

D001A LOADING ASSESSMENT KINGSTON BRIDGE HOUSE, HAMPTON WICK RICHMOND, LONDON KT1 4AG



Date: 21st AUGUST 2023 Ref: JS/TS/21173.D001A

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LOADING ASSESSMENT KINGSTON BRIDGE HOUSE, HAMPTON WICK LONDON, KT1 4AG

ISSUE	PREPARED BY	CHECKED BY	DATE	NOTES
21173.D001	JS	TS	27.01.2023	
21173.D001A	RM	TS	22.08.2023	Assessment of balconies

1.0 INTRODUCTION

- 1.1 Shear Design Limited have been commissioned by Westcombe Group to prepare a loading assessment report for the proposed development at Kingston Bridge House, Church Road, Hampton Wick, KT1 4AG. This report has been prepared in support of the redevelopment of the site and has been commissioned to advise on the feasibility of providing a green/blue roof construction with photovoltaic panels on the roof of each block, 7-storey and 4-storey with respect to the loading on the structure.
- 1.2 In addition to the proposal outlined in section 1.1, Shear Design Limited have been commissioned by Westcombe Group to evaluate the structural feasibility of incorporating the proposed balconies while considering their potential impact on both the overall load distribution and the structural integrity of the existing structure. Section 2.14 outlines the typical construction details proposed for the balconies which we have adopted for our assessment. Sections 3.0 and 5.0 elaborate on the effects of the increased loading attributed to the balconies and provides well-considered conclusion and recommendations.
- 1.3 Shear Design Limited have carried out a high-level review of the proposed planning drawings and recommendations within the Flood Risk Assessment (FRA) completed by Lanmor Consulting (Ref: 201345/DS/JR/KBL/02 REVA) with regards to the proposed requirements for attenuation of the drainage on site and its effect on the loading of the existing structure.
- 1.4 To enable us to prepare this report, a visual walk around of the existing buildings were carried out on the 03rd February 2022 to determine the existing construction of the building where possible.

Photographs were taken during this inspection and are referenced within this report. Please refer to <u>Appendix i</u>.

- 1.5 The initial inspection of the existing buildings was purely a visual inspection, no finishes were removed, and no intrusive investigations were carried out during this inspection. No concrete testing has been undertaken as part of this report.
- 1.6 Further soft strip works were undertaken by the Contractor with all survey/measurement information on the existing structure being issued to Shear Design for use within their loading assessment. The site exposure works determined the wall construction thicknesses, column sizing/spacing, the floor slab thickness and the width/depths of existing reinforced concrete beams.
- 1.7 Guidance from the following publications have been utilised in the preparation of this report:-

"Appraisal of Existing Structures – by Institution of Structural Engineers"

1.8 We have not inspected all areas of the building or other parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part is free from defect. We cannot be held responsible for unforeseen conditions which may exist that are covered. Conditions may exist beneath the structure that are not detectable from our visual inspection.

LOADING ASSESSMENT KINGSTON BRIDGE HOUSE, HAMPTON WICK LONDON, KT1 4AG

- 1.9 The conclusions and recommendations in this report are based on reasonable influences from observations of limited areas of the building. It should be appreciated that general conclusions cannot be drawn with certainty from the limited observations and there is a possibility that our conclusions may need to be modified as a result of further works that will occur once the building is being refurbished and stripped out in the future.
- 1.10 This report is personal to Westcombe Group, is confidential and non-assignable unless noted otherwise in the Appointment Documents. Shear Design accepts no liability for losses suffered by any third parties as a result of reliance on this report.

2.0 EXISTING BUILDING AND PROPOSALS

- 2.1 Kingston Bridge House comprises of two blocks forming an L-shape currently made up of student living facilities which spans over the four-storey and seven-storey elements of the building. The property was originally constructed in the mid-1960's as office accommodation with the building being redeveloped in the mid-1990's to provide student accommodation. The building was again reconfigured at ground level in 2015 to provide an additional common room and bike storage.
- 2.2 The two blocks which currently provide student accommodation share almost identical and easily divisible floor plates with a central core connecting the blocks. See <u>Photograph 1</u> showing the link between the existing four and seven storey structures.
- 2.3 The proposed development will consist of the conversion of the existing student living accommodation to residential apartments, a total of 70 units will be provided.
- 2.4 The existing frame consists of reinforced concrete columns spaced at approximately 1.5m centres externally, with a central line of columns at 6.0m centres internally (See <u>Photograph 2</u>).
- 2.5 The superstructure floor slabs consist of a 150mm thick reinforced concrete slab spanning between down stand beams (230mm depth) at 1.0m centres (<u>Photograph 3</u>). There is a central spine beam 1.9m wide x 230mm deep running the length of each wing which supports the perpendicular beams. For design considerations, the width of the edge beam is assumed to be half that of the central spine beam, which is 900mm wide with a depth of 230mm spanning between columns at 1.5m centres.
- 2.6 The ground floor slab construction is unknown. For the purpose of the loading assessment, we have assumed the ground floor slab is ground bearing.
- 2.7 The existing external wall construction consists of reinforced concrete walls min 200mm thick up to window sill level for ground and first floor levels, then consist of brick/block 225mm thick construction up to sill level for the upper floors. See <u>Photograph 4</u> indicating the blockwork construction up to sill level on the upper floors of the structure. We understand the external skin of the masonry/RC was reclad in lightweight rendered board. We have utilised the proposals for the perimeter of the structures to incorporate a brickwork slip panel with SFS infills internally as part of the loading assessment.
- 2.8 There is a transfer slab level at 1st floor on the four-storey block of the development. This is made apparent by the change in column arrangement to form the parking under croft of the four-storey block. See <u>Photographs 5</u> which shows the circular column arrangement from ground to first floor.
- 2.9 The existing roof coverings for both wings consist of asphalt finish under single ply and insulation over the standard reinforced concrete slab construction as noted above. See <u>Photograph 6</u> of the four-storey roof.

