



Photograph 18: Example of deteriorated paint coatings to handrail glazing system on walkway.

COVERMETER

The covermeter results obtained at Lister and Treves Houses have been corrected wherever possible in line with observations at breakout locations. True concrete cover is stated.

The cover results are summarised in the following tables:

Lister

Element	Depth of Cover (mm)		
	Minimum	Maximum	Mean
Fire Escape Balcony Soffit	25	38	32
Slab Edge	17	59	34
Stairway Wall	16	31	22
Soffit	12	45	29
Column	14	32	22

Treves

Element	Depth of Cover (mm)		
	Minimum	Maximum	Mean
Slab Edge	2	47	24
Stairway Soffit	16	43	28
Stairway Beam	11	24	18
Stairway Landing Edge	11	34	21

CARBONATION

Please note that it is our policy to record carbonation results from in-situ tests to the nearest 5mm only. We do this in recognition of the fact that, in our opinion, the results across any concrete structure can vary significantly, as the concrete is frequently far from homogeneous across that structure. It is also true that the so-called carbonation front is not a parallel plane to the surface of the concrete, rather it is locally seen to be a very irregular plane roughly parallel to the surface. Readings across a single break out can vary by more than 5mm, which would be reflected in the results.

In accordance with BRE Digest 444: Part 2:2000 the progress of carbonation obeys an empirical formula:

$$\text{Simplified CBmm} = k \cdot \sqrt{t}$$

Where CBmm = carbonation depth in mm
 k = a constant reflecting concrete quality
 t = time, in years

The results obtained at Lister and Treves Houses are summarised in the following tables:

Lister

Element	Depth of Carbonation (mm)		
	Minimum	Maximum	Mean
Fire Escape Balcony Soffit	5	10	8
Slab Edge	<5	10	6
Stairway Wall	<5	10	6
Soffit	5	15	10
Column	<5	50	16

Treves

Element	Depth of Carbonation (mm)		
	Minimum	Maximum	Mean
Slab Edge	<5	25	11
Stairway Soffit	25	30	28
Stairway Beam	n/a	>30	n/a
Stairway Landing Edge	<5	15	9

n/a = not applicable as single test result

DUST SAMPLES

Details of the laboratory test findings are to be found in the Lab Results section of this report.

In accordance with BRE Digest 444: Part 2:2000 the risks associated with chloride contamination of concrete are variable with source and age of structure. This has long been our opinion as the critical factor in chloride contamination is in fact the total amount of free chloride ion available to take part in chloride attack on reinforcement.

In simple terms cast-in chlorides tend to combine with the hydration products of the cement, and are therefore considered to be substantially bound. It is known that the carbonation process releases this chemical bond, which results in an accumulation of free chloride ion just ahead of the carbonation front.

Conversely, chlorides that have entered the concrete subsequent to hardening, referred to as ingressed chlorides, must be considered to be substantially free, and available to take part in chloride attack. Ingressed chloride will accumulate with the passage of time, being present in ever-greater concentrations, at ever-greater depth. It follows that this form of chloride contamination is the more aggressive in the normal run of events.

Classification of risk in accordance with BRE Digest 444: Part 2:2000 is a complex procedure that we follow in general terms. The categories of risk are defined as follows: *negligible*, *low*, *moderate*, *high*, *very high*, and *extremely high*. Categorisation varies with source of chloride, age of structure, extent of carbonation and environmental exposure condition.

The results obtained for Lister and Treves Houses are expressed as chloride ion by mass of cement, using an assumed cement content of 14% in the concrete and are summarised in the following tables:

Lister

Element	Chloride Content (%)		
	Minimum	Maximum	Mean
Fire Escape Balcony Soffit	n/a	0.97	n/a
Slab Edge	0.19	1.15	0.51
Stairway Wall	0.11	0.11	0.11
Soffit	0.08	1.12	0.60
Column	0.17	1.52	0.66

n/a = not applicable as single test result

Treves

Element	Chloride Content (%)		
	Minimum	Maximum	Mean
Slab Edge	0.04	0.39	0.16
Stairway Soffit	n/a	0.13	n/a
Stairway Beam	n/a	0.63	n/a
Stairway Landing Edge	n/a	0.27	n/a

n/a = not applicable as single test result

The table has been colour coded to show the risk of reinforcement corrosion occurring in uncarbonated concrete due to the presence of cast in chlorides in accordance with BRE Digest 444 Part 2: 2000, assuming that the structures are approximately 40 years old, as follows: -

Chlorides (%)	Risk of Corrosion
<0.45	LOW
0.46 – 0.70	MODERATE
0.71 – 1.00	HIGH
1.01 – 1.50	VERY HIGH
>1.50	EXTREMELY HIGH

The chlorides were found to be variable to Lister ranging from low o extremely high risk.

The results for Treves were markedly lower ranging from low to moderate risk.

BREAK OUT

Details of the exploratory break out findings are to be found on the relevant detailed test area survey sheets, in the Images Section to this report.

Lister House

A breakout at TA1, 6th floor fire escape balcony soffit, revealed an 8mm square twisted bar. The cover was 25mm and the carbonation was 5-10mm and the bar had slight surface corrosion. It should be noted that the chloride result for here was high risk at 0.97%. There was a 2mm skim and paint layer to the surface.

A breakout at TA2, 3rd floor slab edge, revealed a pair of 6mm \emptyset plain bars which were clean and passive. The cover was 24mm and the carbonation was <5mm. There was a 4-5mm skim and paint layer to the surface.

A breakout at TA4, 3rd floor stairway wall, revealed a horizontal 6mm \emptyset plain bar and a vertical 10mm \emptyset plain bar at a minimum cover of 16mm. The carbonation was 5-10mm and the bars were clean and passive.

At TA6, 1st floor soffit, a breakout revealed an 8mm square twisted bar at a cover of 12mm with slight surface corrosion. It also revealed a perpendicular 6mm \emptyset plain bar at 21mm cover which was clean and passive. The carbonation was 5-10mm. The chloride test result for here was 1.12%.

A breakout at TA7, 8th floor column, revealed a 14mm \emptyset plain bar and two perpendicular 6mm \emptyset plain bars at a minimum cover of 18mm. The carbonation was 5mm and the bars were clean and passive. There was a 2mm skim and paint layer to the surface.

At TA9, 6th floor column, a breakout over a crack revealed a 12mm \emptyset plain bar with surface corrosion. The cover was 28mm and the carbonation was >40mm.

A breakout at TA15, 3rd floor slab edge, revealed a 6mm \emptyset plain bar at 20mm cover. The carbonation was 5-10mm and the bar was clean and passive. There was a 2mm skim and paint layer.

Finally a breakout at TA18, ground floor column, revealed a 12mm \emptyset plain bar at 20mm cover and a pair of 6mm \emptyset plain perpendicular bars at 14mm cover. The carbonation was <5mm and the bars were clean and passive.

Treves House

A breakout at TA1, 2nd floor slab edge, revealed an 18mm \emptyset plain bar end at 2mm cover. The carbonation was 10-15mm and there was slight

surface corrosion to the end of the bar. There was a 10mm skim/render and paint layer to the surface.

A breakout at TA3, walkway slab, revealed a 12mm \emptyset plain bar and a perpendicular 6mm \emptyset plain bar at a minimum cover of 12mm. The carbonation was 15-25mm and the bars had slight surface corrosion. There was 1mm of paint to the surface.

At TA6, stairway soffit, a breakout revealed a 20mm \emptyset plain bar at 21mm cover. The carbonation was 25-30mm and the bar had slight surface corrosion. There was 1-2mm of skim and paint.

A breakout at TA7, stairway beam, revealed a 28mm \emptyset plain bar and a 6mm \emptyset plain bar both with slight surface corrosion. The minimum cover was 11mm and the carbonation was >30mm.

Finally a breakout at TA8, stairway landing edge, revealed a 16mm \emptyset plain bar at 19mm cover and the end of a link bar at 4mm cover. The carbonation was <5-15mm. The 16mm bar was clean and passive but the link bar corroded and the concrete spalled.

BRICKWORK

Details of the brickwork findings are to be found on the relevant detailed test area survey sheets, in the Images Section to this report.

Lister House

Six brickwork test areas were carried out to exposed brickwork panels on the gable ends.

The walls were found to be cavity wall insulated (blown in polystyrene balls). This of course hindered any borescope inspecting of the cavities. The cavities were generally ~80mm wide. At one area a larger cavity of some 300mm was found – service duct. One cavity was recorded as only 40mm wide.

The wall tie detectors could not pick up any wall ties reliably except for indicating a regular pattern down each panel side. Breakouts revealed galvanised metal strip/straps regularly spaced down each side. These were found to be embedded in the adjacent columns, bent down into the mortar joints.

Treves House

Testing of the two gable ends revealed the walls to be of bonded solid brickwork construction. Six test areas were undertaken over the two gable ends.

CLADDING

Details of the cladding investigation findings are to be found on the relevant detailed test area survey sheets, in the Images Section to this report.

The cladding was investigated to both Lister and Treves Houses.

It was found to be a profiled metal sheet cladding fixed to a timber frame which in turn is fixed to the concrete frame (where we examined it). There is a cotton reinforced plastic sheet continuous across the timber frame (behind the metal cladding) covering an insulation layer which was a fibrous material, possibly fibreglass.

This was checked in a few locations and found to be repetitive to both Lister and Treves Houses. On Treves House there was old boarding to the floor soffit of unknown material.

The following photographs illustrate the findings:



Photograph 19: General view showing typical metal cladding (on Lister House).



Photograph 20: View showing metal cladding secured along base of concrete slab edge. Note concrete exposed - first floor on Lister.



Photograph 21: As lower section of metal cladding lifted revealing edge strip over concrete.



Photograph 22: View showing metal cladding with reinforced sheet behind, over wall insulation (broke through to expose it).



Photograph 23: A closer view, as previous photograph, showing insulation dug out to concrete behind.



Photograph 24: View showing typical metal cladding profile externally.



Photograph 25: General view showing typical fixing of cladding at timber work directly below window openings.



