J1542A.
31st May, 2022

36 Lindley Avenue, Narrabeen

Geotechnical Comments for Section 4.55.

We have reviewed the existing geotechnical report, the original plans, and the 9 amended plans by JGC Design Services, drawings numbered A0.00, A1.00, A2.00, A3.00, A4.00, A5.00, A5.01, A5.02, and A5.03, Issue A, dated 16/5/22.

The changes are as follows:

- Remove proposed retaining wall in NE corner of property.
- Remove proposed first floor balcony.
- Various other minor modifications to the house and external areas.

The changes are considered minor from a geotechnical perspective and do not alter the recommendations or the risk assessment in the original report carried out by this firm numbered J1542 and dated the 9th November, 2017.

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GEOTECHNICAL INVESTIGATION:

Alterations & Additions at **36 Lindley Avenue, Narrabeen**

1. Proposed Development

1.1 Construct a new retaining wall on the NE corner of the property and place ~2.5m of filling to form a level area.

1.2 Various internal and external modifications to the house.

1.3 Details of the proposed development are shown on 7 drawings prepared by Interior Connections, drawings numbered 17415WD02D, 17415WD03E, 17415WD04C, 17415WD05D, 17415WD16A, 17415WD17A & 17415WD18A dated 20th October, 2017.

2. Site Description

2.1 The site was inspected on the 8th November, 2017.

2.2 This residential property is on the low side of the road and has a NE aspect. The block runs longways to the N so the slope is a slight cross fall. The block is located on the moderate to steeply graded lower middle reaches of a hillslope. From the upper boundary the natural slope falls across the property at a maximum angle of ~10°. Sandstone joint blocks on the E common boundary form rock faces to a maximum height of ~2.5m. The slope above and below the property continue at similar angles that increase.

2.3 From the road frontage a concrete driveway runs to a brick paved parking area and garage attached to the uphill side of the house (Photos 1 & 2). Another shared driveway lines the W boundary of the property and runs to the downhill neighbouring properties (Photo 3). Filling has been placed for the parking area. It is supported by a concrete block retaining wall that is partly obscured by thick vegetation (Photo 4). From what could be seen of the wall it appears stable. The two storey brick house displays no significant signs of movement in the external supporting walls that could be associated

with slope instability. The E side of the house is partly supported on an exposed, large medium strength sandstone joint block (Photo 5). The block is mostly embedded in the slope and displays no visible signs of movement. Beside the lower E side of the house ~1.4m of filling has been placed for a brick paved area (Photos 6 & 7). It is supported by a brick retaining wall that appears stable. There was minor settlement of the surface pavers and underlying fill beside the house (Photo 7). The movement is expected to be due to inadequate compaction of the fill and it is not considered a significant risk to life or property. On the lower NE corner of the block an excavation has been made into the slope for a concrete slab and awning (Photo 8). The cut is supported by an old rough stack rock retaining wall. The proposed retaining wall will be constructed below and beside the existing retaining wall and the void backfilled between the old and new walls.

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by the Newport Formation of the Narrabeen Group. This is described as interbedded laminite, shale and quartz to lithic quartz sandstone.

4. Subsurface Investigation

One Hand Auger Hole (AH) was carried out to identify the soil materials. Six Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to weathered rock. The location of the tests are shown on the site plan. It should be noted that a level of caution should be applied when interpreting DCP test results. The test will not pass through hard buried objects so in some instances it can be difficult to determine whether refusal has occurred on an obstruction in the profile or on the natural rock surface. This is not expected to be an issue for the testing on this site and the results are as follows:

AUGER HOLE 1 (~RL 20.5) – AH1 (Photo 9)

Depth	Material Encountered
0.0 to 0.6	**FILL,** mixture of soil and clay with fine to medium rock fragments throughout, dry.
0.6 to 1.0	**CLAY**, yellow/white, firm to stiff, dry.
1.0 to 1.3	**SANDY CLAY**, orange, very stiff, dry.
1.3 to 1.4	**CLAY** like weathered rock, white/yellow, very stiff, dry.