- 2.10 The drainage requirements noted within the Lanmor Consulting drainage strategy report advises the use of a green/blue roof for attenuation purposes as part of the redevelopment of the scheme. Shear Design have completed a scheme rainwater drainage layout at roof level and have completed preliminary attenuation calculations to estimate the proposed green/blue roof system requirement. As a result of the design calculations, an estimated 100mm of attenuation within the construction build-up has been accounted for within the loading assessment. The final thickness of attenuation required will be confirmed at detailed design stage. See <u>Appendix ii</u> for 21173.D100 Proposed Rainwater Drainage at Roof Level.
- 2.11 A Bauder green/blue roof solution has been utilised to assess the existing structures from an additional loading perspective. See <u>Appendix iii</u> for the system summary of the Bauder green/blue roof solution.
- 2.12 The introduction of photovoltaic cells (PV) on the roofs have been incorporated into the loading assessment. To negate the requirement of a ballasted PV system, we have utilised a BauderSOLAR system which is a mounting solution for framed PV panels onto the Bauder green/blue roof build-up. The system utilises the self-weight of the green/blue roof build-ups as ballast which helps to reduce proposed weights of the overall system. See <u>Appendix iii</u> for the system summary of the BauderSOLAR system.
- 2.13 Shear Design has adopted a Bauder roofing solution as an example. Within the detailed design, the client may choose a different supplier of the green/blue roof and PV solution. This may affect the associated loadings on the existing roofs and will need further verification against the loading assessment.
- 2.14 The proposed balcony additions are found at all upper floor levels of both the 7-storey and 4storey blocks. Shear Design have received conceptual balcony designs from Fluent-ADS Limited. The design proposal comprises lightweight cantilevered balconies, intended to be anchored to the existing concrete perimeter beam through the use of cold-formed sections bolted to the perimeter beam with tie rods connecting the balcony back to the existing structure. Additionally, there are inset balconies where the perimeter walls are inset into the building with the existing columns remaining to the perimeter slab edge. The window openings will be positioned to suit the column perimeter centres. Accordingly, at the inset balcony locations there is no additional loading transferred to the structure as the floor area remains unchanged. See <u>Appendix vi</u> for the proposed proprietary cantilever balcony drawings.

3.0 LOADING ASSESSMENT

- 3.1 In order to assess the structural feasibility of adding a green/blue roof build-up and photovoltaic panels on the existing roof and adding balconies to the upper floors of both blocks, it must be demonstrated that the additional loadings associated with the proposals do not compromise the capacity of the existing structure and its foundations. At detailed design stage, a structural solution can be developed to accommodate additional loads on the existing structure where required.
- 3.2 The assessment was based on findings from the visual site inspection and further soft strip works completed by the Contractor. The floor depths have been measured and used within the calculations, and confirmed from the site exposure works. The findings from the exposure works have confirmed the assumptions made within the structural loading appraisal.
- 3.3 Within <u>Appendix iv</u>, a high-level loading assessment has been produced that compares the existing loadings against the proposed loadings. The investigative works and measurements provided by the Contractor have confirmed the assumptions within the calculations on the existing structural arrangement of each wing.
- 3.4 The loading assessment considers the critical load configuration of each element through the structure. The calculations completed utilise the thicknesses and construction type of the existing floor slabs for the loading assessment to provide what we consider to be an appropriate increase in loadings to the building's foundations of less than or equal to 10%.
- 3.5 The principles of the loading assessment incorporate the following updates of the applied loading to the building as part of the roof construction change. The below is subject to detailed design following receipt of subcontractor proposals with exact weights of the new roofing build-ups and photovoltaic systems finalised. In accordance with the codal floor loading requirements at the time of construction (British Standard CP3 PartV-1952), the office imposed floor loading would have been based 2.5kN/m². The proposal for conversion to residential accommodation reduces this imposed load to 2.0kN/m². Providing a saving of 0.5kN/m² (50kg/m²) on each habitable floor plate. See the table below for the existing and proposed loadings of each floor and the roofs which change as part of the redevelopment:

Development Change	Existing Loading	Proposed Loading	Percentage Increase
Imposed Load from change of use from Office Loading to Residential Loading at each floor	2.50kN/m² + 1.0kN/m² Total 3.50kN/m²	2.0kN/m² + 1.0kN/m² Total 3.0kN/m²	-14% Decrease per floor
Roof Finishes	1.13kN/m ²	3.68kN/m ²	+226% Increase at roof level

3.6 The proposed balconies result in an additional dead load of 0.85 kN/m² at every floor level of the existing structure. When assessing the foundation load, we consider that the load imposed by the balconies is 1.5kN/m². This is because its impractical to assume that the balconies will be loaded concurrently with the residential floors. However, when assessing the localised impact of the proposed balconies on the existing structure, an imposed load of 2.5kN/m² has been adopted for design purposes.