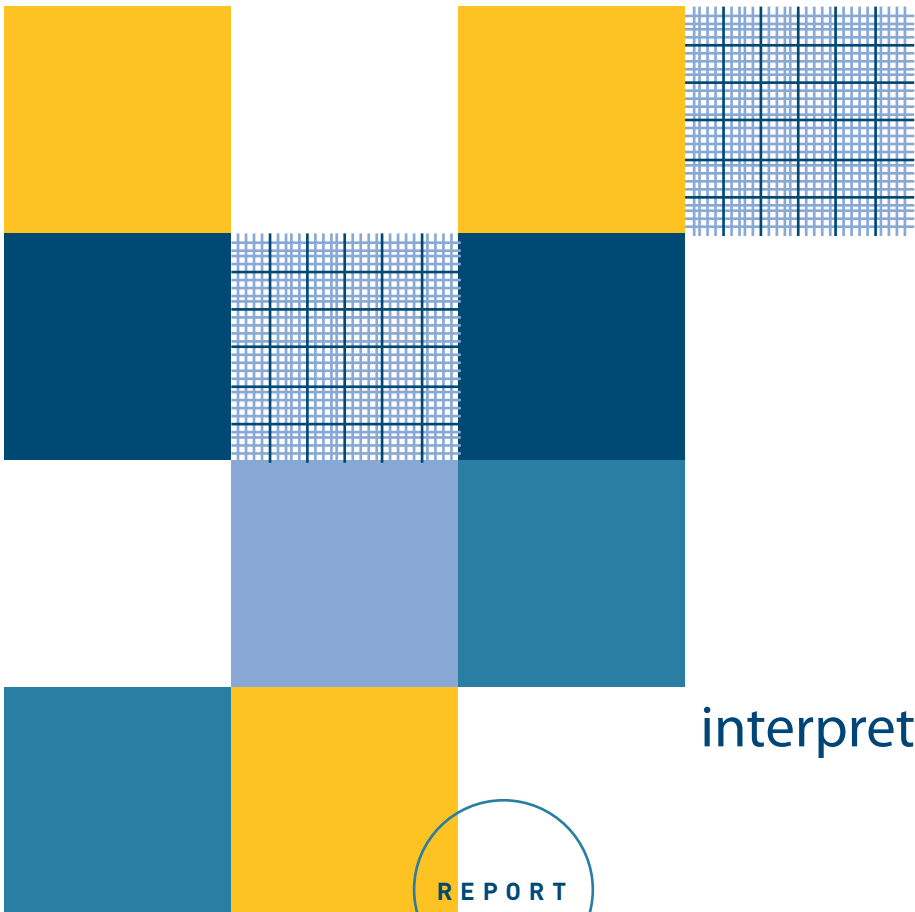
Photograph 26: Another opening up revealing insulation covered by reinforced sheet (on Treves House).



Photograph 27: As previous photograph but opened further revealing timber framework secured back to concrete. Here a render layer behind the insulation is also apparent.



Photograph 28: General view of underside at walkway to Treves, with boarding across the soffit.



MARTECH

interpretation



t e s t

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to select the section you require,
please click on the relevant heading

INTERPRETATION

TEST REPORT

The test results obtained at Lister and Treves Houses indicate that there is significant deterioration to the various elements.

Lister House

There are occasional spalls and extensive deteriorated coatings to exposed concrete elements. The minimum cover and maximum carbonation test results indicated that there are some areas of reinforcement within or near to carbonated concrete. The mean cover and carbonation results indicated reinforcement is generally within alkaline concrete though.

The chloride test results were widely variable and found to be of low to extremely high risk where tested indicating cast-in chlorides. Therefore there is significant latent damage (as well as the visible damage seen) in places. The chloride results ranged from 0.08% to 1.52% by mass of cement.

At a couple of the exploratory breakouts surface corrosion was found to reinforcement in alkaline concrete – which had high risk chloride levels.

The brickwork panels to the gable ends were found to be of cavity construction and retro insulated. The wall tie detector did not pick up any ties in the panels except to the vertical edges adjacent the columns. Breakouts found there to be galvanised metal straps from the concrete columns into the brickwork mortar beds.

The cladding detailing was confirmed as requested and basically found to be a metal profiled sheet cladding attached to a timber frame in turn attached to the original concrete with insulation in between. This was found to be similar on both structures.

Treves House

There are again occasional spalls and deteriorated coatings to the concrete elements. In the access area there is also extensive plant growth over the concrete frame (and brickwork).

The minimum cover and maximum carbonation test results indicated there are areas of reinforcement within carbonated concrete. The mean results indicated significant latent damage with regards to carbonation to some of the elements e.g. stairway soffit with mean cover of 28mm and mean carbonation of 28mm, but further testing would be recommended to confirm how extensive that may be.

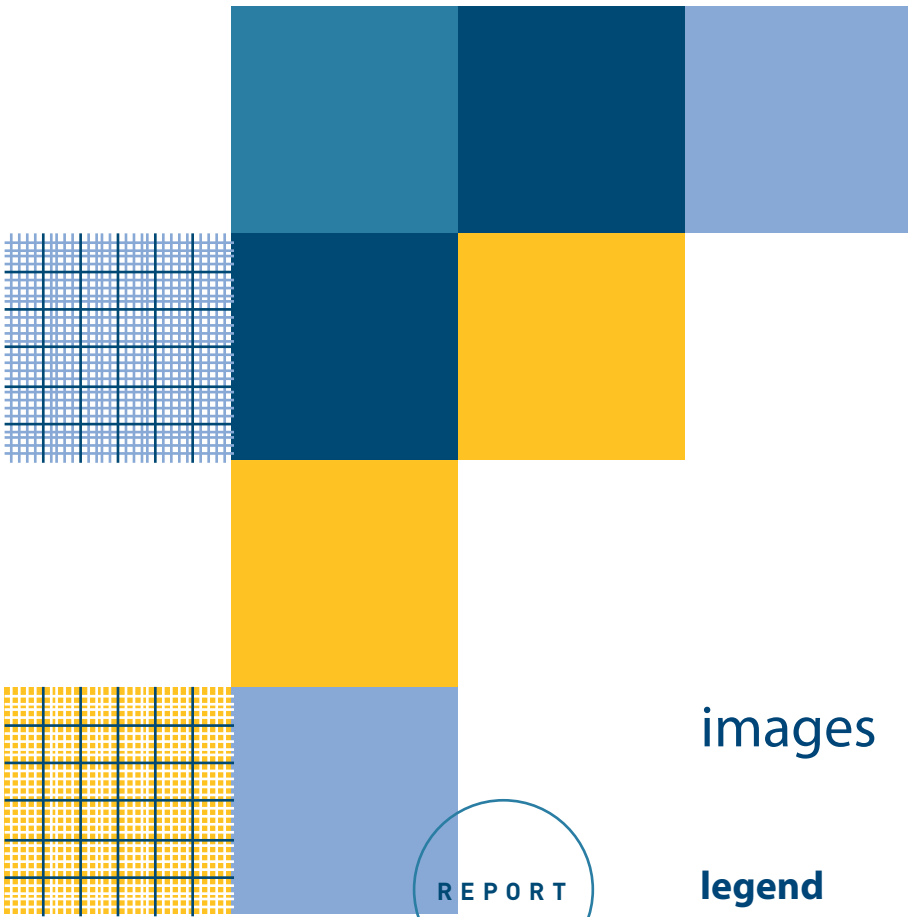
The chloride test results were markedly lower than those seen to Lister House. They ranged from 0.04% (low risk) to 0.63% (moderate risk) by mass of cement.

Where carbonation had reached reinforcement in the exploratory breakouts surface corrosion was noted. Otherwise the reinforcement was clean and passive.

The gable brickwork walls were confirmed as being of bonded solid brickwork construction.

The cladding investigations confirmed similar detailing to that already found on Lister House – i.e. metal cladding on a timber frame against the original structure with insulation between.

The findings should be assessed by the Structural Engineer so that appropriate remedial advice can be formulated in accordance with his client's plans for the structures.