End of hole @ 1.4m. Auger still very slowly penetrating clay like weathered rock.
No watertable encountered.

DCP TEST RESULTS – Dynamic Cone Penetrometer

Equipment: 9kg hammer, 510mm drop, conical tip. Standard: AS1289.6.3.2- 1997

Depth(m) Blows/0.3m	DCP 1 (~RL 20.8)	DCP 2 (~RL 20.6)	DCP 3 (~RL 20.5)	DCP 4 (~RL 20.2)	DCP 5 (~RL 19.6)	DCP 6 (~RL 19.6)
0.0 to 0.3	1F	1F	1F	6	6F	3F
0.3 to 0.6	3	4	5	11		2F
0.6 to 0.9	8	11	9	35	4	10
0.9 to 1.2	11	20	16	#	9	16
1.2 to 1.5	14	48	40		16	22
1.5 to 1.8	26	#	30		50	28
1.8 to 2.1	#		#		#	#
	Refusal on Rock @ 1.6m	End of Test @ 1.4m	End of Test @ 1.6m	End of Test @ 0.9m	End of Test @ 1.8m	End of Test @ 1.6m

#refusal/end of test. F=DCP fell after being struck showing little resistance through all or part of the interval.

DCP Notes:
DCP1 – Refusal on rock @ 1.6m, DCP bouncing off rock surface, clean dry tip.
DCP2 – End of test @ 1.4m, DCP thudding on rock surface, red rock fragments on dry tip.
DCP3 – End of test @ 1.6m, DCP thudding on rock surface, clean dry tip.
DCP4 – End of test @ 0.9m, DCP thudding on rock surface, clean dry tip.
DCP5 – End of test @ 1.8m, DCP thudding on rock surface, clean dry tip.
DCP6 – End of test @ 1.6m, DCP thudding on rock surface, clean dry tip.

5. Geological Interpretation

In the test locations there was filling that ranged from depths of 0.6 to 0.9m below the current surface. The fill is underlain by a shallow topsoil over a firm to very stiff sandy clays and clays with the weathered zone of the under lying rocks encountered at depths between 1.4 to 1.8m below the current surface. It is interpreted from the response of the DCP tests on the underlying rock surface that the rock strength is extremely low to very low strength. This is a soft rock and can appear as a mottled stiff clay when it is cut up by excavation equipment.

It should be noted that bands of medium to high strength sandstone were exposed to the S of the proposed works (Photo 5) and on the neighbouring property to the W (Photo 10). The ground tests did not exceed a depth of 1.8m below the current surface and did not encountered sandstone. The rock strength below the tests is unknown but is expected to gradually increase with depth.

See Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Normal ground water seepage is expected to move over the exposed rock and the buried surface of the clay and rock and through the cracks in the rock. Due to the slope and elevation of the block, the water table in the location is expected to be many metres below the base of the proposed development.

7. Surface Water

No evidence of significant surface flows were observed on the property during the inspection. Normal sheet wash will move onto the site from the slope above during heavy down pours.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below or beside the property. The moderate to steeply graded surface that falls across the property is a potential hazard (**Hazard One**). The proposed retaining wall is a potential hazard (**Hazard Two**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The steep to moderately graded surface (i.e. slope and sandstone joint blocks) failing or toppling and impacting the existing house.	The proposed retaining wall transferring loads onto the existing downslope boundary retaining wall that causes failure.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (35%)	'Medium' (30%)
RISK TO PROPERTY	'Low' (2 x 10^{-5})	'Moderate' (2 x 10^{-4})
RISK TO LIFE	8.3 x 10^{-7}/annum	3.2 X 10^{-3}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	This level of risk is 'UNACCEPTABLE'. To move the risk to 'ACCEPTABLE' levels the recommendations in **Sections 12 & 14** are to be followed.