- 3.7 We have analysed the 150mm thick roof slab spanning between the downstand beams at 1.0m centres. The existing roof slab has been checked using minimum area reinforcement and is acceptable for the loading increase as a result of the roof finish change.
- 3.8 We have analysed the roof slab downstand beams at 1.0m centres incorporating the updated roof finish loads and can confirm they are over utilised. The beams will need strengthening with hot rolled steelwork or will need the loaded areas reduced by 50%. This can be achieved by introducing additional steelwork between the 1.0m centres of the beams.
- 3.9 The internal columns have been analysed based on the proposed loading. The percentage load increase at roof level into the columns is an increase of 35%. Utilising a minimum area of reinforcement to meet the current codal requirements the column design is acceptable. As such the increase in loading as a result of the increase in roof finish weight is acceptable.
- 3.10 Previously the edge columns have been analysed based on the proposed green roof loading. The percentage load increase at roof level into the columns was found to be 35%. Additionally, the proposed balcony at this level introduces an extra 9% increase in loading to both blocks, resulting in a cumulative 44% increase. By utilising the minimum area of reinforcement to meet the current codal requirements, the column design is deemed acceptable. As such the increase in loading as a result of the increase in roof finish weight and balconies is regarded as acceptable for feasibility assessment.
- 3.11 At separating floors, the edge columns have been analysed based on the proposed balcony loading. The percentage increase is 12% per floor. By utilising the minimum area of reinforcement to meet the current codal requirements, the column design is deemed acceptable. As such the increase in loading as a result of the inclusion of balconies is regarded as acceptable for feasibility assessment.
- 3.12 The internal spine beam has been analysed at roof level to confirm the increase in roof loading is acceptable. The spine beam design works based on a minimum reinforcement of 11 No. H16 bars in the bottom of the beam. The existing reinforcement within the beams will need to be investigated/verified on site.
- 3.13 The reinforced concrete edge beam will serve as a direct support for the balcony structure, provided that the steel reinforcement is exposed to allow for the assessment of its capacity against the additional balcony loading at the detailed design stage. Alternatively, a steel channel member could be utilised to evenly distribute the balcony load onto the edge beam. This can be achieved by anchoring the channel to the edge beam at regular intervals.
- 3.14 The 4-storey building has been previously analysed to confirm that the additional loading at foundation level due to the proposed green roof is less than 10%. The calculations confirm a foundation level increase of 3.5% for internal foundations and 1.8% for edge foundations. Additionally, the proposed balconies result in an additional load increase of 8.2% for edge foundations, resulting in a cumulative total increase of 10% increase. In our considered opinion, this increase is viewed as acceptable.

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3.15 The 7-storey building has been analysed to confirm that the increase in loading at foundation level is less than 10%. The previous calculations, which were based on the added loading from the green roof, confirmed that there is no increase at the foundation level due to the reduction in imposed loading through change of use from office to residential loadings. This saving of 0.5kN/m² at each floor level counteracts the increase in loading introduced. The proposed balconies add an additional loading increase of 8% to the edge foundations. Given that this increase remains below 10%, we consider it acceptable in our opinion.

4.0 FURTHER INVESTIGATIONS/RECOMMENDATIONS

- 4.1 An allowance must be incorporated into the proposals for strengthening the existing downstand beams of each roof slab to ensure structural integrity remains when supporting the increased loading from the new roof finishes. The exact strengthening requirements will be provided during the detailed design of the proposals; however, an additional line of steel beams can be expected to help reduce the loaded areas on the existing reinforced concrete downstand beams.
- 4.2 Intrusive investigations must be completed on site to confirm the existing reinforcement size/spacing and cover within the internal spine and external perimeter beams at roof level. It would be prudent to allow for strengthening works at costing stage if minimum reinforcement is not found during the validation exposure works. A markup of required exposure works can be provided during the detailed design of the scheme.
- 4.3 Intrusive investigations must be completed on site to confirm the existing reinforcement size/spacing and cover within the existing columns below roof level, ground floor columns to podium and a small number of targeted columns throughout the height of the building. Providing minimum area of reinforcement is present, the column integrity remains. A markup of required exposure works can be provided during the detailed design of the scheme.
- 4.4 Intrusive investigations must be completed on site to confirm the existing reinforcement size/spacing and cover within the existing perimeter beams at separating floor levels and the podium transfer beams within the 4-storey block at first floor level. An evaluation of the perimeter beams and the transfer beam is required to ascertain whether strengthening enhancements are needed to accommodate the additional forces introduced by the balcony connections.

5.0 CONCLUSION

5.1 Shear Design have visited and carried out a walk around visual inspection of Kingston Bridge House, Hampton Wick, London and compiled a loading assessment so to investigate the feasibility of adding a green/blue roof and photovoltaic panels on the existing building with respect to an increase in loading.

