan

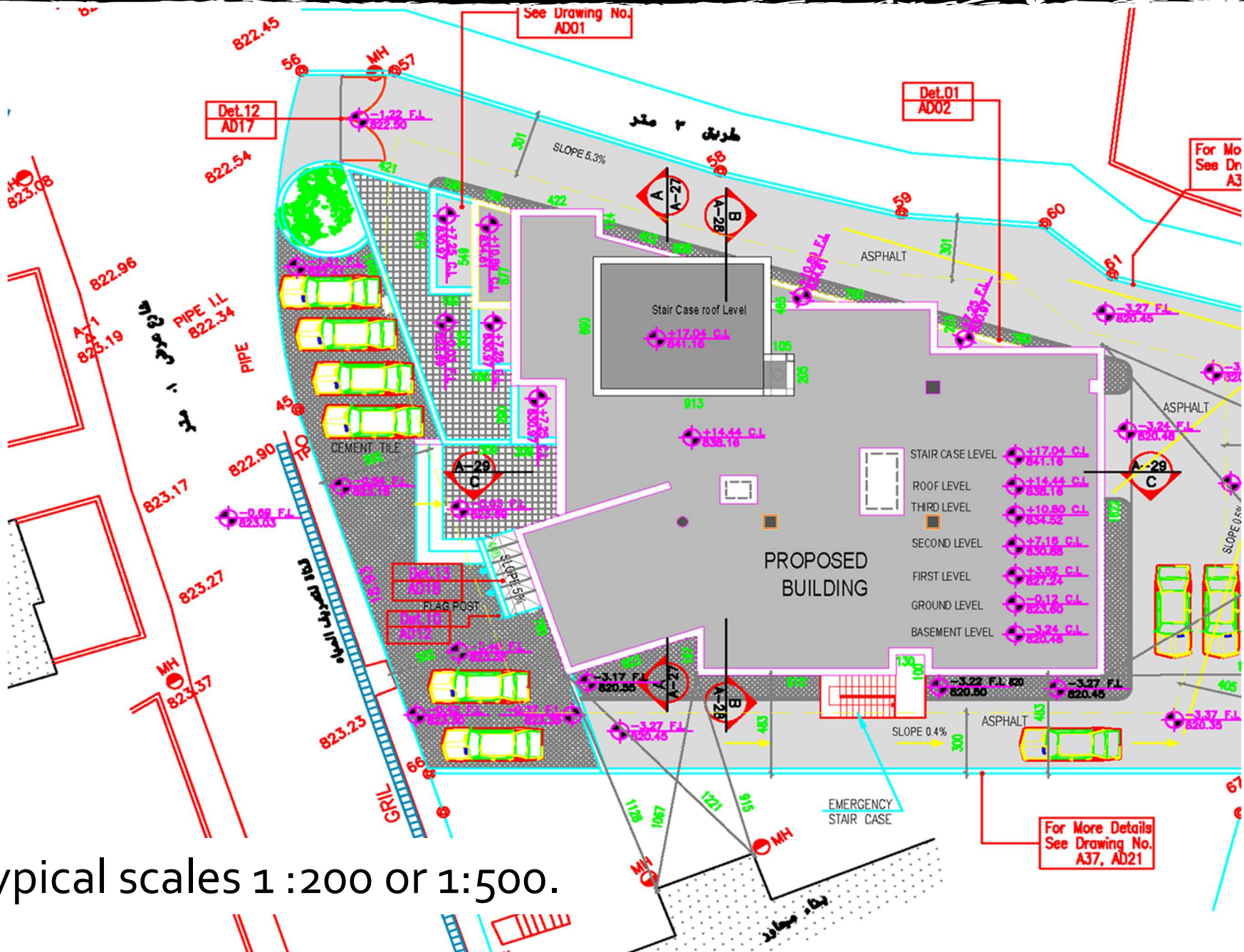
■ حسب متطلبات النقابه يجب ان يتضمن مخطط المساحه ما يلي

- ✘ إحداثيات زوايا الموقع منسوبة إلى نقاط المرجع المحددة (نقطة B.M.).
- ✘ نقاط تثليث (Control Points) مربوط بنقاط المرجع.
- ✘ خطوط كنتور بفترة لا تتجاوز (3-1.0) متر ارتفاع. وفي حال الأرض معالجة (مجروفة) إضافة أكثر من منسوب.
- ✘ اتجاه سهم الشمال.
- ✘ أبعاد القطعة الخارجية وأقطارها وزواياها وقائم المنحنى (إن وجد).
- ✘ خطوط الكهرباء والمياه التي تمر على حدود الموقع أو بداخله وأقرب مصدر للتغذية بها.
- ✘ خطوط الصرف الصحي التي تخدم القطعة، وتوضيح المنهل العام ومنسوب السطح والقاع.
- ✘ القطع أو الطمم الخارج عن طبوغرافية الأرض الطبيعية.
- ✘ الأشجار والأسوار أو أي معالم بارزة أخرى.
- ✘ مجرى النقطة الأقل منسوباً على كامل مساحة القطعة (المسار الطبيعي للمياه).
- ✘ وصف حدود الشوارع والطرق الخاصة بالتنظيم وعرضها وحالتها إذا كانت معبدة أو غير ذلك.
- ✘ وصف المباني القائمة (تسميات الأدوار القائمة) بالإضافة لمنسوب السطح.

Site plan

- A site plan is a plan drawn from above all of the buildings including the new design and the surrounding context. The main function of a basic site plan is to determine the placement of the structure as it sits in reference to the boundaries of the construction site.
- Site plans usually contain all appropriate site information detail including building outline, lot (property) lines, existing and new grade contour lines, power and water lines, trees to be removed and remaining, storm drainage, catch basins and manholes, building floor slab elevations, paved areas, ..etc. Space permitting, this drawing should also contain all appropriate legends pertaining to the site plane.
- Site plans are frequently one of the first drawings completed, since they define site constraints, locate all site services, and establish property lines.
- The plan help the structural engineer visualizes the building and the relationship between interior and exterior. Additionally, it is the base drawing for the site works.