(See Aust. Geomech. Jnl. Mar 2007 Vol. 42 No 1, for full explanation of terms)

9. Suitability of the Proposed Development for the Site.

The proposed development is suitable for the site. No geotechnical hazards will be created by the completion of the proposed development provided it is carried out in accordance with the requirements of this report and good engineering and building practice.

10. Stormwater.

No significant stormwater runoff will be created by the proposed works.

11. Excavations.

Apart from those for footings no excavations are required.

12. Retaining Wall

The retaining wall type is yet to be determined but will be influenced by the existing fills, the location of the existing retaining walls and access difficulties. It may be a soldier pile wall, a gravity wall or a concrete block wall. All these walls have their pros and cons on this site but a soldier pile wall may be most suitable due to the fact it has the smallest footing footprint. The pros and cons of the various design options can be assessed by the structural engineer in consultation with the geotechnical consultant.

The retaining wall is to be constructed before any fill (backfill) is placed on site.

Retaining walls supporting fill can be designed for a lateral earth pressure coefficient K_a of 0.35 and assume a bulk density of 20kN/m^3. It should be noted that this lateral earth pressure coefficient assumes the surface above the wall is near level.

For embedded soldier pile retaining walls no passive resistance should be attributed to fill or for the ground inside the zone of influence of the existing downslope retaining wall. In this instance the zone of influence is the area above a theoretical 30^o line from the base of the existing boundary retaining wall towards the proposed footings of the retaining wall. Passive resistance can be estimated using an ultimate passive earth pressure coefficient of Kp = 2 for firm to very stiff clays and sandy clays and assume Kp = 400kPa for extremely low to very low strength rock. These are ultimate values so an appropriate safety factor is to be applied. These values assume a level surface above the wall. As the slope falls below the proposed retaining wall allowances are to be made for the associated reduction in lateral restraint of the piles.

Any surcharge loads that may act on the retaining walls are to be accounted for in the design.

All retaining walls are to have sufficient back wall drainage and be backfilled immediately behind the wall with free draining material (such as gravel). This material is to be wrapped in a non-woven Geotextile fabric (i.e. Bidim A34 or similar), to prevent the drainage from becoming clogged with silt and clay. If no back wall drainage is installed in retaining walls likely hydrostatic pressures are to be accounted for in the retaining wall design.

13. Filling

Filling to a maximum height of ~2.5m will be placed on the NE corner of the property to form a level area behind the proposed retaining wall. The retaining wall is to be constructed before any filling is place. The surface is to be prepared before any fills are laid by removing any organic matter and topsoil. Fills are to be laid in a loose thickness not exceeding 0.2 before being moderately compacted. Due to the location and scale of the work light weight equipment such as a hand held plate compactor (so as not to damage the retaining wall) is suitable. No structures are to be supported on fill.

14. Foundations

Downslope retaining wall heights need to be confirmed before the structural design begins so all foundations are outside the zone of influence of the existing walls.

A gravity or concrete block retaining wall can be founded on the stiff clays with the utilisation of shear keys. For foundations supported on firm to stiff clays of the natural profile assume a maximum an allowable bearing pressure of 200kPa. Alternatively foundations can be piered to extremely low strength shale expected at a depth of ~ 1.5m below the current surface with a maximum allowable bearing pressure of 600kPa.

It is recommended for the installation of a soldier pile wall that a mini piling rig capable of drilling through medium strength rock be used to drill the pier holes so there are no issues getting the required embedment depth. These machines are available in sizes as small as 5 tonnes. We note the ground tests carried out for this report could not penetrate rock deeper than 1.8m below the current surface. The machine is to be set back as far as possible from the existing retaining walls and is to use its reach to drill the holes.