As a result of the above the conclusions are as follows:

- The attenuation requirement for the green/blue roof has preliminarily been calculated as 100mm thickness of attenuation across the roofs. This is subject to detailed design in coordination with the specialist supplier of the roofing system.
- The proposed roofing system has been based on a Bauder roofing solution as an example. Within the detailed design, the client may choose a different supplier of the green/blue roof and PV solution. This may affect the associated loadings on the existing roofs and will need further verification against the loading assessment.
- The existing roof construction for each wing of the building requires strengthening to ensure structural integrity remains. Exact strengthening to be confirming within the detailed design.
- The existing roof spine and edge beams require further intrusive investigations to confirm validity of the additional loads ensuring structural integrity remains.
- The existing perimeter and transfer beams require further intrusive investigation to confirm their adequacy to support the loading from the balconies. Localised strengthening works may be required which will be determined in detailed design stage but can be provided by use of bolted steelwork plates or similar.
- The existing columns have been analysed with respect to additional loadings from the proposed green roof and balconies and we can advise that based on utilising minimum area of reinforcement within the columns they have capacity to support the additional loads from the redevelopment. The columns, as identified in section 4.0 will require intrusive investigations. Subject to these, localised strengthening work may be required but can be accommodated adopting bolted steelwork places or similar.
- The existing foundations have been analysed to determine the loading increase percentage as a result of the redevelopment comprising additional green roof and balconies. The foundations of the 4-storey and 7-storey wings do not increase greater than 10% and as such are within acceptable limits for the capacity of the existing foundations.
- 5.2 Based on the loading assessment calculations and subject to the recommendations/conclusions within this report, it is our considered opinion that the existing building is capable of supporting the additional loadings associated with the roof finishes and inclusion of balconies of the proposed redevelopment.

21st AUGUST 2023

LOADING ASSESSMENT KINGSTON BRIDGE HOUSE, HAMPTON WICK LONDON, KT1 4AG

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ON BEHALF OF SHEAR DESIGN LTD TONY SPENCER CEng MICE DIRECTOR

21st AUGUST 2023

APPENDIX

i) PHOTOGRAPHS

21st AUGUST 2023

LOADING ASSESSMENT KINGSTON BRIDGE HOUSE, HAMPTON WICK LONDON, KT1 4AG





PHOTOGRAPH 1

PHOTOGRAPH 2



PHOTOGRAPH 3



PHOTOGRAPH 4

21st AUGUST 2023

LOADING ASSESSMENT KINGSTON BRIDGE HOUSE, HAMPTON WICK LONDON, KT1 4AG





PHOTOGRAPH 5

PHOTOGRAPH 6

APPENDIX

ii) 21173.D100 PROPOSED RAINWATER DRAINAGE AT ROOF LEVEL



21173.D100

RESIDENTIAL DEVELOPMENT, KINGSTON BRIDGE HOUSE, HAMPTON COURT ROAD, CHURCH GOVE, LONDON

PROPOSED RAINWATER DRAINAGE AT ROOF LEVEL

CONTRACT NO:	21173.D100
DATE:	23.01.2023
BY:	TU

DOCUMENT INDEX SHEET

Contract: **KINGSTON BRIDGE HOUSE** Project No: 21173 CONTENT Page No 1.0 **ROOF DRAINAGE OVERVIEW** 3 APPENDED DRAINAGE CALCULATIONS Α. **RAINWATER CALCULATIONS** HAMPTON COURT ROAD BLOCK В. **RAINWATER CALCULATIONS CHURCH GROVE BLOCK** DRAINAGE LAYOUT AT ROOF LEVEL С.

Issue	Prepared by	Checked by	NOTES	Date
I	TU	TS	First Issue	23/01/2023

1.0 ROOF DRAINAGE OVERVIEW

These Calculations are based on Lanmor Consulting's drainage strategy report dated January 2023 with reference 201345/DS/JR/KBL/02 REV A.

All drainage parameters used by Shear Design within the MicroDrainage software match those used in the drainage strategy for the 1:100 year return period and 40% climate change. The only minor difference is the value adopted for ratio R derived from MicroDrainage mapping (0.405) rather than the figure used in the report (0.411).

The roofs work within a total discharge rate of 2.0 l/s utilising a 100mm depth cellular storage system. The calculations include an allowance for 20% siltation resulting in an effective long-term porosity of 77% compared with a newly installed porosity value of 95%. With reference to the drawing in Appendix C we have assumed the presence of parapets and a 1.0-metre-wide perimeter margin that reduces the area available for rainwater detention.

The Church Grove block has proportionally more functioning green/blue roof area allowing the discharge to be restricted to 0.6 l/s

The Hampton Court Road block has comparatively less functioning green/blue roof area requiring the flow to be restricted to no less than 1.4 l/s. The perimeter margin was reduced from a width of 1.0m to a width of 0.7m to sufficiently increase the proportion of functioning green/blue roof area.