MARTECH

t e s t

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REPORT

images

legend

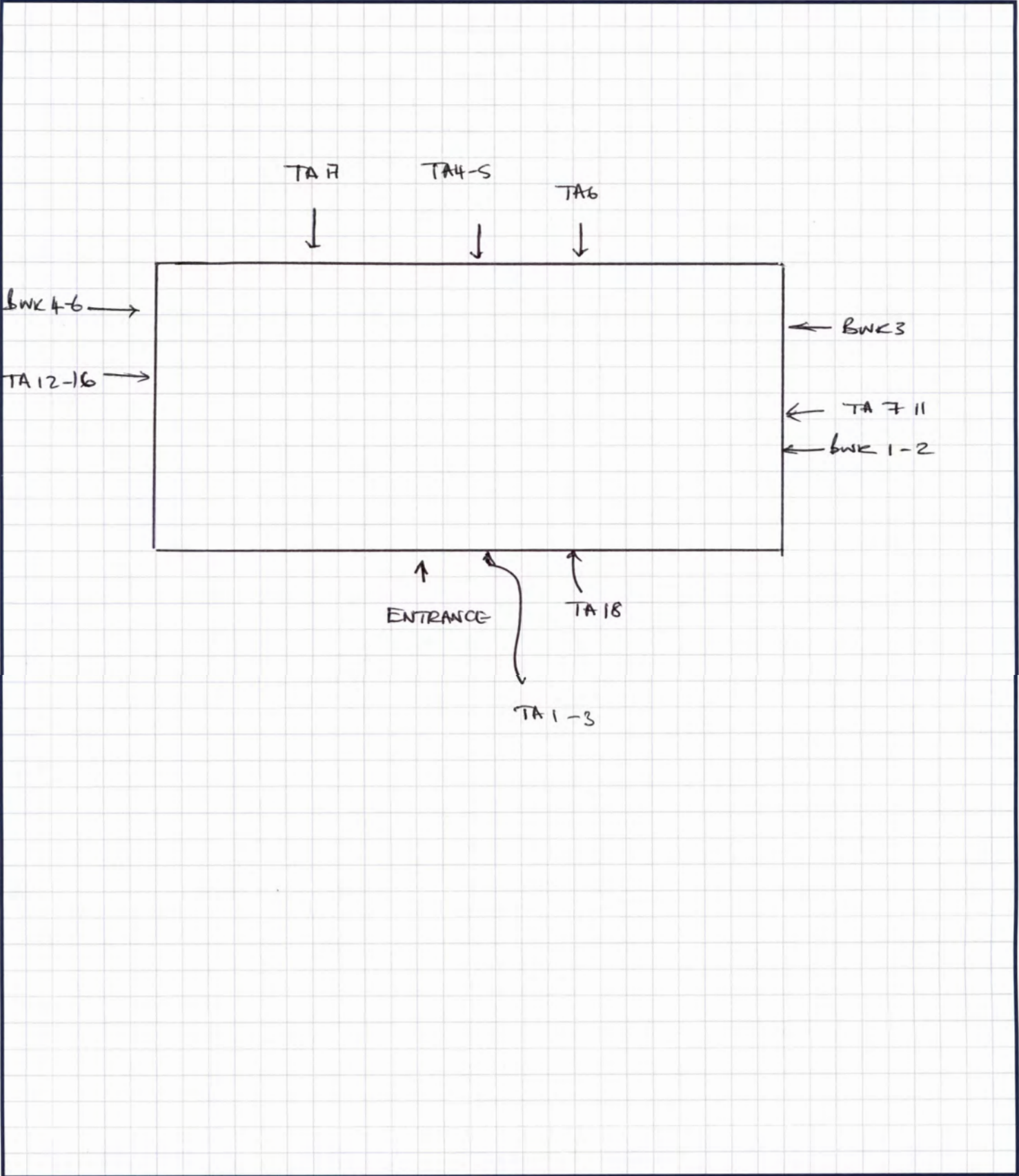
survey sheets - lister

survey sheets - treves

to select the section you require,
please click on the relevant heading

LEGEND

TA	Test Area Location and Reference
⊕ S	Sample Location and Reference
CV	Depth of Cover (mm)
BWK	Brickwork
CB	Depth of Carbonation (mm)
C+P	Clean and Passive Steel
LOP	Loss of passivity
SP	Spall
PR	Previous Repair
FPR	Failed Previous Repair
TW	Tie Wire
RS	Rust Spot/Stain
PY	Pyrite
B/O	Breakout to Expose Reinforcement
FM	Facing Mix
BM	Backing Mix
{c	Crack
VS	Visible Steel
BE	Bar end
45	Rebar Location and Depth of Cover (mm)
⊕ C1	Core Sample Location and Reference
SSC	Slight Surface Corrosion
SC	Surface Corrosion
H	Hollow



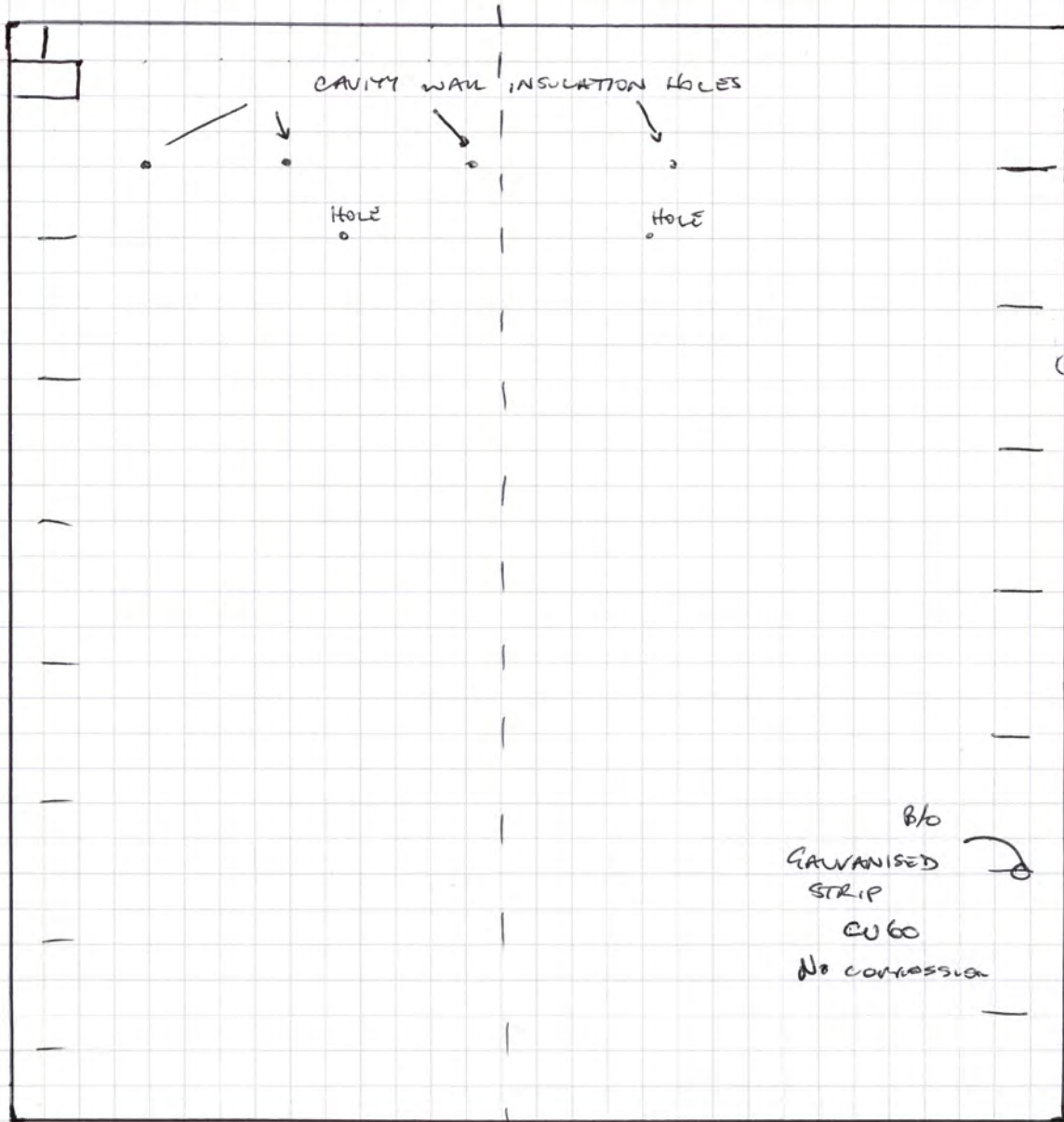
Project LISTER & TREVES HSES.

Date _____
Report No 14093

Location LISTER HSES
TA & BWK LOCATIONS

Sheet No _____

BWR 1 8th floor



Polystyrene ball insulation
80mm cavity

Stretcher bond brick outer
Mortar ok

No other ties detected

↑
300mm cavity
Service duct
pipe (gas water?)

Project Lister & Treves HSEs

Location BWR 1.

Lister H

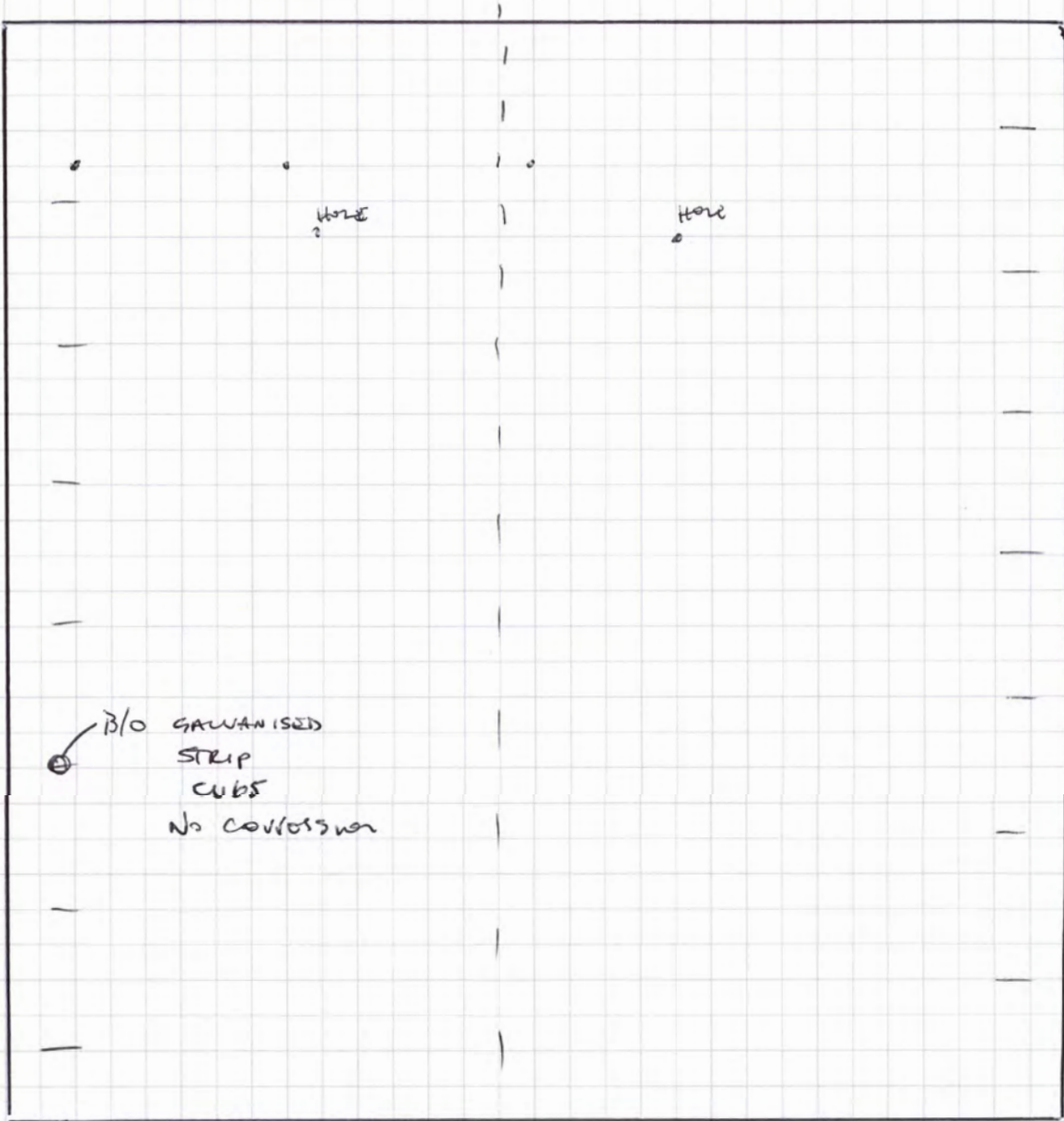
Date

Report No 14093

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Sheet No

BWK 2 5th floor



↑
 Polystyrene ball insulation
 30mm cavity
 Stretcher bond brick outer
 Mortar 22
 No other ties detected

↑
 300mm cavity
 Service duct.

Project Lister & Treves Hoes

Location BWK 2

Lister H.