As the bearing capacity of clay and extremely low to very low strength rock reduces when it is wet we recommend the footings be dug, inspected and poured in quick succession (ideally the same day if possible). If the footings get wet they will have to be drained and the soft layer of wet clay or shale on the footing surface will have to be removed before concrete is poured.

If a rapid turnaround from footing excavation to the concrete pour is not possible a sealing layer of concrete may be added to the footing surface after it has been cleaned.

NOTE: If the contractor is unsure of the footing material required it is more cost effective to get the geotechnical professional on site at the start of the footing excavation to advise on footing depth and material. This mostly prevents unnecessary over excavation in clay like shaly rock but can be valuable in all types of geology.

15. Inspections

The client and builder are to familiarise themselves with the following required inspection as well as council geotechnical policy. We cannot provide geotechnical certification for the owners and regulating authorities if the following inspection has not been carried out during the construction process.

- All footings are to be inspected and approved by the geotechnical professional while the excavation equipment is still onsite and before steel reinforcing is placed or concrete is poured.

- When the fill is being laid and compacted behind the wall it is to be inspected by the geotechnical consultant in 1.0m rises to ensure the compaction is adequate.

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Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9 – Base of the auger is at the bottom of the photo

Photo 10

Photo 11

Important Information about Your Report

It should be noted that Geotechnical Reports are documents that build a picture of the subsurface conditions from the observation of surface features and testing carried out at specific points on the site. The spacing and location of the test points can be limited by the location of existing structures on the site or by budget and time constraints of the client. Additionally the test themselves, although chosen for their suitability for the particular project, have their own limiting factors. The testing gives accurate information at the location of the test, within the confines of the tests capability. A geological interpretation or model is developed by joining these test points using all available data and drawing on previous experience of the geotechnical professional. Even the most experienced practitioners cannot determine every possible feature or change that may lie below the earth. All of the subsurface features can only be known when they are revealed by excavation. As such a Geotechnical report can be considered an interpretive document. It is based on factual data but also on opinion and judgement that comes with a level of uncertainty. This information is provided to help explain the nature and limitations of your report.

With this in mind, the following points are to be noted:

- If upon the commencement of the works the subsurface ground or ground water conditions prove different from those described in this report it is advisable to contact White Geotechnical Group immediately, as problems relating to the ground works phase of construction are far easier and less costly to overcome if they are addressed early.

- If this report is used by other professionals during the design or construction process any questions should be directed to White Geotechnical Group as only we understand the full methodology behind the report's conclusions.

- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- This report should not be applied to any other project other than that outlined in section 1.0.

- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- It is common for the design and construction process to be adapted as it progresses (sometimes to suit the previous experience of the contractors involved). If alternative design and construction processes are required to those described in this report contact White Geotechnical Group. We are familiar with a variety of techniques to reduce risk and can advise if your proposed methods are suitable for the site conditions.