Ref: 21173.D100

APPENDIX A

RAINWATER CALCULATIONS HAMPTON COURT ROAD BLOCK

Ref: 21173.D100 Web: <u>www.shear-design.com</u>

Shear Design Ltd									Page	1
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960 min	Summer	9.883	0.048		0.0	1.2	1.2	11.3	OK	
1440 min	Summer	9.868	0.033		0.0	1.1	1.1	7.8	OK	
2160 min	Summer	9.852	0.01/		0.0	1.0	1.0	3.9	OK	
2880 min	Summer	9.841	0.006		0.0	1.0	1.0	1.5	OK	
4320 min	Summer	9.835	0.000		0.0	0.9	0.9	0.0	OK	
5760 min	Summer	9.835	0.000		0.0	0.7	0.7	0.0	OK	
7200 min	Summer	9.835	0.000		0.0	0.6	0.6	0.0	OK	
8640 min 10000 min	Summer	9.835	0.000		0.0	0.5	0.5	0.0	OK	
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360	min Winter	9.918	0.083		0.0	1.3	1.3	19.6	ΟK	
480	min Winter	9.911	0.076		0.0	1.3	1.3	17.8	ΟK	
600	min Winter	9.903	0.068		0.0	1.3	1.3	16.0	ΟK	
720	min Winter	9.896	0.061		0.0	1.2	1.2	14.3	O K	
960	min Winter	9.883	0.048		0.0	1.2	1.2	11.2	OK	
2160	min Winter	9.862	0.027		0.0	1.1	1.1	6.Z	OK	
2100	min Winter	9 835	0.000		0.0	0.9	1.0	1.5	0 K	
4320	min Winter	9.835	0.000		0.0	0.6	0.6	0.0	0 K	
5760	min Winter	9.835	0.000		0.0	0.5	0.5	0.0	ΟK	
7200	min Winter	9.835	0.000		0.0	0.4	0.4	0.0	ΟK	
8640	min Winter	9.835	0.000		0.0	0.4	0.4	0.0	ОК	
10080	min Winter	9.835	0.000		0.0	0.3	0.3	0.0	ΟK	
		Storm Event	(1	Rain mm/hr)	Flooded Volume (m³)	Discharg Volume (m³)	e Time-P (mins	eak 3)		
	2.0				0.0	0.0	0	20		
	30	min Wi	nter !	56 712	0.0	20.	9 1	3∠ 60		
	120	min Wi	nter (34.176	0.0	31.	- 4	116		
	180	min Wi	nter 2	25.072	0.0	34.	6	166		
	240	min Wi	nter 2	20.006	0.0	36.	9	188		
	360	min Wi	nter 3	14.514	0.0	40.	1	266		
	480	min Wi	nter 1	11.557	0.0	42.	6	340		
	600	min Wi	nter	9.678	0.0	44.	6	414		
	720	min Wi	nter	8.369	0.0	46.	კ ი	484		
	960	min W1	nter	0.048 4 700	0.0	49.	U 1	0∠U 878		
	2160	min Wi	nter	3.459	0.0	57	- 4 1	208		
	2880	min Wi	nter	2.739	0.0	60.	7	0		
	4320	min Wi	nter	1.968	0.0	65.	5	0		
	5760	min Wi	nter	1.556	0.0	69.	0	0		
	7200	min Wi	nter	1.295	0.0	71.	8	0		
	8640	min Wi	nter	1.115	0.0	74.	2	0		
	10080	min Wi	nter	0.982	0.0	76.	2	0		
			©19	82-20	20 Innc	ovyze				

Shear Design Ltd		Page 3
7 Ashtree Court Kingsto	n Bridge House East	
Woodsy Close Hampton	Court Road, Kingston	
Cardiff Gate Business Park		Micro
Date 16/01/2023 16:39 Designe	d by TU	
File 2023.01.16 21173 Green Checked	by TS	Dialitage
Innovyze Source	Control 2020.1.3	
Rainfall Model	Petails FSR Winter Storms Yo	25
Return Period (years) Region England and Wa M5-60 (mm) 20. Ratio R 0. Summer Storms	100 Cv (Summer) 0.7 ales Cv (Winter) 0.8 000 Shortest Storm (mins) 405 Longest Storm (mins) 100 Yes Climate Change %	50 40 15 30 40
Total Area (1	a) 0.055	
	.,	
Time (mins From: To:) Area (ha)	
0	4 0.055	
Time Area	Diagram	
Total Area (1	na) 0.000	
Time (mins From: To:) Area (ha)	
0	4 0.000	
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Shear Design Ltd	Page 4
7 Ashtree Court	Kingston Bridge House East
Woodsy Close	Hampton Court Road, Kingston
Cardiff Gate Business Park	Micro
Date 16/01/2023 16:39	Designed by TU
File 2023.01.16 21173 Green	Checked by TS
Innovyze	Source Control 2020.1.3
M. Storage is On.	Model Details line Cover Level (m) 10.000
Cellula:	r Storage Structure
Inver Infiltration Coefficient Infiltration Coefficient Depth (m) Area (m ²) Inf. Are	et Level (m) 9.835 Safety Factor 2.0 Base (m/hr) 0.00000 Porosity 0.77 Side (m/hr) 0.00000 Pa (m ²) Depth (m) Area (m ²) Inf. Area (m ²)
0.000 305.0	0.0 0.201 0.0 0.0
0.200 305.0	0.0
Comple	ex Outflow Control
	Orifice
Diameter (m) 0.010 Discharge	e Coefficient 0.600 Invert Level (m) 9.735
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Diameter (m) 0.010 Discharge	e Coefficient 0.600 Invert Level (m) 9.735
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Diameter (m) 0.010 Discharge	e Coefficient 0.600 Invert Level (m) 9.735
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Diameter (m) 0.010 Discharge	e Coefficient 0.600 Invert Level (m) 9.735
	<u>Orifice</u>
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	UIIICE
Diameter (m) 0.010 Discharge	e Coefficient 0.600 Invert Level (m) 9.735

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Shear Design Ltd	Page 5	
7 Ashtree Court Kingston Bridge	House East	
Woodsy Close Hampton Court R	oad, Kingston	
Cardiff Gate Business Park	Micco	
Date 16/01/2023 16:39 Designed by TU		
File 2023.01.16 21173 Green Checked by TS		JE
Innovyze Source Control	2020.1.3	
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Orifice		
Diameter (m) 0.010 Discharge Coefficient 0.600	Invert Level (m) 9.735	
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APPENDIX B