Site plan - Example

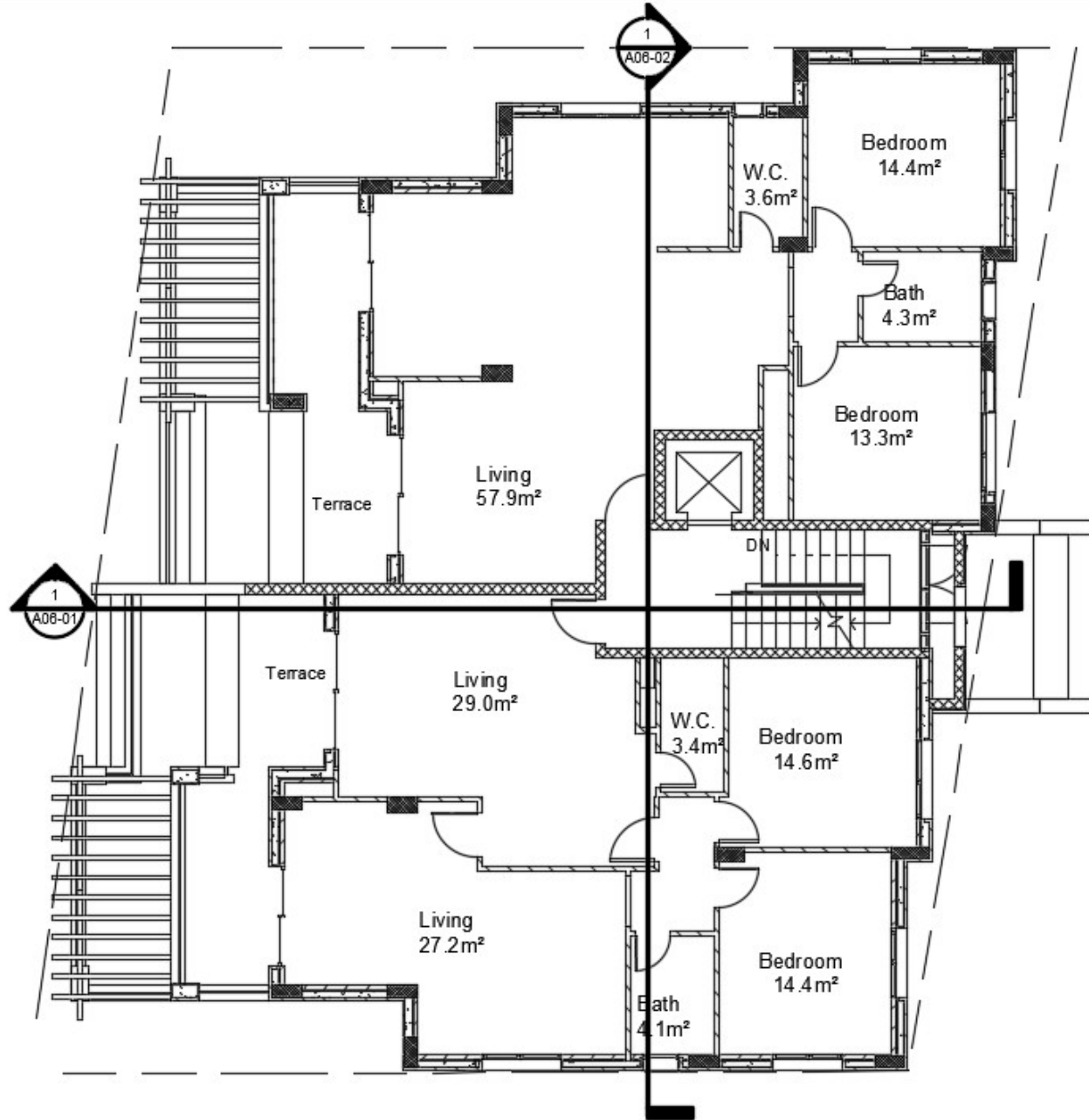
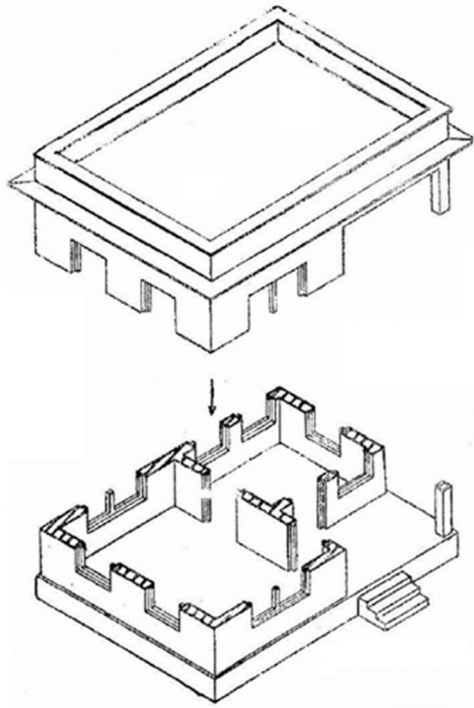


Typical scales 1 : 200 or 1 : 500.

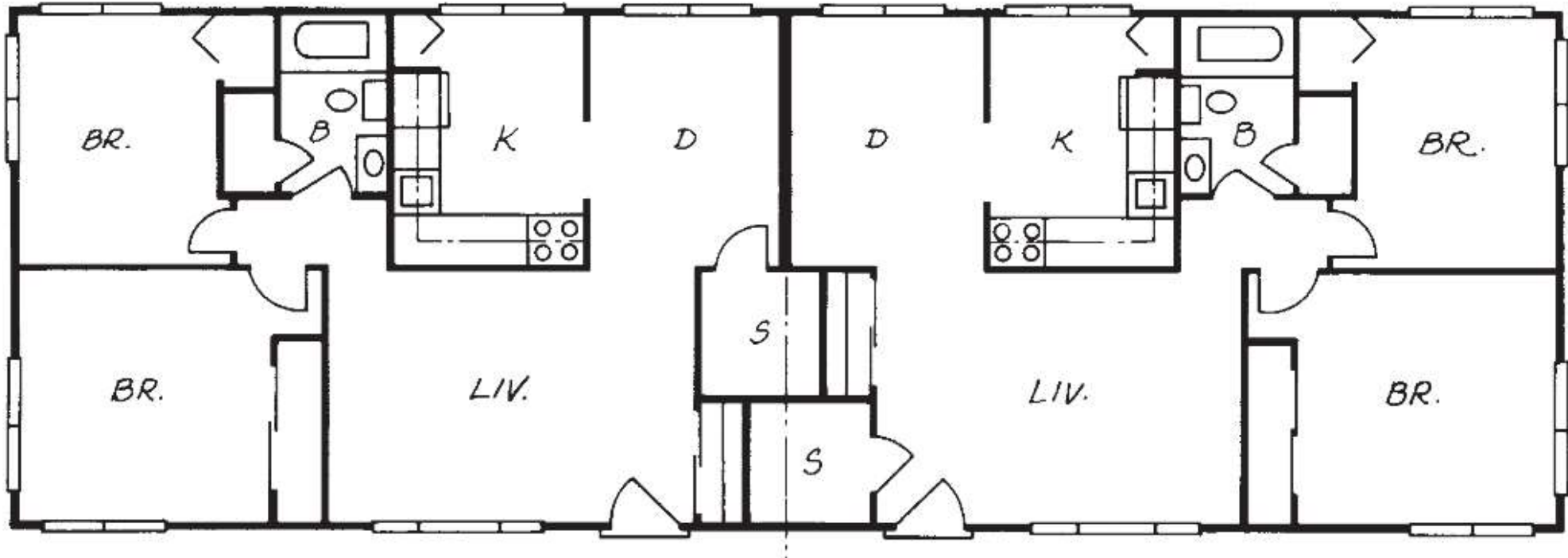
Floor plan

- The floor plan is a means to convey architectural space. It is a horizontal cut through a building, typically at about 1.2 m above floor level. The plans are often associated with other drawings, schedules, and specifications. When too much information is shown on a single plan, it becomes confusing, which is why very often, especially for complex projects, several different plans are required.
- Floor plans may include key dimensions and levels, and may also use, hatching, symbols and other standard annotations and abbreviations to indicate materials, fittings and appliances, and so on.
- The floor plan is of primary importance for the development of working drawings. It is the drawing from which all other architectural and engineering design is done. It is used to develop exterior and interior elevations, sections, and appropriate details. Usually, structural engineer begin with floors plan to determine and coordinate the location of the building structural system based on the given space.