SITE PLAN – showing test locations

LINDLEY AVENUE

EXISTING DWELLING No38

PRIVATE ACCESS ROAD

950

LELVEL ONE PROPOSED SHALLOW BALCONY AND PRIVACY SCREEN

PROPOSED FIXED LOUVERED PERGOLA OVER EXISTING GROUND FLOOR TERRACE

APPROX SEWER POSITION

EXISTING DWELLING No36

CREATE RETAINING WALL AROUND EXISTING EUCALYPT

15240

4550

EXISTING RETAINING WALL

DCP4

EXISTING RETAINING WALL

DCP6

AH 1

2510

DCP1

INSTALL NEW RETAINING WALL

DCP2

DCP3

INSTALL NEW RETAINING WALL

DCP5

40595

EXISTING SHED TO BE REMOVED AND SLOPING AREA TO BE INFILLED AND LEVELLED

11500

3500

4925

EXISTING DWELLING No34

N

SITE PLAN

SITE PLAN

36 LINDLEY AVENUE, NARRABEEN

17415WD05D

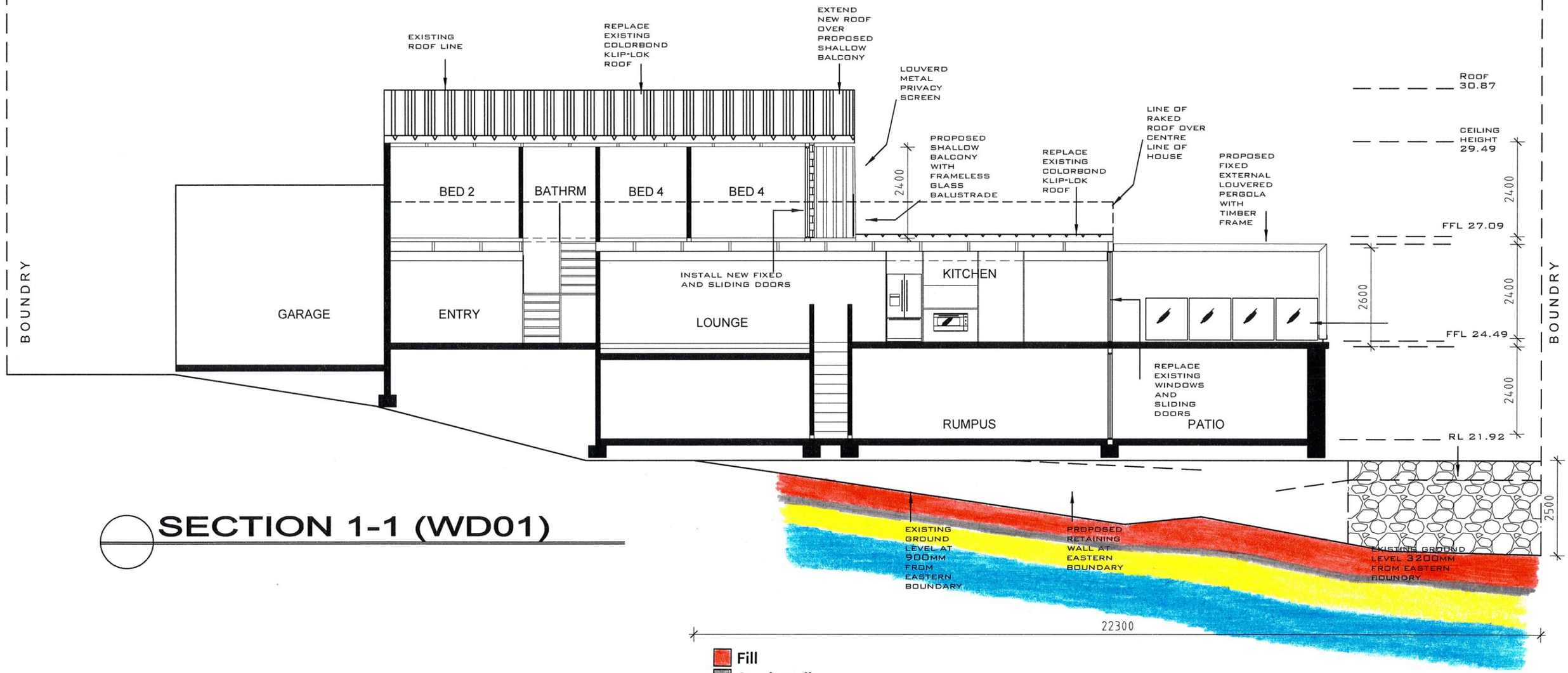
28 JULY 2017

1:200 @ A3

INTERIOR CONNECTIONS

INTERIOR CONNECTIONS

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



Fill
Sandy Soil
Sandy Clay & Clay – Firm to Very Stiff
Extremely Low to Very Low Strength Rock

SECTION 1-1 (WD01)

SECTION

36 LINDLEY AVENUE, NARRABEEN

17415WD04C

20 OCTOBER 2017

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INTERIOR CONNECTIONS