RAINWATER CALCULATIONS CHURCH GROVE BLOCK

Ref: 21173.D100 Web: <u>www.shear-design.com</u>

Shear Design Ltd									Page	1
7 Ashtree C	7 Ashtree Court Kingston Bridge House West									
Woodsy Close Church Grove Kingston										
Cordiff Cate Business Bark										× ,
Cardiff Gate Business Park										
Date 16/01/	2023 14:45	5		Desi	gned b	y TU				
File 2023 0	1 16 21173	Green	h	Chec	ked by	- ͲϚ			Uldl	Idye
TILE 2023.01.10 ZIL/S GLEEN CHECKED BY TS										
Innovyze				Sour	ce Con	trol 2020).1.3			
	Summary c	f Resu	lts f	or 10	0 year	Return	Period	(+40%))	
					4			. ,	-	
		T.	lf Dwo	in min						
		Пс	ili Dia	. 11 1 1 1	lle : 452	minuces.				
	Storm	Maw	Mow	м-		Max	Maw	Maw	Status	
	Freeze	Tamal	Max Domth 1		1 . 	Max Combrol 1	Max Outflou	Max	Status	
	Event	Tever 1	/m)	/1				vorume		
		(m)	(m)	(1)	(S)	(1/S)	(1/S)	(m°)		
15	min Summer	9 878 1	1 043		0 0	0 5	0 5	14 0	ОК	
20	min Summer	9 890 1	055		0.0	0.5	0.5	18 1	0 K	
50 KN	min Summer	9,902	0.067		0.0	0.6	0.0	21 Q	0 K	
120	min Summer	9 911	0.0076		0.0	0.6	0.0	24.9	0 K	
180	min Summer	9,914	0.079		0 0	0.6	0.0	25.8	0 K	
240	min Summer	9,914	0.079		0 0	0.6	0.0	25.0	0 K	
360	min Summer	9,912	0.077		0 0	0.6	0.0	25.5	0 K	
480	min Summer	9,909	0.074		0.0	0.6	0.0	24 2	0 K	
600	min Summer	9 906	0.071		0.0	0.6	0.6	23.3	0 K	
720	min Summer	9 904	0.071		0.0	0.0	0.6	22.5	0 K	
960	min Summer	9 900 1	0.005		0.0	0.0	0.6	22.3	0 K	
1440	min Summer	9 893 1	1 058		0.0	0.0	0.6	18 8	0 K	
2160	min Summer	9 883 1	1 048		0.0	0.0	0.0	15 6	0 K	
2880	min Summer	9 874 0	1 N39		0.0	0.5	0.5	12 7	O K	
4320	min Summer	9 859 1	n 024		0.0	0.5	0.5	8 0	O K	
5760	min Summer	9 849 0	014		0.0	0.5	0.5	4 6	0 K	
7200	min Summer	9 842 1			0.0	0.5	0.5	2.2	0 K	
8640	min Summer	9 837 0	002		0.0	0.5	0.5	0 7	0 K	
10080	min Summer	9 835 (0002		0.0	0 4	0.4	0.0	0 K	
15	min Winter	9.883	0.048		0.0	0.6	0.6	15.8	0 K	
		3.000	•••••		0.0	0.0	0.0	20.0	0 10	
		a 1	-		1 1	Discharge		1-		
		Storm		kain	F100ded	Discharge	· TIME-P	eak 、		
		Event	(m	m/hr)	Volume	Volume	(mins	5)		
					(m³)	(m³)				
	15	min Sum	mer 13	8 754	0 0	14	1	19		
	30 T D	min Cum	mer 0	0 006	0.0	10 (<u>.</u>	± 2 3 3		
	20 20	min Sull	mer 5	6 712	0.0	10.1 23 4	5	55 62		
	120	min Sull	mer ?	4 176	0.0	23.0	5	122		
	120	min Sum	mer ?	5 072	0.0	20.0	, 1	182		
	210	min Sull	mer ?	0 006	0.0	23 i 2T.4	<u>.</u>	240		
	240	min Sum	mer 1	4 51 A	0.0	32.0	1	226		
	18U	min Cum	mer 1	1 557	0.0	20.4	<u>.</u> 7	390		
	400	min Cum	mer 1	9 672	0.0	JO.	5	452		
	720	min Sum	mer	8.369	0.0	42 0	,)	518		
	920	min Quim	mer	6 648	0.0	1/1	, 5	654		
	1///	min Quim	mer	4 799	0.0	17. 10	,)	924		
	2160	min Quim	mer	3 459	0.0	50.2	-	324		
	2100	min Quim	mer	2 729	0.0	55 (- 1	728		
	2000	min Sum	mer	1 968	0.0	59.0	, 1 3 2	464		
	4JZ0 5760	min Sull	mer	1 556	0.0	67 4	, 2 ; 2	168		
	7200	min Sum	mer	1 295	0.0	65 0) 2) 2	±00 824		
	8640	min Sum	mer	1.115	0.0	67 5	5 4	496		
	10080	min Sum	mer	0.982	0.0	69	. т }	0		
	15	min Win	ter 13	8.754	0.0	16.2	2	18		
1			-							