Floor plan - Example

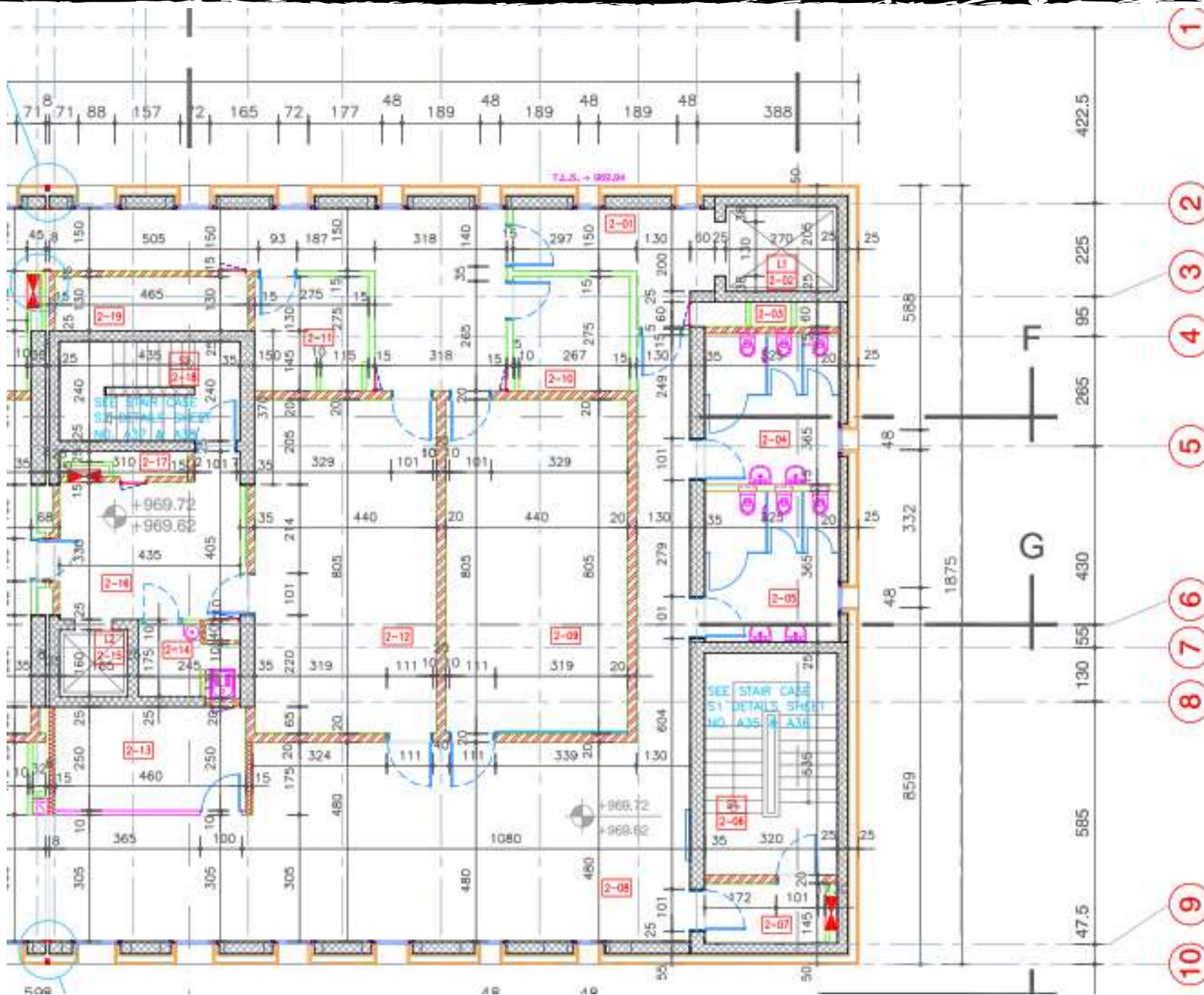


Floor plan - Example



Determine the locations of columns in the simple building plan shown

Floor plan - Example



Elevations

- The term 'elevation' refers to an orthographic projection of the exterior (or sometimes the interior) faces of a building, that is a two-dimensional drawing of the building's façades. As buildings are rarely simple rectangular shapes in plan, an elevation drawing is a first angle projection that shows all parts of the building as seen from a particular direction with the perspective flattened. Generally, elevations are produced for four directional views, for example, north, south, east, west.
- Historically, buildings have been drawn by hand on two dimensional paper. However, increasingly, buildings are being drawn using computer aided design (CAD) or building information modelling (BIM) software that represents them in three dimensions. Two-dimensional elevations can be generated from these 3D models, but they do not need to be drawn individually.

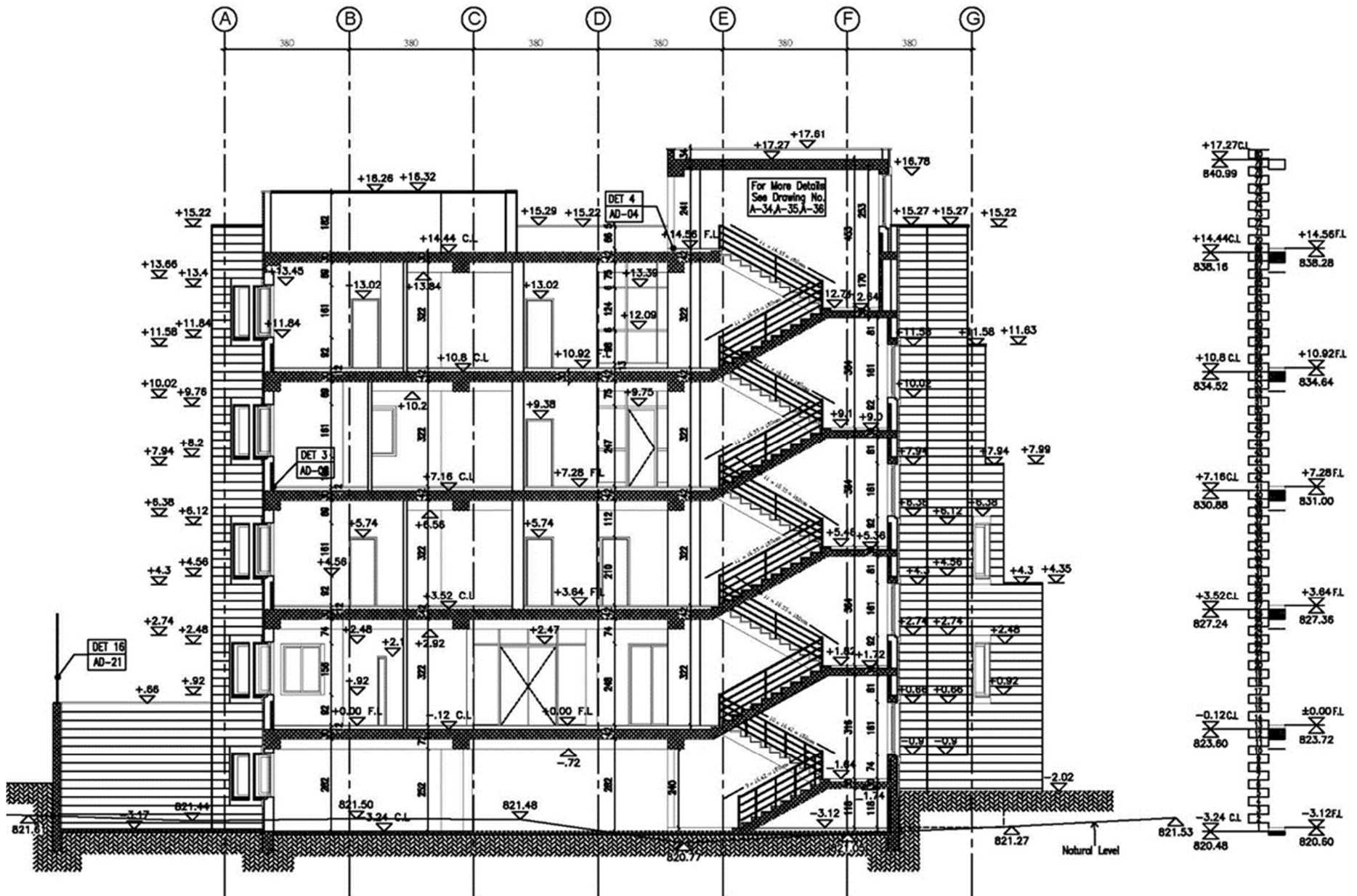
Elevation - Example



Sections

- A section drawing shows a view of a structure as though it had been sliced in half or cut along another imaginary plane. This can be useful as it gives a view through the spaces and surrounding structures (typically across a vertical plane) that can reveal the relationships between the different parts of the buildings that might not be apparent on plan drawings.
- Different type of sections can be produced such as Building cross sections, Wall sections, Window and door sections, Stair sections in addition to Sections for specific details (insulation, drainage, ...).