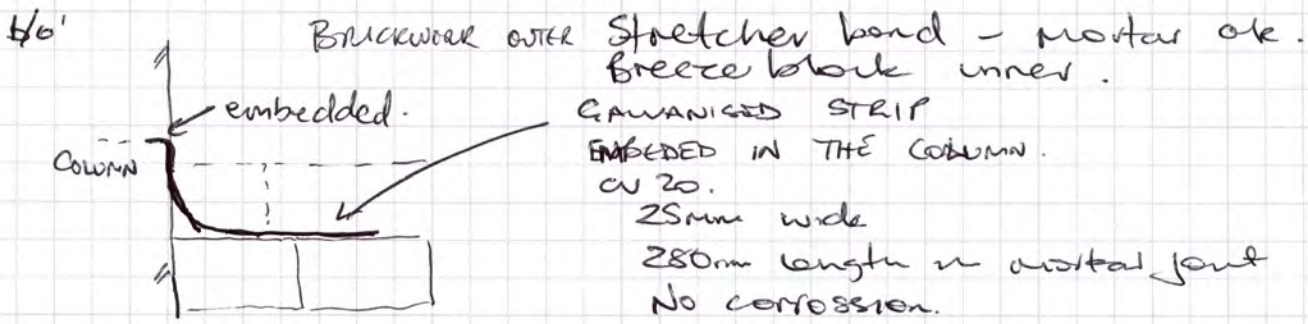
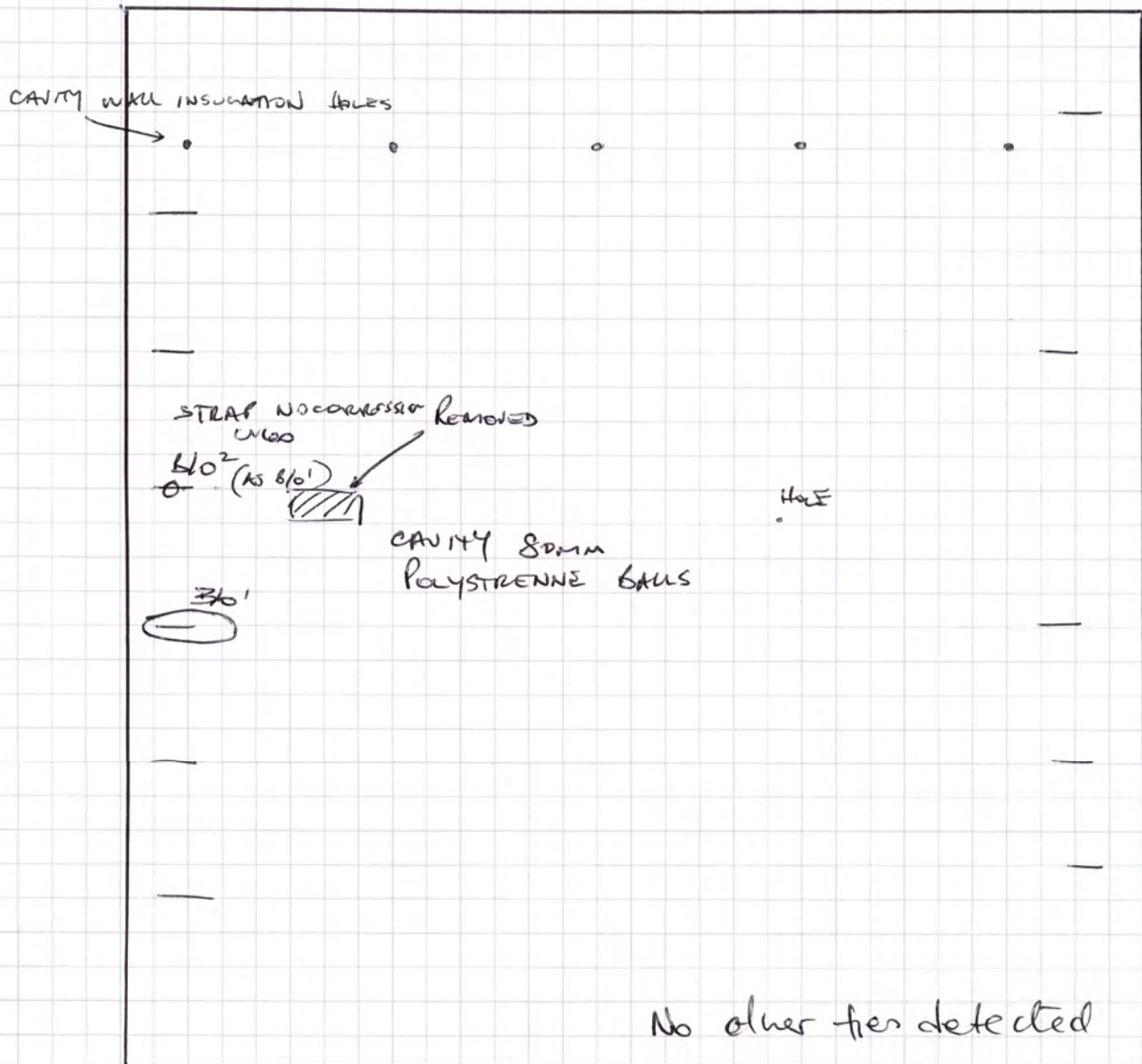
Date

Report No 14093

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Sheet No

Bulk 3 GARD floor



Project Lister & Treves Hse

Location Bulk 3

Lister H.

Date

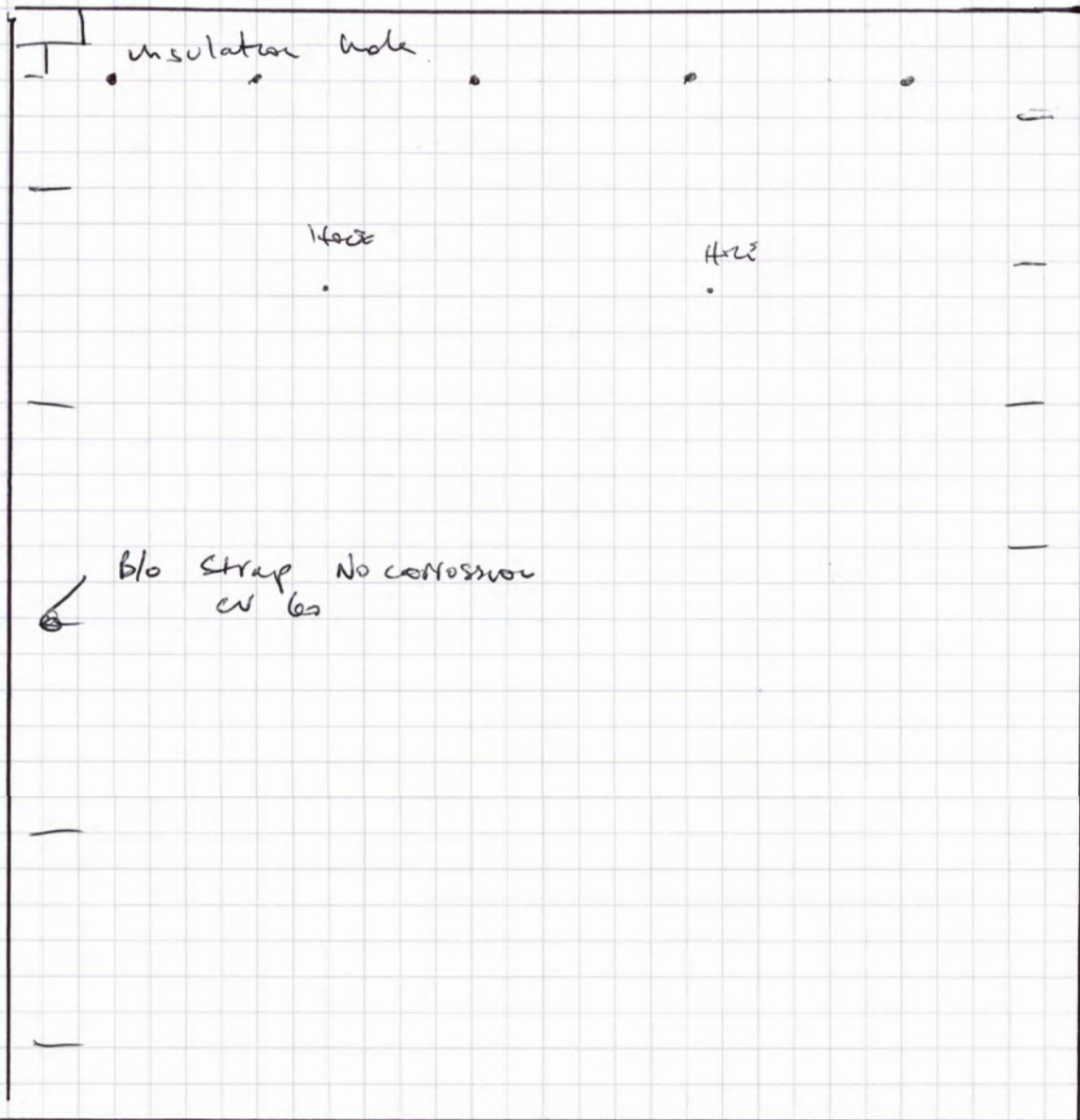
52

Report No

14093

Sheet No

buve 4 8m floor



BRICKWORK OUTER STRUCTURE BOND
POLYSTYRENE BALL CAVITY INSULATION
MORTAR OR
80mm CAVITY.

No other ties detected

Project Lister & Treves Ages

Location Buive 4

Lister H.