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Shear Design Ltd	Page 2								
7 Ashtree Court									
Woodsv Close									
Cardiff Gate Business				1-1-					
$D_{2+0} = \frac{16}{01} \frac{01}{2022} = \frac{14.45}{2022}$	Date $16/01/2023$ 11.15 Designed by TII								
Date 16/01/2023 14:43	Draina	Ub							
File 2023.01.16 211/3									
Innovyze		Sour	ce Cont	trol 202	0.1.3				
Summary of	f Results	for 10)0 year	Return	Period	(+40%)	-		
Storm	Max Max	Ma	ax	Max	Max	Max	Status		
Event	Level Depth	Infilt	ration (Control S	Outflow	Volume			
	(m) (m)	(1)	/s)	(1/s)	(1/s)	(m³)			
30 min Winter	9.897 0.062		0.0	0.6	0.6	20.4	ОК		
60 min Winter	9.911 0.076		0.0	0.6	0.6	24.7	ОК		
120 min Winter	9.921 0.086		0.0	0.6	0.6	28.3	ОК		
180 min Winter	9.925 0.090		0.0	0.6	0.6	29.6	ОК		
240 min Winter	9.927 0.092		0.0	0.6	0.6	30.0	O K		
360 min Winter	9.926 0.091		0.0	0.6	0.6	29.6	0 K		
480 min Winter	9.922 0.087		0.0	0.6	0.6	28.6	0 K		
600 min Winter	9.919 0.084		0.0	0.6	0.6	27.5	ОК		
720 min Winter	9.916 0.081		0.0	0.6	0.6	26.5	ОК		
960 min Winter	9.910 0.075		0.0	0.6	0.6	24.6	ОК		
1440 min Winter	9.899 0.064		0.0	0.6	0.6	21.1	OK		
2160 min Winter	9.885 0.050		0.0	0.6	0.6	10.3 12 1	OK		
4320 min Winter	9.872 0.037		0.0	0.5	0.5	5 6	0 K		
5760 min Winter	9.839 0.004		0.0	0.5	0.5	1.4	0 K		
7200 min Winter	9.835 0.000		0.0	0.4	0.4	0.0	ОК		
8640 min Winter	9.835 0.000		0.0	0.4	0.4	0.0	ОК		
10080 min Winter	9.835 0.000		0.0	0.3	0.3	0.0	ОК		
S	torm	Rain	Flooded	Discharge	e Time-P	eak			
E	vent	(mm/hr)	Volume	Volume	(mins	3)			
			(m³)	(m³)					
30 1	nin Winter	90.906	0.0	21.2	2	33			
60 1	min Winter	56.713	0.0	26.	5	62			
120 1	min Winter	34.176	0.0	32.0	0	120			
180 1	min Winter	25.072	0.0	35.2	2	178			
240 1	min Winter	20.006	0.0	37.	5	234			
360 1	min Winter	14.514	0.0	40.8	8	344			
480 1	nin Winter	11.557	0.0	43.3	3	446			
600 1	nın Winter	9.678	0.0	45.	4	478			
720 1	nin Winter	8.369	0.0	4/.	L L	226 710			
960 1	nin Winter	0.048	0.0	49. 57	ح ۱	/ L U 0 1 0			
2160 -	nin Winter	3 159	0.0	58	0 L 4 1	428			
2880 1	min Winter	2.739	0.0	61	- 1 7 1	840			
4320 1	nin Winter	1.968	0.0	66.1	5 2	552			
		1.556	0.0	70.	1 3	176			
5760 1	min Winter			73	1	0			
5760 1 7200 1	nin Winter nin Winter	1.295	0.0	13.	-				
5760 1 7200 1 8640 1	nin Winter nin Winter nin Winter	1.295 1.115	0.0 0.0	75.	5	0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0	75.5	5	0 0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0	75.3	5 6	0 0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0	75	6	0 0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0	75.	6	0 0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0	75. 77.	6	0 0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0	75. 75.	6	0 0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0	75	6	0			
5760 1 7200 1 8640 1 10080 1	nin Winter nin Winter nin Winter nin Winter	1.295 1.115 0.982	0.0 0.0 0.0 20 Innc	75. 77.	6	0			

Shear Design Ltd		Page 3
7 Ashtree Court	Kingston Bridge House West	
Woodsy Close	Church Grove, Kingston	
Cardiff Gate Business Park		Mirro
Date 16/01/2023 14:45	Designed by TU	Drainago
File 2023.01.16 21173 Green	Checked by TS	Diamage
Innovyze	Source Control 2020.1.3	
File 2023.01.16 21173 Green Innovyze Rainfall Model Return Period (years) Region Engl. M5-60 (mm) Ratio R Summer Storms Tin Tot Tin Tot Fr Tin Tot Tin Tot	Checked by TS Source Control 2020.1.3 infall Details FSR Winter Storms 2 100 Cv (Summer) 0.7 and and Wales Cv (Winter) 0.8 20.000 Shortest Storm (mins) 0.405 Longest Storm (mins) 100 Yes Climate Change % me Area Diagram al Area (ha) 0.056 me Area Diagram al Area (ha) 0.000 ime (mins) Area om: To: (ha) 0 4 0.000	Zes 750 340 15 080 +40
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Shear Design Ltd		Page 4
7 Ashtree Court	Kingston Bridge House West	
Woodsy Close	Church Grove, Kingston	
Cardiff Gate Business Park		Mirro
Date 16/01/2023 14:45	Designed by TU	Drainago
File 2023.01.16 21173 Green 0	Checked by TS	brainacje
Innovyze	Source Control 2020.1.3	
<u>Mc</u>	odel Details	
Storage is Onl	ine Cover Level (m) 10.000	
Cellular	Storage Structure	
Invert Infiltration Coefficient B Infiltration Coefficient S	t Level (m) 9.835 Safety Factor 2.0 Base (m/hr) 0.00000 Porosity 0.77 Side (m/hr) 0.00000	
Depth (m) Area (m²) Inf. Area	a (m ²) Depth (m) Area (m ²) Inf. Area ((m²)
0.000 425.0 0.100 425.0	0.0 0.0	0.0
Complex	x Outflow Control	
	Orifice	
	0111100	
Diameter (m) 0.010 Discharge	Coefficient 0.600 Invert Level (m) 9.	735
	Orifice	
Diameter (m) 0.010 Discharge	Coefficient 0.600 Invert Level (m) 9.	735
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Diameter (m) 0.010 Discharge	Coefficient 0.600 Invert Level (m) 9.	735
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Diameter (m) 0.010 Discharge	Coefficient 0.600 Invert Level (m) 9.	735
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Diameter (m) 0.010 Discharge	Coefficient 0.600 Invert Level (m) 9.	735
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Diameter (m) 0.010 Discharge	Coefficient 0.600 Invert Level (m) 9.	735
	Orifice	
Diameter (m) 0.010 Discharge	Coefficient 0.600 Invert Level (m) 9.	735