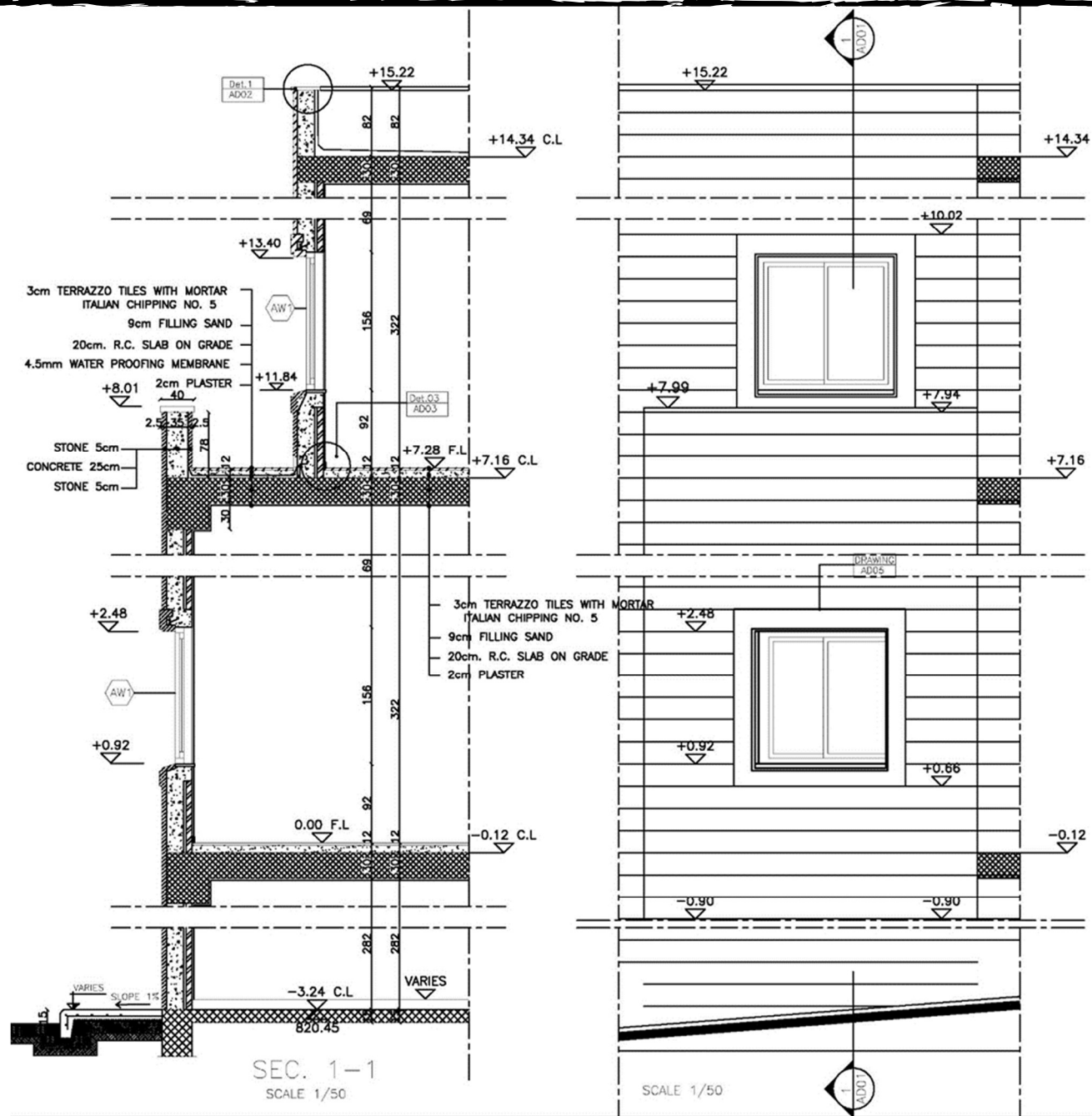
Sections - Example



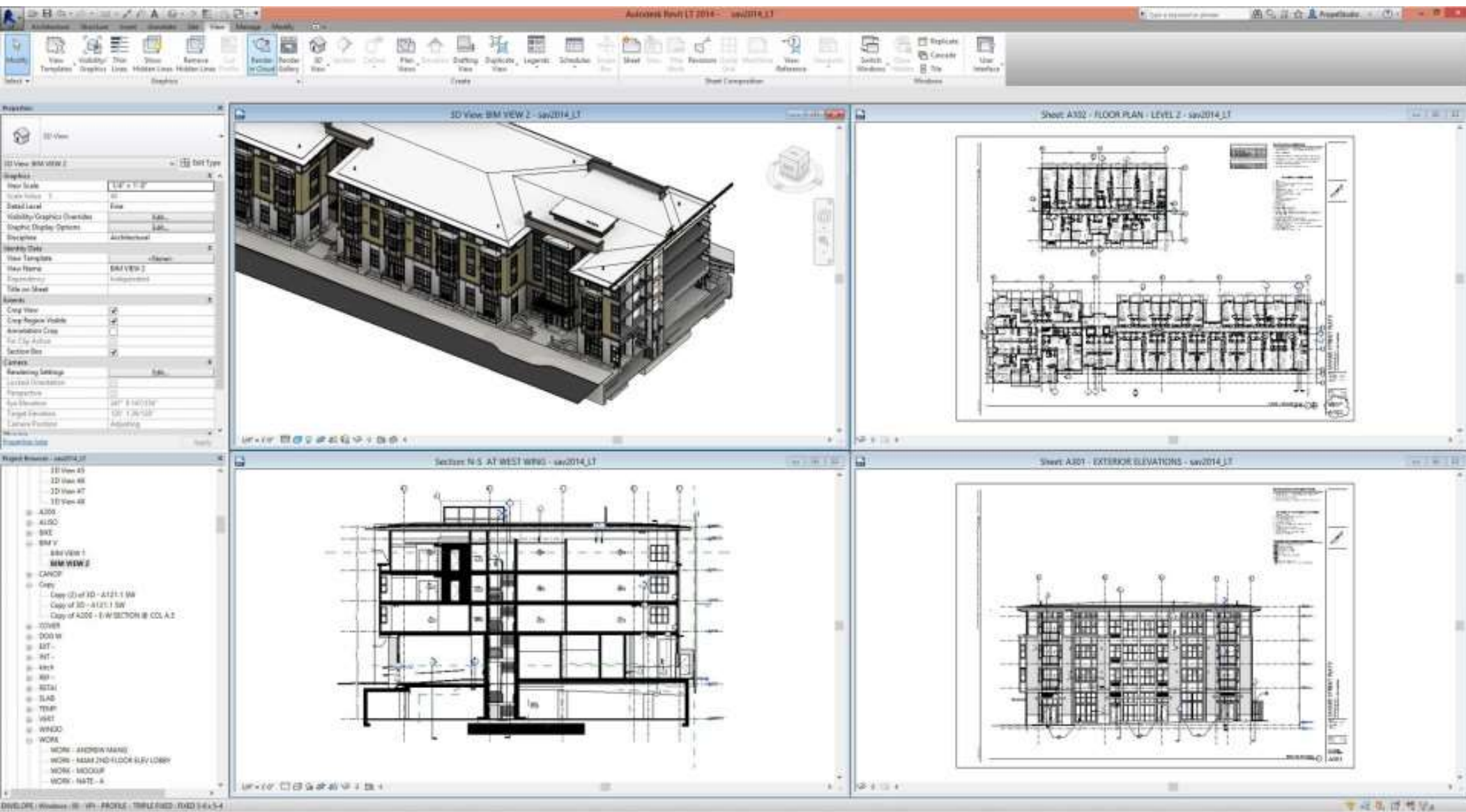
3D - Example