Date

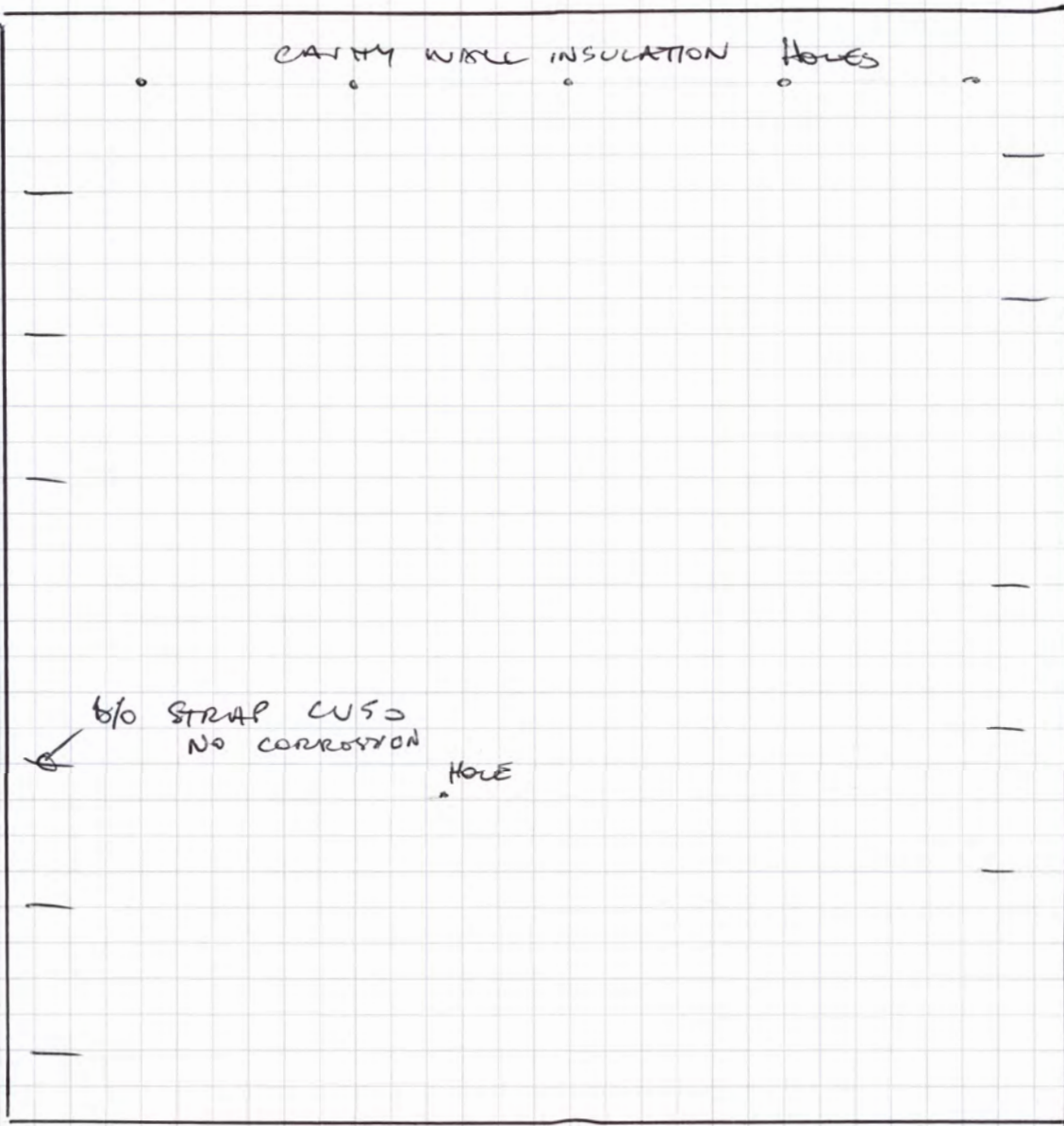
Report No

14093

53

Sheet No

BNK 5 4th Floor



BRICKWORK OUTER STRUCTURE BAND
 MORTAR DR.
 CAVITY WALL INSULATION POLYSTYRENE BEADS
 CAVITY 40mm
 No other ties detected

Project Liston 4 Frees Hse

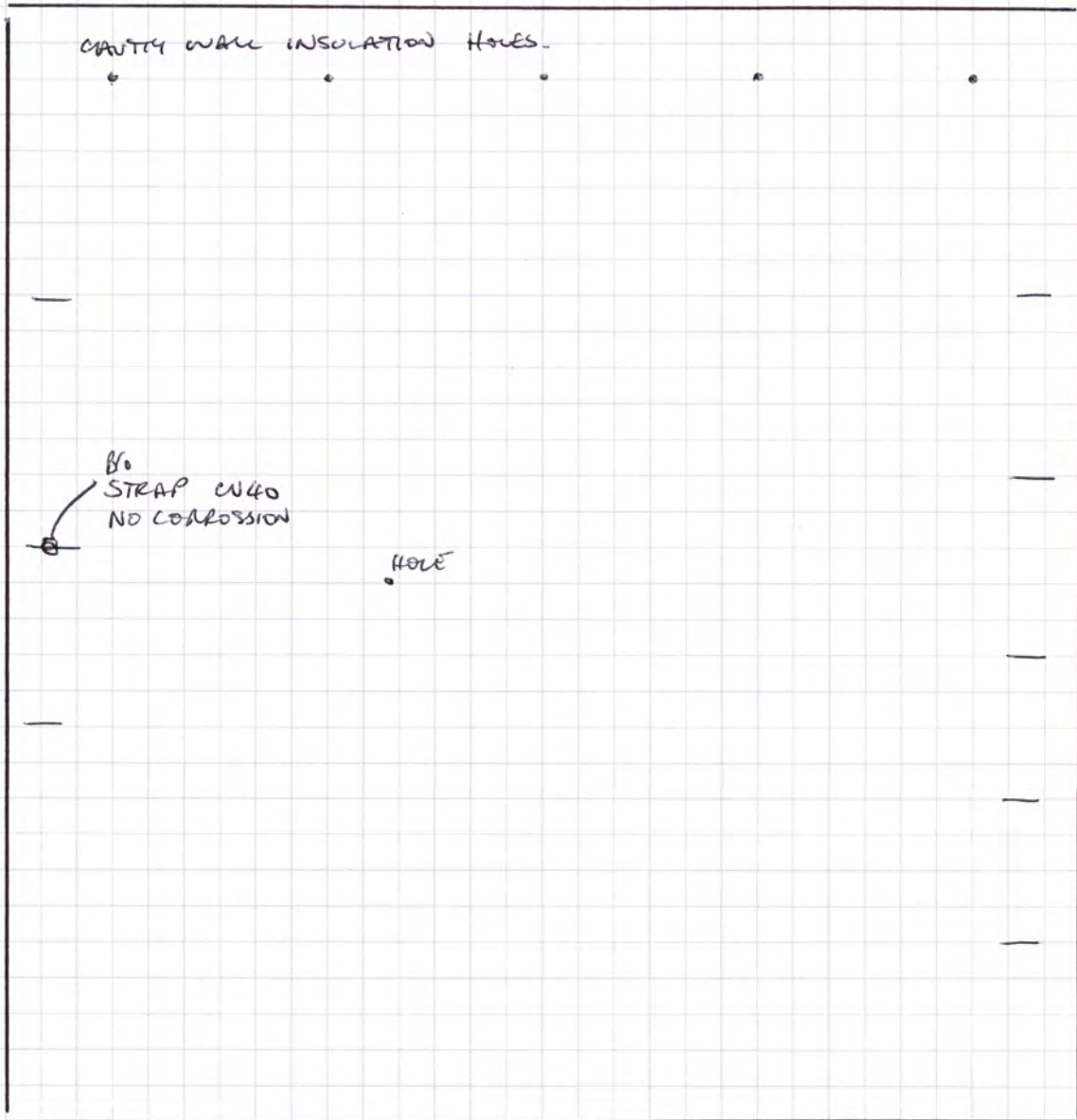
Location BNK 5
Liston H.

Date _____ 54

Report No 14093

Sheet No _____

~~F26~~ BULK 6 GND FLOOR



BRICKWORK ON STEEL STRUTTING BOND
MORTAR OR
CAVITY WALL INSULATION POLYSTYRENE BEADS
CAVITY WIDTH 80mm

No other ties detected.