Sections - Wall section Example

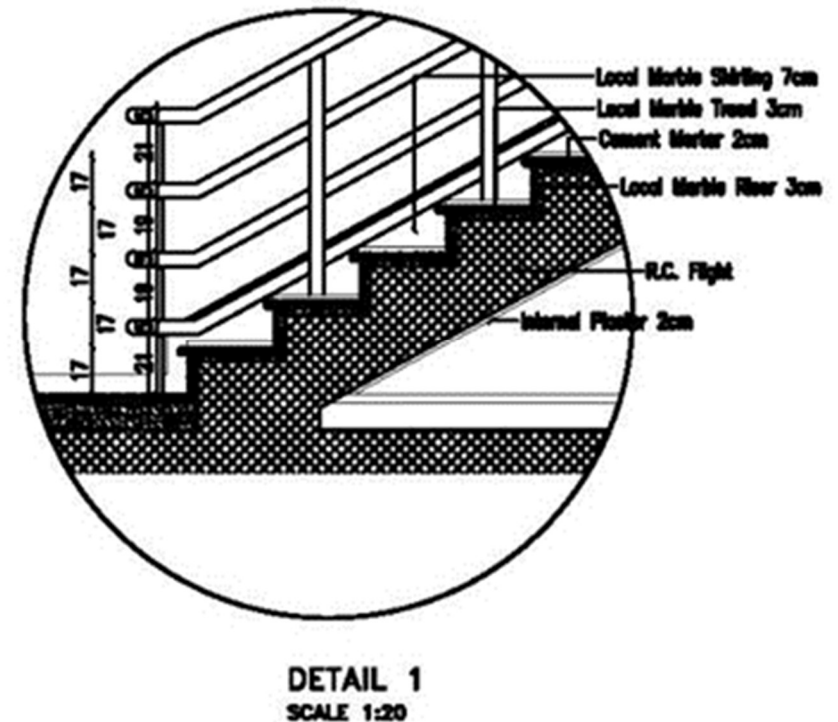
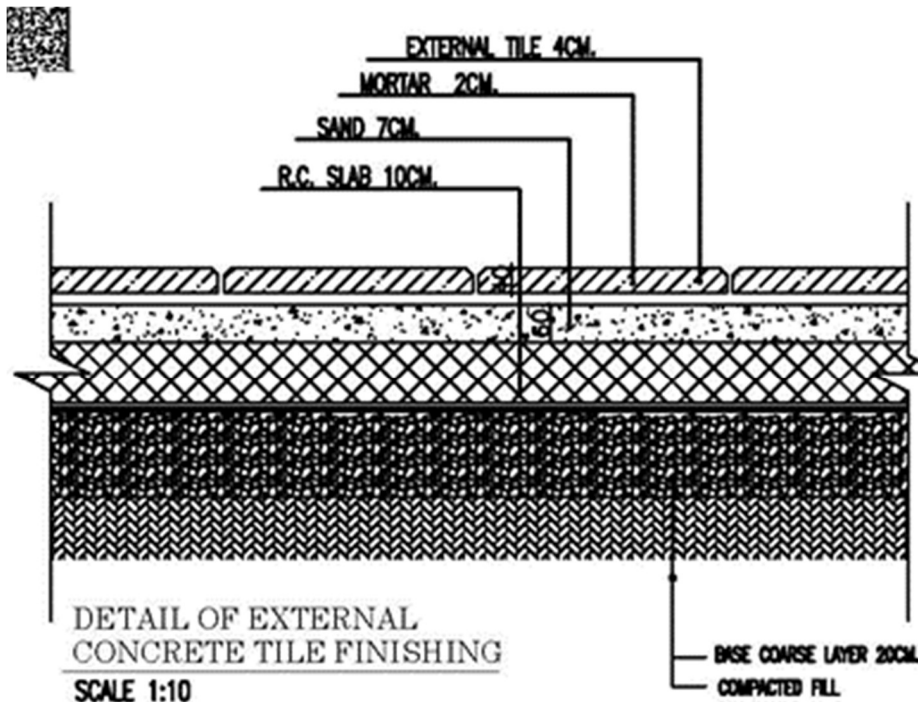


Architecture drawings - Revit

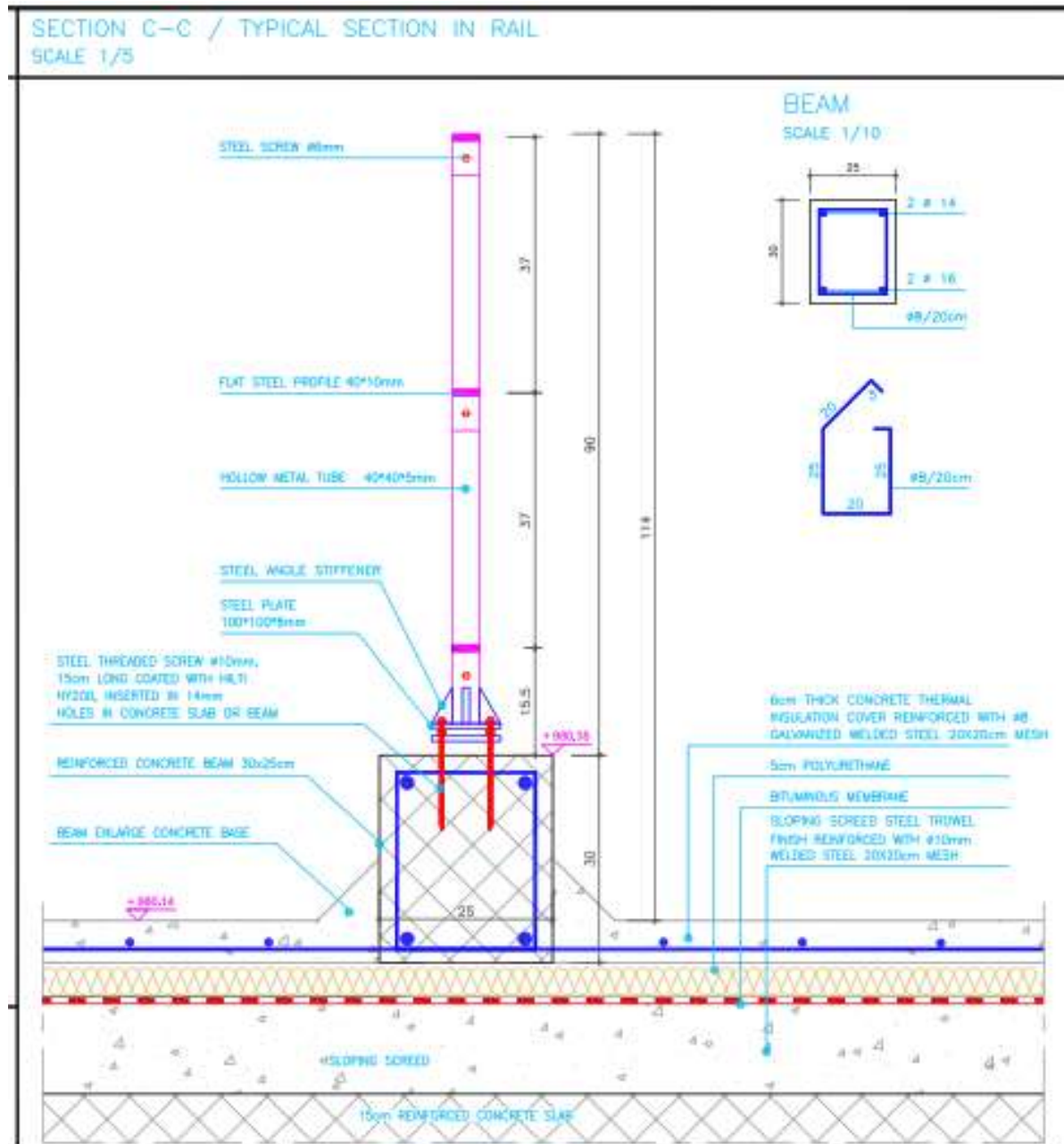


Architectural Details

Details are enlarged drawings that provide essential specific information. They are used to describe and define areas that require additional emphasis. The best way to visualize a detail drawing is as a close-up photograph.



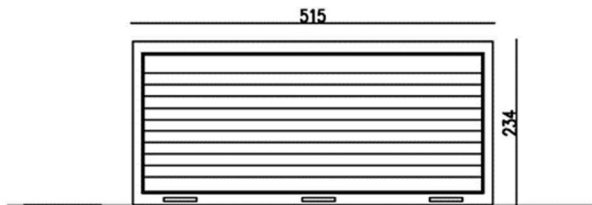
Architectural Details



Architectural Details

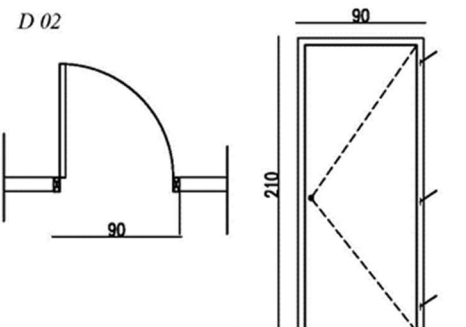
DOORS SCHEDULE

D 01



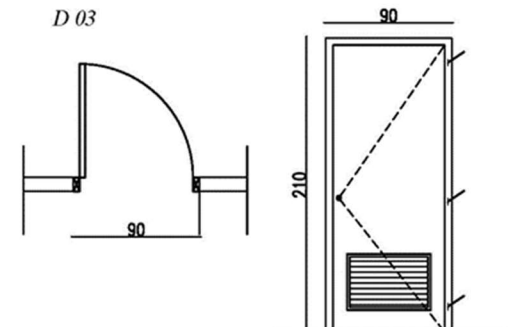
SCALE 1:50
NAME : GARAGE

D 02



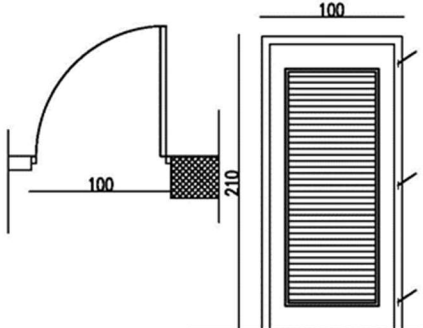
NAME : STAIR CASE AT BASEMENT

D 03



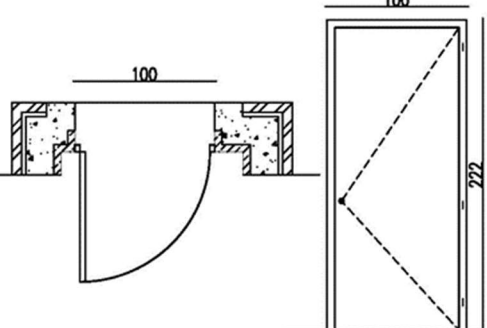
NAME : STORE & ELECTRICITY ROOM

D 04



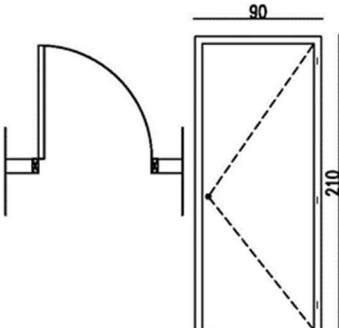
NAME : BOILER ROOM

D 05



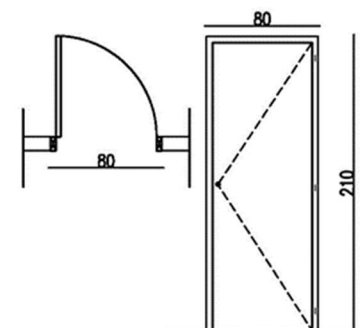
NAME : BASEMENT, STAIRCASE & MACHINE ROOM AT ROOF

D 06



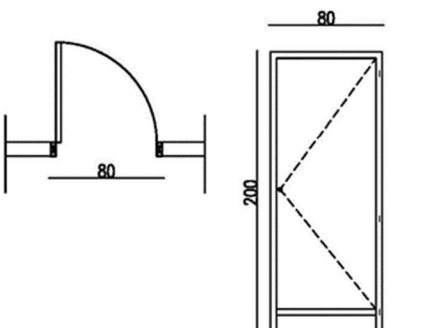
NAME : OFFICE

D 07



NAME : MAIN ENTRANCE OF SANITARY UNIT

D 08



NAME : BATH ROOM

DOORS SCHEDULE

DOOR#	WIDTH	HEIGHT	DESCRIPTION	BASMENT FLOOR	GROUND FLOOR	FIRST FLOOR	SECOND FLOOR	THIRD FLOOR	ROOF FLOOR	TOTAL
D01	600	234	ONE METAL ROLLER PANEL	1	0	0	0	0	0	1
D02	90	210	ONE METAL PANEL	1	0	0	0	0	0	1
D03	90	210	ONE WOODEN PANEL WITH LOUVERS IN LOWER PART	3	1	1	1	1	0	7
D04	100	210	ONE METAL PANEL WITH LOUVERS	1	0	0	0	0	1	1
D05	100	222	ONE METAL PANEL	1	0	0	0	0	2	3
D06	90	210	ONE WOODEN PANEL	2	17	14	9	16	0	58
D07	80	210	ONE WOODEN PANEL	1	2	2	3	2	0	10
D08	80	200	ONE WOODEN PANEL	0	4	4	4	4	0	16