Project Lister & Treng Ares

Location Bulk 6

Lister H

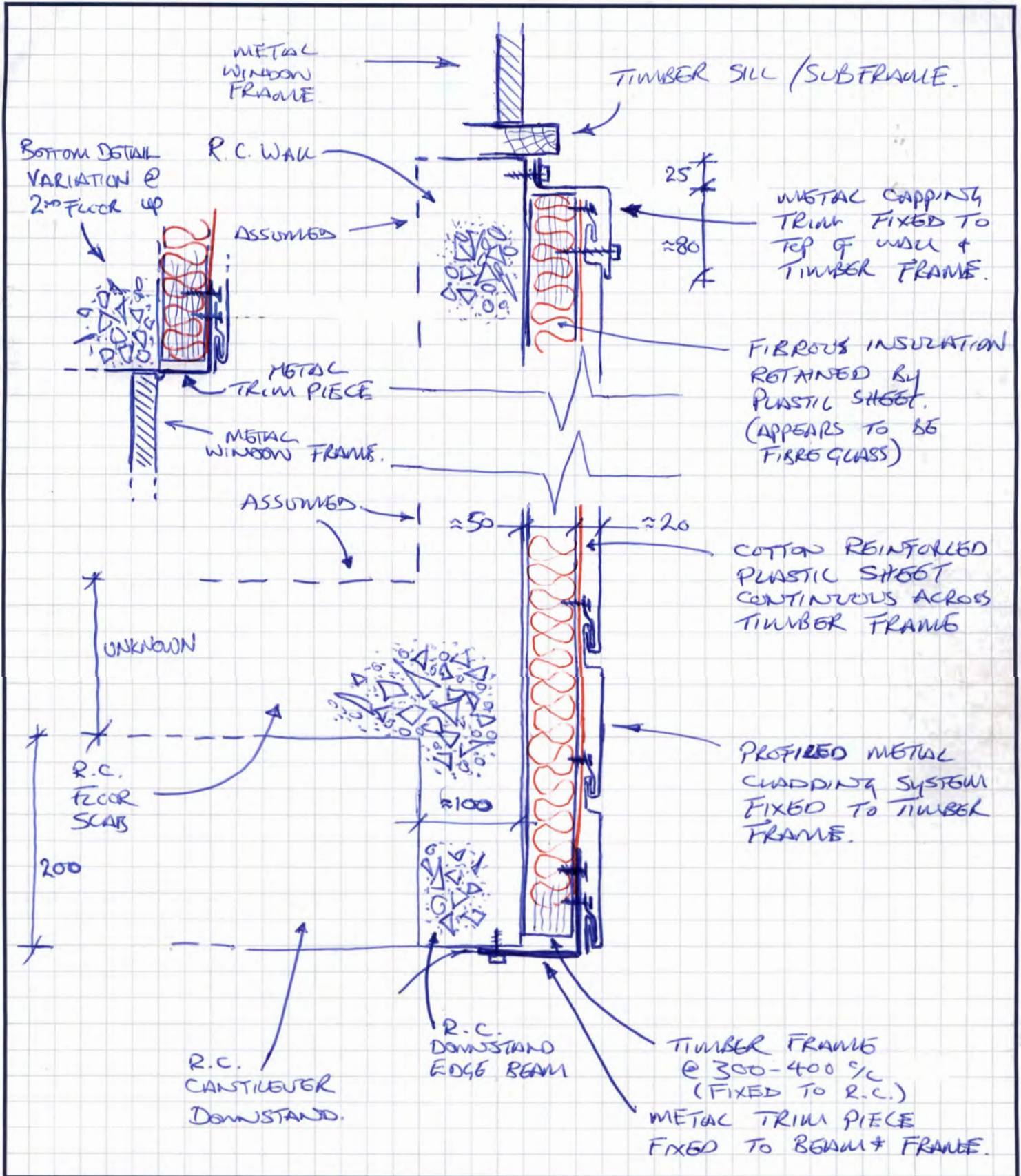
Date

Report No

14093

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Sheet No



Project

Lister + Treves Houses

Location

TYPICAL SECTION OF
CLADDING (FLOOR)
LISTER HOUSE

Date

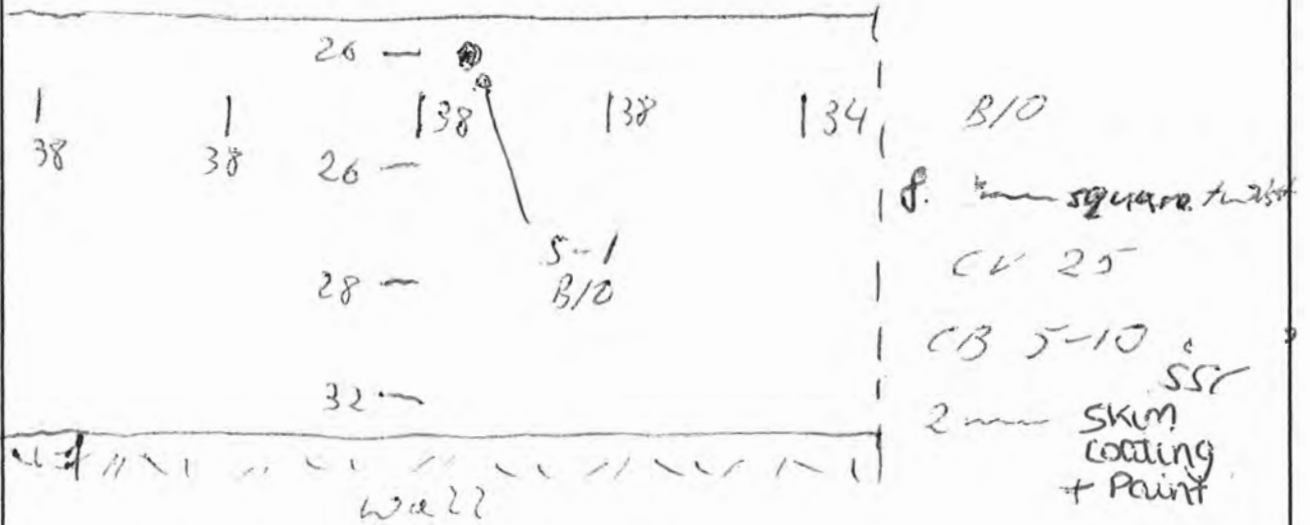
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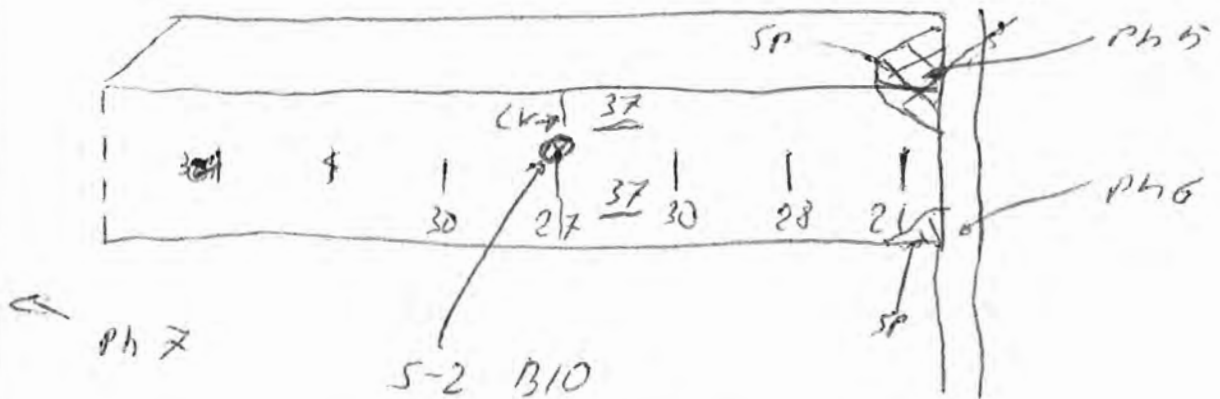
Sheet No

MARTECH

TA 1 Fire escape balcony slab 6th floor



TA 2 3rd slab edge



4-5mm Skim + paint

B10 2x 6mm plain bar CV 24 CB C5

C+P

Project: _____

Listier + Trezza

Manager

Date: _____

Location: _____

TA Location: _____

LISTIER H.

Report No:

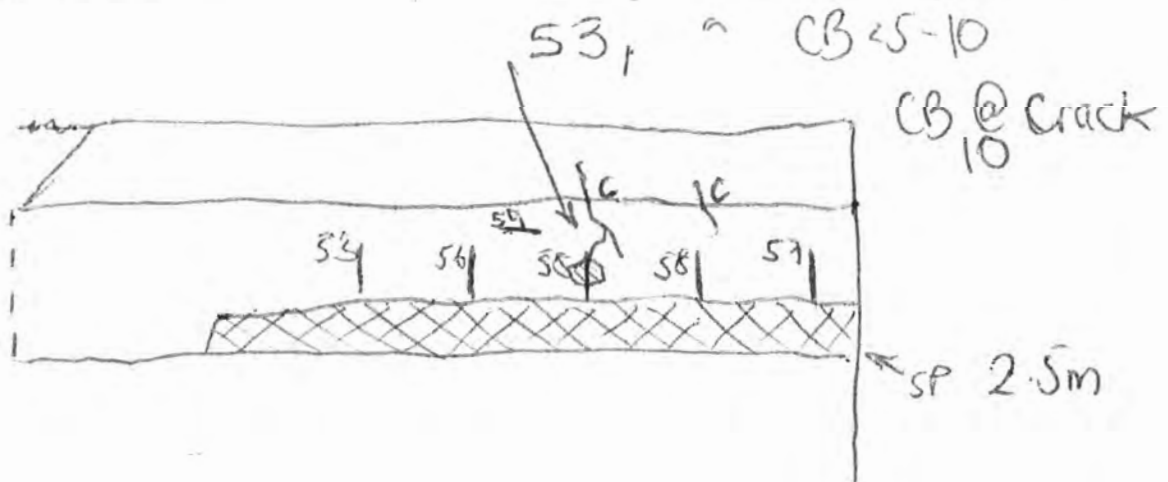
14093

Sheet No:

1st floor slab edge

TA3

Skim + Paint
3-4mm



Project: _____

Lister - Towers

Towers

Date: _____

Location: _____

TA Location

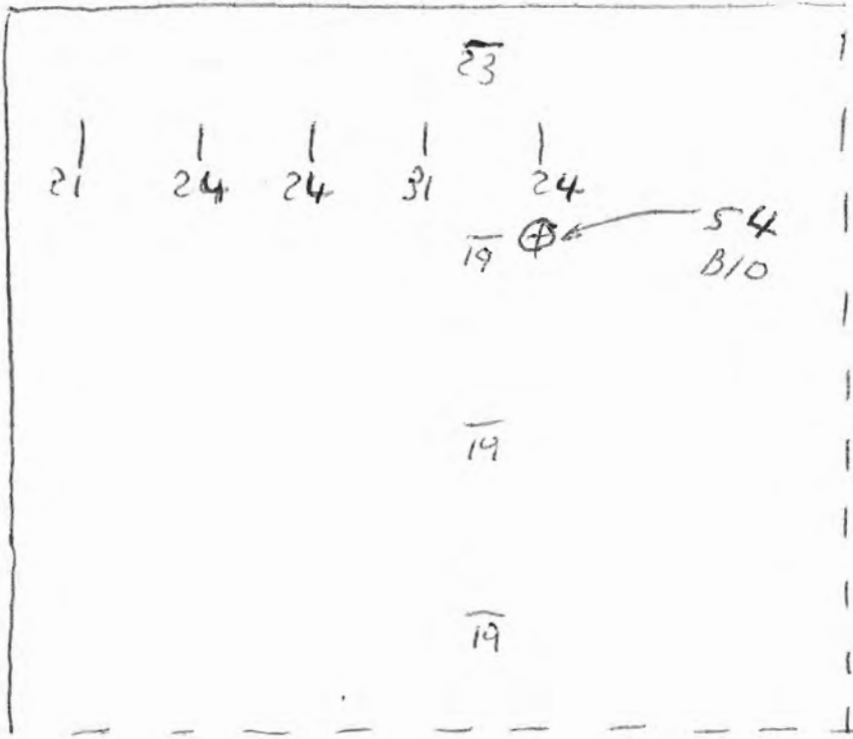
LISTER 58 H

Report No:
14093

Sheet No:

MARTECH

TA 4 7th Floor Stair Way Wall



B/10 ← 6m plain bar CV 16
↓ 10m plain bar CV 21
CB 5-10 C + P

Project: _____

Lister & Treves

MONSIEUR

Date: _____

Location: _____

7th Floor Stairway

LISTIER H

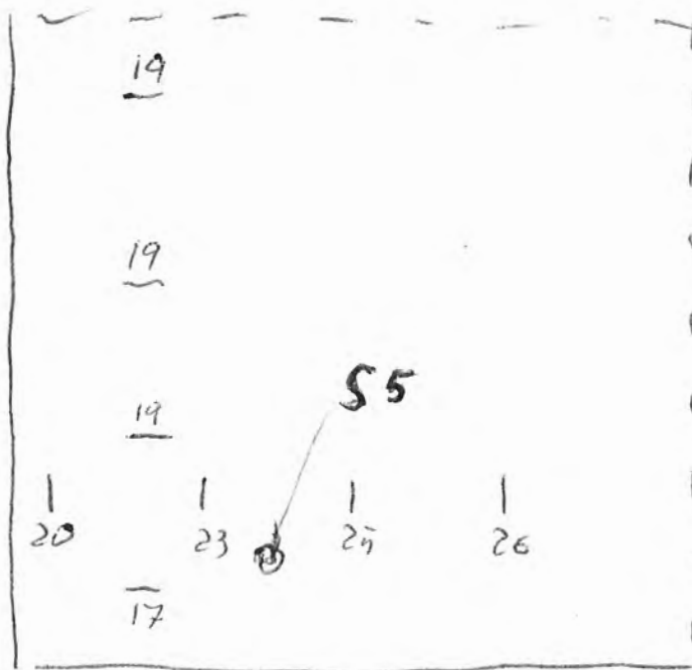
Report No: _____

14093

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MARTECH

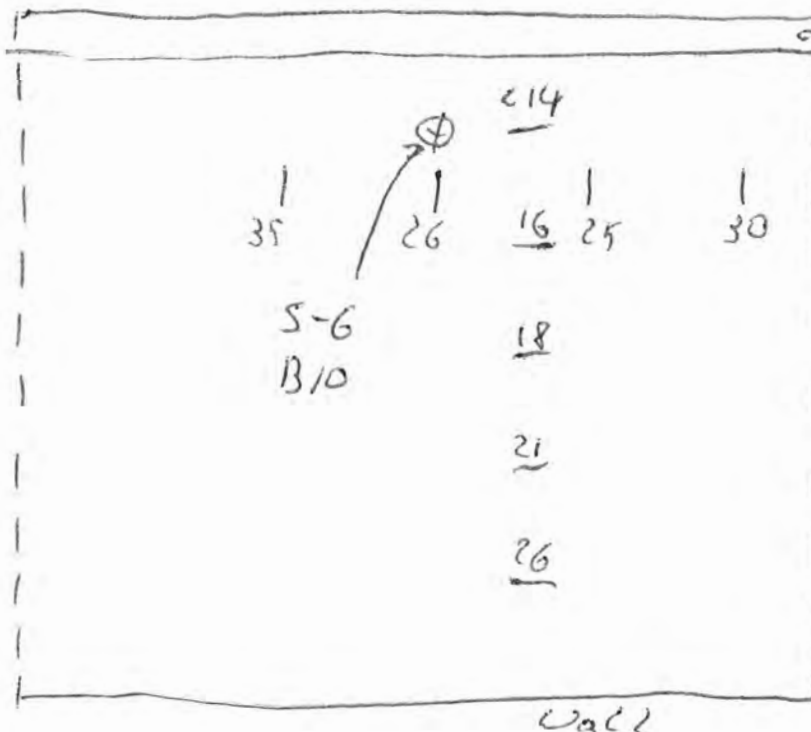
TA 5 5th Floor Stair Way Wall



S-5

CB < 5

TA 6 First Floor Soffit



S-6

B/D

8 in square twist
w/ 4
CV 12 SSC

1 in plain bar
C/P
CV 21

CB 5-10

Project: _____
Lister + Treves
_____ Houses
Date: _____

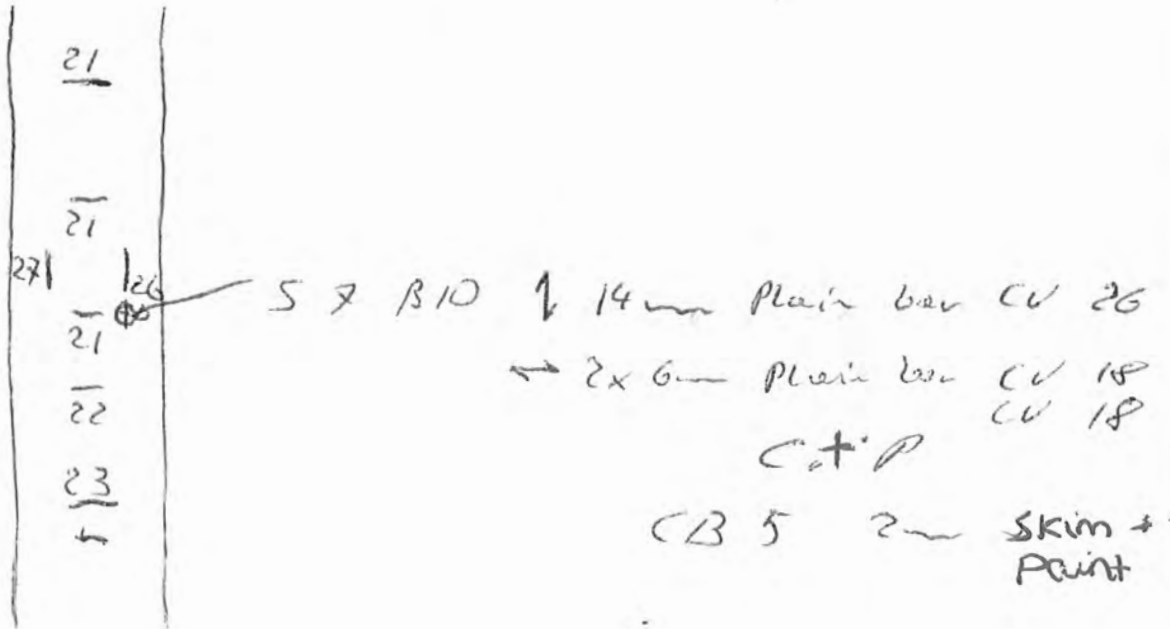
Location: _____
TA Location
_____ LISTER 60 H.

Report No: _____
14093

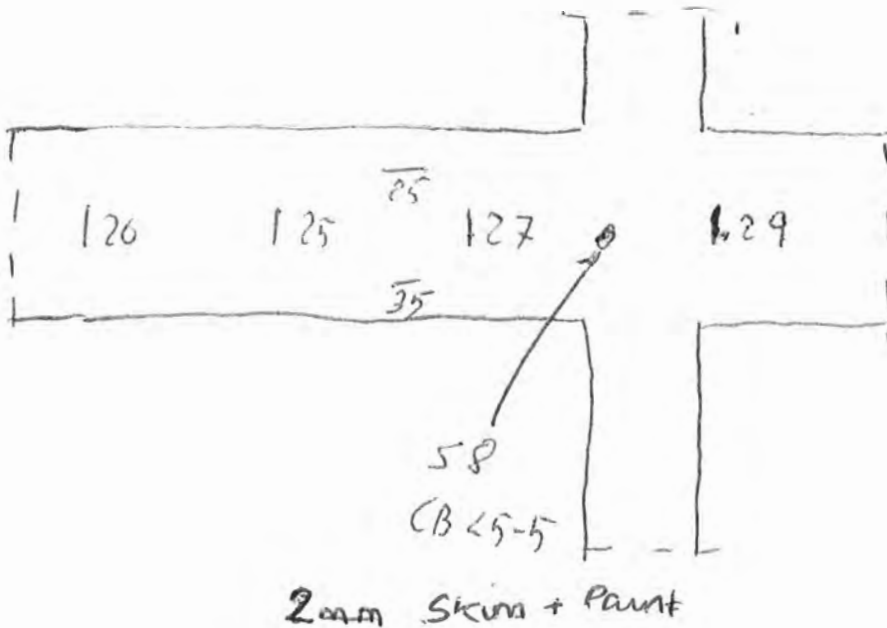
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MARTECH

TA 7 8th Floor Column



TA 8 8th Floor Slab Edge



Project: _____

Liston + Treves

17/01/2005

Date: _____

Location: _____

TA Location

LISTER H. 61

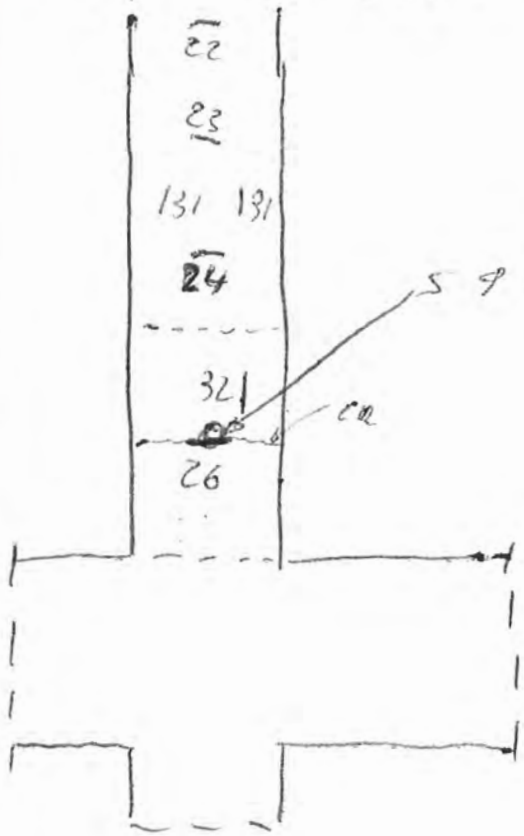
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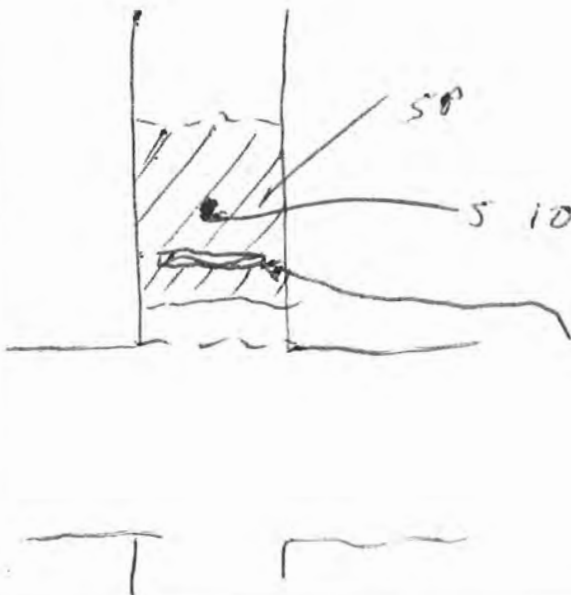
MARTECH

TA 9 8th Floor Column



5 9 B10 → 12mm Steel plank
 CV 28
 SC
 CB > 40

TA 10 3rd Floor Column



5 10 CB < 50 Patchy
 12mm 525
 Orig. CV 24mm

Project: _____
 Lister Treves
 Mouses
 Date: _____

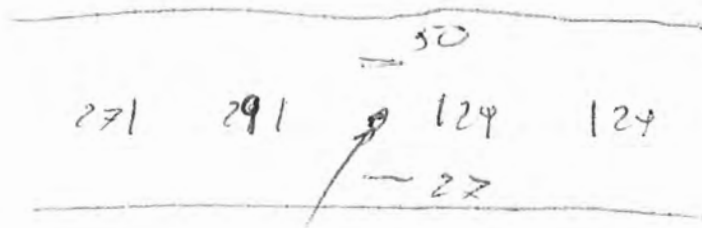
Location: _____
 T-4 Location
 Lister 62 M.