Introduction to Structural Drawings

Section

3

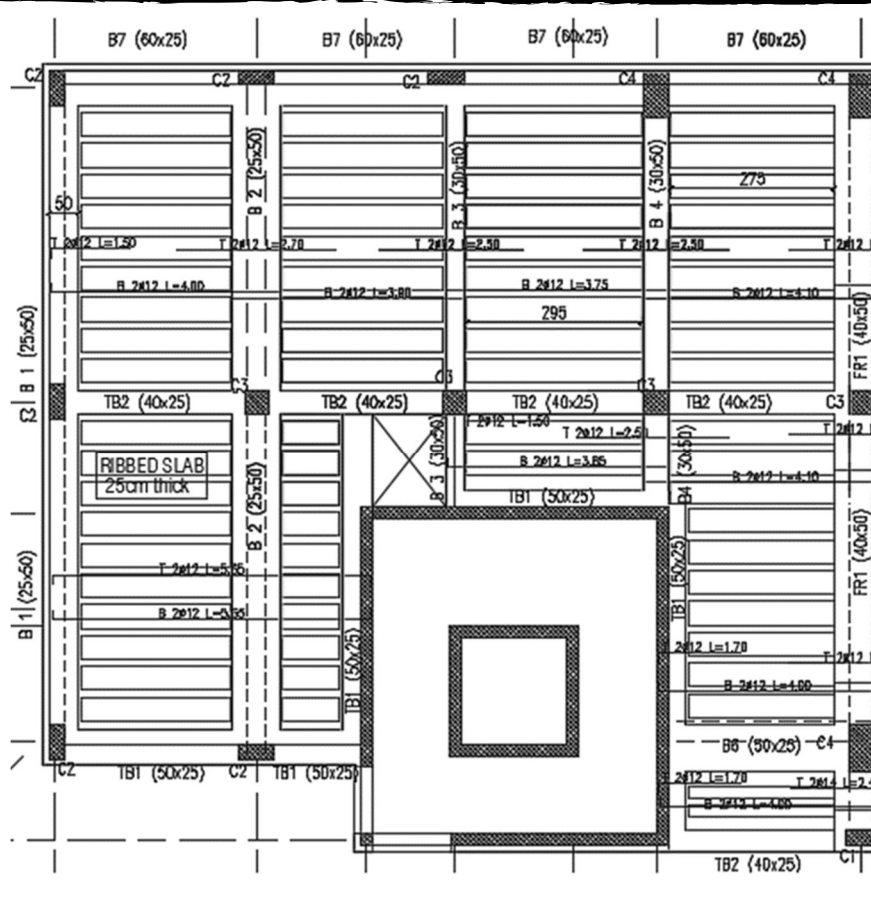
Introduction

- Structural drawings are primarily concerned with the load-carrying members of a structure. They outline the size and types of materials to be used, as well as the general demands for connections.
- Structural drawings are sequentially numbered beginning with an “S,” as in S-1, S-2, S-3, etc. They are normally located after the architectural drawings in a set of working drawings.
- Usually starts with the plan views followed by the sections and details in the same basic format as in the architectural drawings. Schedules are used to record such information as footings, columns, and trusses.
- It is recommended that A1 size drawings are generally used for General Arrangements, larger sized drawings being used only when unavoidable. A3 are recommended for details.
- Details of materials to be used will normally be given in a separate specification, and reference to the concrete or other types of material on drawings will be in an abbreviated form.

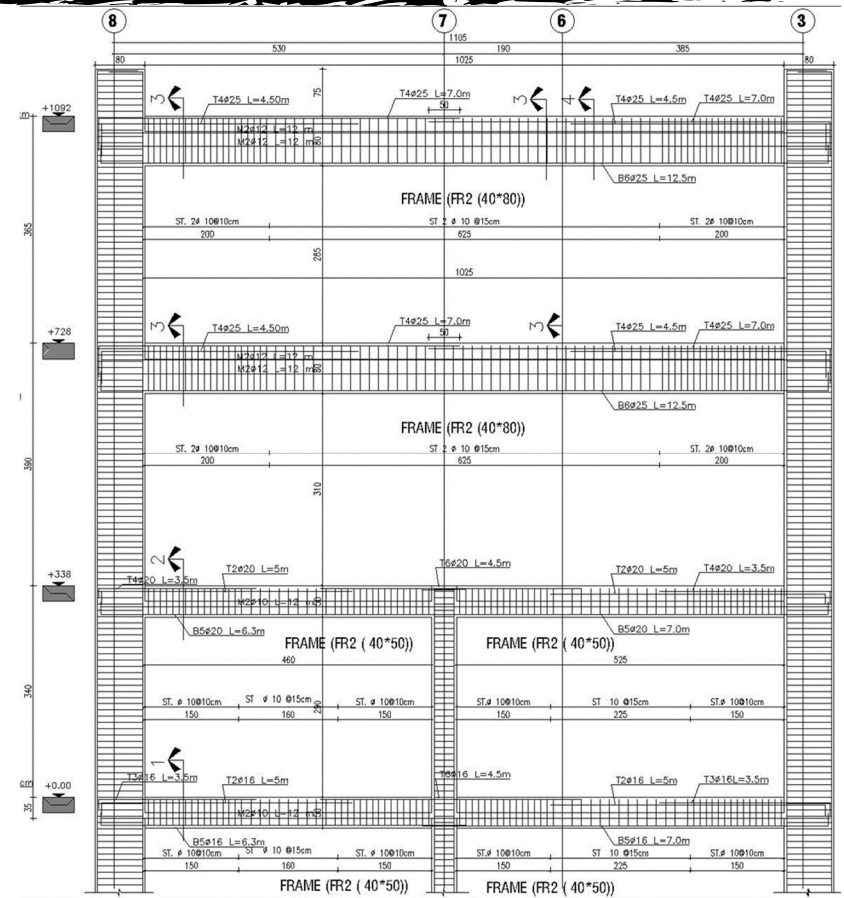
Elements of the structural drawings

- **Plans:** Plans should be drawn in such a way as to illustrate the method of support below, which should be shown as broken lines. This is achieved if one assumes a horizontal section drawn immediately above the surface of the structural component. The plans show arrangements of various members (footing, columns, beams, slabs,..)
- **Elevations:** An elevation on a portion of a structure will normally be taken as a vertical cut immediately adjacent to the element under consideration. Structural members cut by the section should be shown in full lines. Other connecting members behind the member being detailed should be shown by dashed lines.
- **Sections:** Where sections are taken through structural elements, only the material in the cutting plane is shown on a section; in general a cut showing features beyond should not be used. The directions of sections should be taken looking consistently in the same direction, looking towards the left for beams and downwards for columns.

Elements of the structural drawings

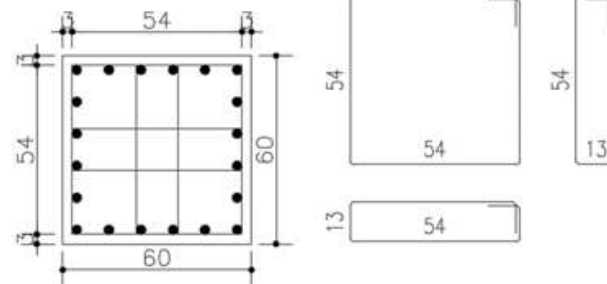


Plan Example



Elevation Example

Section Example



V 20Ø 16

ST. 3Ø10@12cm TO Lo = 75cm

ST. 3Ø10@20cm OTHER

General notes of structural drawings

This is more of a codes and by laws of the buildings. It is an extensive list of general notes depending on the type of structure notes usually include:

- Design note - refers to the building codes and other requirements .
- Soil note - comments on or quotes from the geotechnical investigation.
- Design loading
- Structural material notes
 - Concrete note - contains information on grades of concrete for various structural members, compressive strength, et ..
 - Reinforcing steel - specifies the types and grades of reinforcing steel and requirements for its cover, bending, lapping and placing.
 - Structural steel - specifies the types and grades of steel for structural members and requirements for bolting or welding them.
- Backfilling note - states conditions for backfilling and acceptable types of backfill material.
- General rules relevant to the type of the structure and structural material used.

متطلبات لوحة معطيات التصميم وفقا لدليل العمل الاستشاري

لوحة معطيات التصميم: وتتضمن ما يلي:

- أ. قوة تحمل التربة وعمق التأسيس.
- ب. بيان مقاومة الخرسانات المعتمدة.
- ج. بيان نوع ومقاومة حديد التسليح.
- د. عدد الأدوار التي يتم عليها التصميم.
- هـ. الأحمال المختلفة لجميع الطوابق (الحية، الميتة، الزلازل، الثلوج، الرياح، ... إلخ).
- و. ملاحظة أنه في حالة اختلاف نوع التربة أو نوعية أو أماكن القسامات أو الأحمال الحية يطلب مراجعة المهندس المصمم.
- ز. وصف النظام الإنشائي المستخدم: (SMRF): هيكل خرسانية خاصة مقاومة للعزوم، IMRF: هيكل خرسانية متوسطة مقاومة للعزوم، OMRF: هيكل خرسانية عادية مقاومة للعزوم).
- ح. الكودات المعتمدة في التصميم (علماً بأن الكودات المعتمدة هي أحدث الطباعات من كودات البناء الوطني الأردني أو أية كودات متوافقة معها).
- ط. تحديد المعاملات الزلزالية:

- نوع مقطع التربة Soil Profile
- عامل المنطقة الزلزالي Seismic Zone Factor (Z)
- العامل الزلزالي Acceleration Seismic Coefficient (Ca)
- العامل الزلزالي Velocity Seismic Coefficient (Cv)
- الحمل الميت الزلزالي WD
- عامل الأهمية Importance Factor (I)
- المعامل Over Strength & Ductility Factor (R)

General Notes Sample

GENERAL NOTES

1. CODE OF PRACTICE

Detailing and workmanship shall be according to ACI 318-93, and the technical specifications provide
Approved equivalent International codes shall be accepted
Design for concrete done according to ACI 318-93 & Jordanian National Building Code.

2. DIMENSIONS

As shown

3. DRAWINGS

- Structural drawings shall be read in conjunction with Architectural, Mechanical, Electrical and Sanitary drawings. For required openings refer to Architectural, Mechanical and Electrical drawings.
- Sleeves and openings smaller than 200x200mm are not shown on the drawings. For required openings refer to Architectural, Mechanical and Electrical drawings.
- Contractor shall prepare working drawings and bar bending schedules for reinforcement in a format agreed with the engineer.
- Drawings are not necessarily to scale.
- Chamfers for fair faced concrete are not shown on Structural Drawings. Reference should be made to Architectural details for such purpose.
- Contractor shall supply detailed drawings and calculations for all support and temporary works and propping systems as applicable and all other relevant information subject to the Engineer's approval prior to commencement of construction.

E:\farhat-housing\5\5.dwg

4. REINFORCEMENT

- Reinforcement shall be deformed high strength steel bars of characteristic strength of 414 Npa complying with ASTM standards or equivalent for diameters 12mm & above.
2- Reinforcement shall be deformed steel bars of characteristic strength of 275 NPa complying with ASTM standards or equivalent for diameters 10mm & below.
- Contractor to provide bar bending schedule.
- Where bar length is not specified, longest practicable bar length shall be employed with staggered lap splices. Lap length shall be 45 times bar diameter.
- Bar crank shall not exceed 1: 12.

5. REINFORCED CONCRETE

The following two types of reinforced concrete shall be employed:

- C40 - Grade 40 for columns and columns necks all reinforced concrete members age of 28 days shall be:
C40 - 40 MPa
C35 - Grade 35 for for all remaining reinforced concrete members except architectural fair faced concrete facades.

Characteristic Strength as defined by a 150 mm cube at

age of 28 days shall be:
C30 - 35 MPa

Minimum cement content, per cubic meter, shall be:
C30 - 350 kilograms

6.

PLAIN CONCRETE

The following type of plain concrete shall be employed:
C15 - Grade 15 concrete of characteristic cube strength equal to 15 NPa, minimum cement content of 120 kilograms per cubic metre, and a maximum water-cement ratio of 0.70 to be used for binding concrete under foundations.

7. AGGREGATES

Maximum aggregate size shall be 20 mm.

8. FOUNDATIONS

- Bearing capacity = 300 KN/m² (ASSUMED), contractor to prepare a site investigation report (Foundation to be Modified According to site Nav investigation report Recommendation)
- Contractor shall adhere strictly to the geotechnical report for this project. He shall be responsible to determine stress characteristics at the appropriate levels.
- Contractor shall be responsible for the coordination of all required E/M services with the sub-structure subject to approval of the engineer.
- Foundations are designed for FIVE floors only.

9. BACK FILL

All back fill material shall conform to specifications and shall be properly tested. No back filling is permitted around basement walls prior to pouring of retaining slabs.

10. DESIGN LOADING

Design Live Loads are as follows

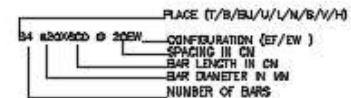
- Rooms 3.00KN/m²
- HALL 5.00KN/m²
- Stairs 5.00 KN/m²

GENERAL RULES

1. NOTATION

B= BOTTOM BARS
BLF= BOTTOM LEVEL OF R.C. FOOTING
BU= BENT UP BARS
EF= EACH FACE
EW = EACH WAY
H= HORIZONTAL BARS
L= L SHAPED TDP BARS
N= LACER BARS AT SIDE FACES
R= MILD STEEL BARS
TGB= TOP LEVEL OF GRADE BEAMS

S= STIRRUPS
SOG= SLAB ON GRADE
T= TOP BARS
U= U SHAPED BARS
V= VERTICAL BARS
W= HIGH YIELD BARS



2. COVER

Clear concrete cover to reinforcement shall be:

- 70mm for concrete below grade.
- 30mm for columns & beams.
- 20mm for walls, slabs and joists.

3. Min. Bar Spacing

Bar spacing "s" shall be not less than the greatest in the following three cases:
1) 25 mm 2) 1.5 d 3) 1.25 times the max. size of coarse aggregate.

4. Standard Hook Details and Bar Bends

Hook details	Bar size		Application
	Primary	Min	
	D	4d	10mm dia. bar and larger
	1a	12d	
	D	4d	10mm dia. bar and smaller
	1a	12d	
	D	4d	T- and L-shaped stirrups
	1a	12d	
	D	4d	90°/135°
	1a	8d	
	D	4d	Spacer bar
	1a	10d	

Intermediate position

Hook details	Bar size		Application
	Primary	Min	
	D	2d	10mm dia. bar and larger
	1a	12d	
	D	4d	10mm dia. bar and smaller
	1a	12d	
	D	4d	Min bar less than 10mm in column and chair
	1a	12d	
	D	4d	10mm dia bar and over in beams and chair
	1a	12d	

Grid/ Center lines plan

- These form a network across the job and provide a convenient datum for dimensioning and referencing elements. Grids usually coincide with the center-lines of columns; Otherwise the center-line is defined by offset dimensions from nearest grid.
- The plan also include the overall size of the column immediately above foundation with clear indication of orientation and location relative to the nearest grid lines.