Report No: _____
 14093

Sheet No: _____

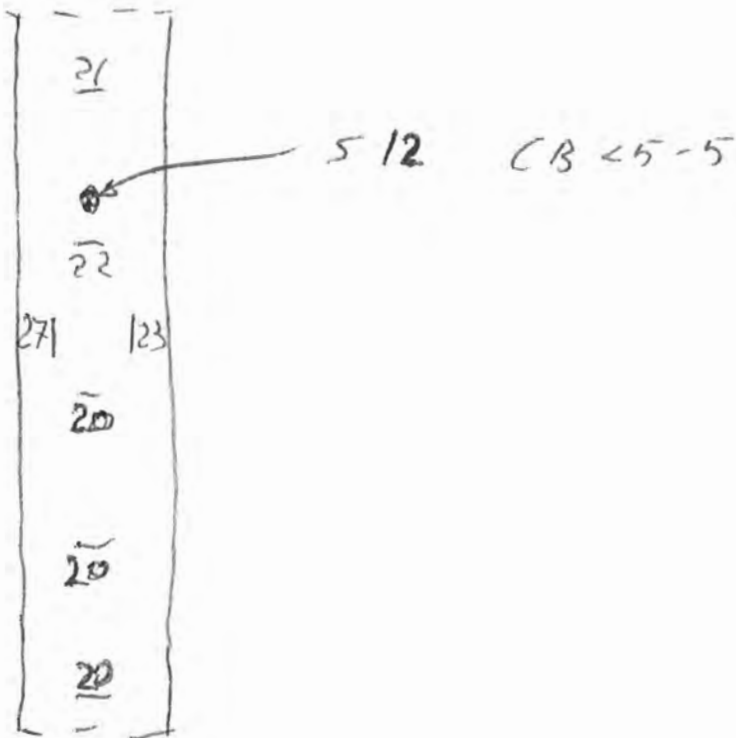
MARTECH

TA 11 1st Fl Slab Edge



S 11 CB $5-5$
elastic paint

TA 12 8th Floor Column



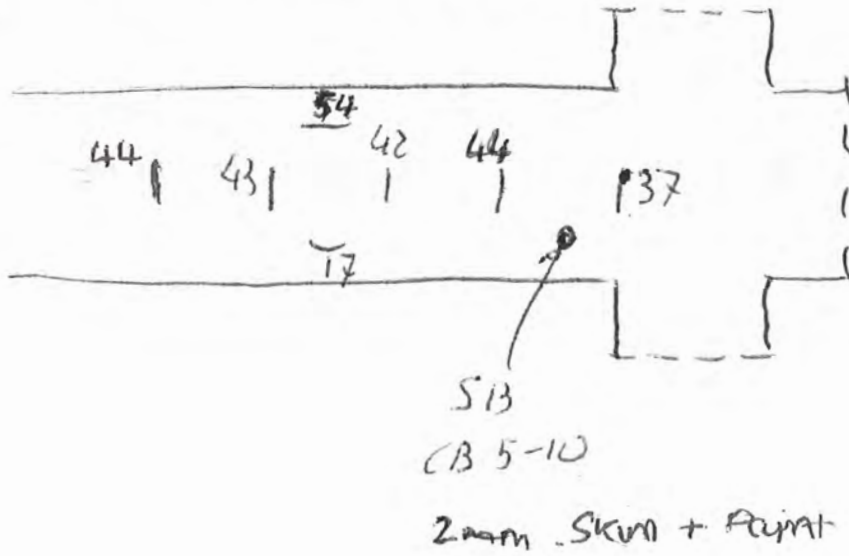
Project: _____
Lister + Trevas
Mouses
Date: _____

Location: _____
TA Location
Lister M.

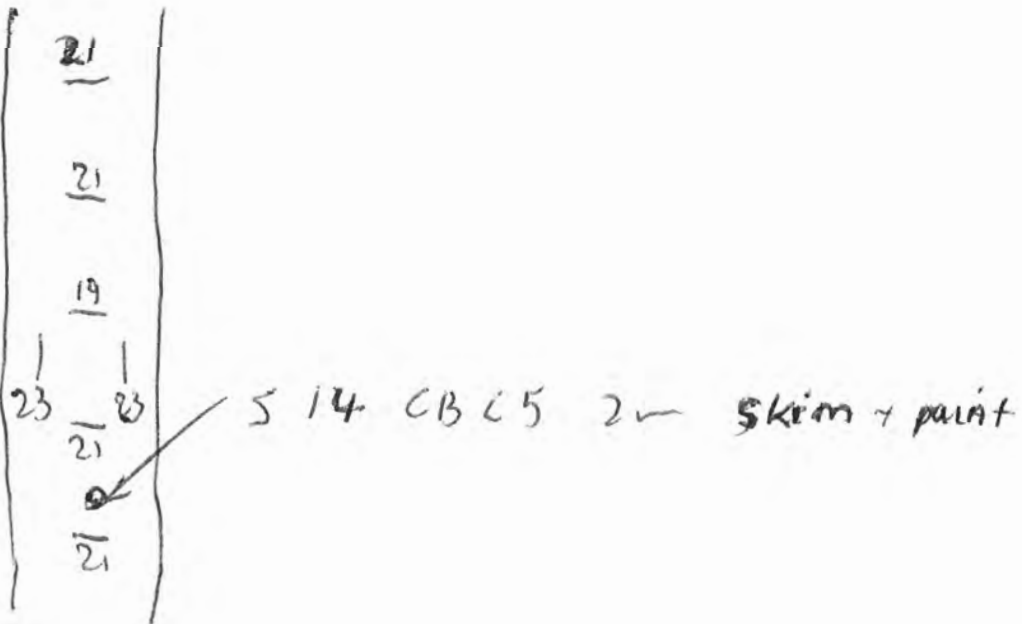
Report No:
14093
Sheet No:

MARTECH

TA 13 7th Floor Slab Edge



TA 14 9th Floor Column



Project: _____
 Lister + Treves

 170503
 Date: _____

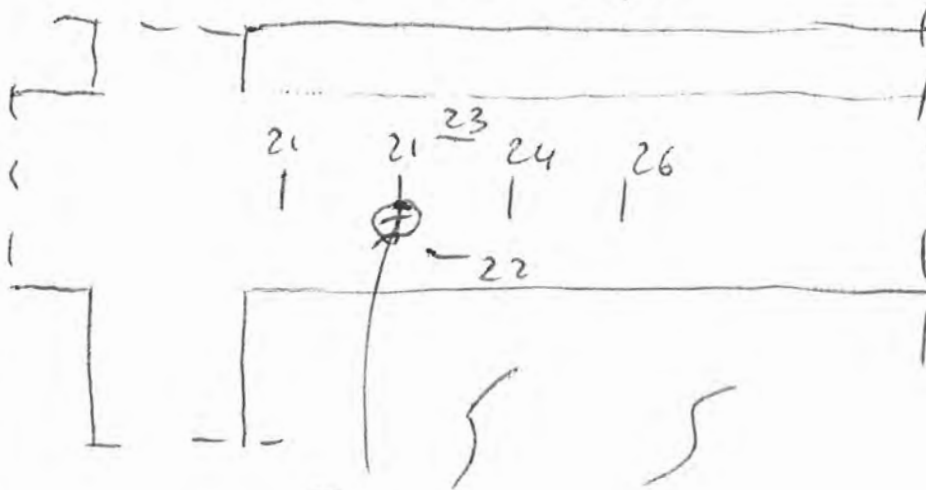
Location: _____
 TA Location

 Lister 64/11

Report No: _____
 19093
 Sheet No: _____

MARTECH

TA15 3rd Floor Slab Edge



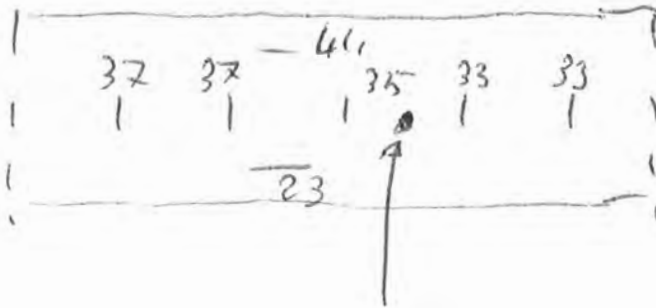
S15 BID

16m plain bar @ 20 C+P

CB 5-10

2mm Skim + Paint

TA16 1st Floor Slab Edge



S16

CB 5-10

2mm Skim + Paint

Project: _____

Lister + Treves

Houses

Date: _____

Location: _____

TA Location

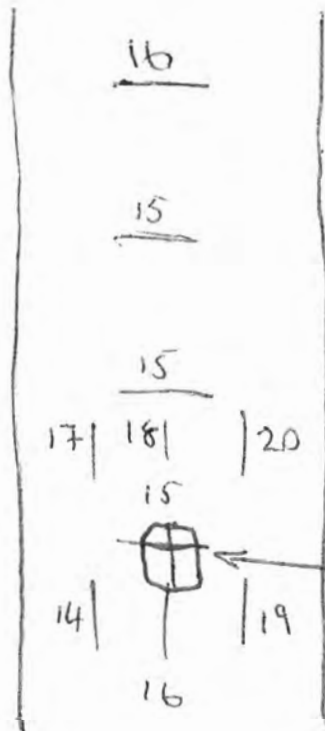
Lister H

Report No:

14093

Sheet No:

A18 Ground Floor Column



S18/B.0
CB < 5

1x Main plain Bar 22 mm ϕ
 CV TO main 20 mm
 C+P
 2x 6mm ϕ Plain Links
 CV 14
 C+P

i

<p>Project: _____ Lister + Trevel House _____ Date: _____</p>	<p>Location: _____ LISTER HOUSE TA Location _____</p>	<p>Report No: _____ 14093 _____ Sheet No: _____ _____</p>
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