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APPENDIX C

DRAINAGE LAYOUT AT ROOF LEVEL

Ref: 21173.D100 Web: <u>www.shear-design.com</u>



00 5 5 £. 5 5 5 5 HAMPTON COURT ROAD BUILDING. ROOF AREA. CATCHMENT: 545 sqm GREEN BLUE ROOF: 300 sqm \checkmark DETENTION CELL DEPTH: 100mm DISCHARGE RATE ACHIEVED: 1.4 I/s



APPENDIX

iii) BAUDER SYSTEM SUMMARIES

BAUDER

SYSTEM SUMMARY

Bauder Blue Roof - Sedum on substrate system

Green / Blue Roof Solution

Green roofs are an ideal partner for blue roofs as they will naturally delay and reduce rain water run-off from the roof. Green roofs when combined with the blue roof system (Bauder's Attenuation Cell 100) and flow restrictors allow the precise control of the roofs discharge rate and enable large volumes of water to be attenuated at roof level.

A sedum blanket system offers a low maintenance green roof. Laying Bauder's mature SB sedum blanket on a bed of Bauder's extensive substrate gives the system both rooting depth and water retention to make it the most resilient of green roof finishes.

Contraction of the second second	Product	Description	thickness	weight
	<mark>1</mark> Bauder SB Sedum Blanket *	Typically sown with 17 species of sedums and grown by Bauder for around 12 months before it is harvested.	25mm	24.0Kg/m²
2	2 Bauder Extensive Substrate	A lightweight, low nutrient growing material tested to BS8616 and manufactured to meet both GRO and FLL guidelines.	80mm	96Kg/m²
4	3 Bauder Filter Fleece	Filtration layer that prevents substrate fines from washing into the drainage and water storage layer.	1mm	0.125Kg/m²
5	4 Bauder DSE 20 Drainage Layer	A 20mm drainage board, holding 7.4 ltr/m2. It is manufactured from 100% recycled HDPE.	20mm	8.6Kg/m ² (water filled)
7-8	5 Attenuation Cell 100	A high strength void element which is 95%+ void. This can hold 95 litres per m2. Allowing it to slowly discharge through the flow restrictor (fitted to the outlet).	100mm	8.06 kg/m2
	<mark>6</mark> Bauder FSM 600 Protection Layer	Is 100% recycled Polyester and polypropylene fibre mix protection layer to prevent mechanical damage to the underlying waterproofing.	4mm	0.6Kg/m²
	7 Underlying Waterproofing System	Bauder's BTGRS Bituminous Membrane or Bauder Hot melt, Bituminous Waterproofing system.	N/A	N/A
*Bauder also produce Wildflower and seeded solutions When to specify	8 Bauder Blue Roof Flow Restrictor	A combined restrictor plate and overflow, enabling discharge flow rates to be altered for SUDS requirements.	N/A	N/A
Where an immediate vegetated finish is required on completion. Bauder SB sedum blanket gives instant ground	Blue & Green Ro (fully saturated ex Cell during a rain	230mm	137Kg/m²	
	Note: Paudar Plus	a of sustams require been also flow rate calculations al	ana contract Da	udar's tashnisal

Note: Bauder Blue roof systems require bespoke flow rate calculations please contact Bauder's technical department

cover and a low maintenance solution. Ideal for very exposed roof environment.

UNITED KINGDOM Bauder Ltd

70 Landseer Road, Ipswich, Suffolk IP3 0DH T: +44 (0)1473 257671 E: info@bauder.co.uk bauder.co.uk



SYSTEM SUMMARY

BauderSOLAR G LIGHT

Green roof mounting solution for framed solar photovoltaic modules

BauderSOLAR G LIGHT is an integrated solar PV mounting system specifically for Bauder biodiverse or extensive green roofs.



Product	Description	Dimensions (mm)	Weight
1 BauderSOLAR DSE 40 Anchor board	Modified DSE40 drainage board installed above base rails to ballast the mounting system	1040 X 2030	
2 BauderSOLAR BS-4 or BauderSOLAR BS-2 Base Rail	Powder coated steel base rail installed on protection layer and beneath DSE40 Anchor board	3994 (BS-4) or 1994 (BS-2) x 36 x 72	
3 BauderSOLAR MTR Module carrier rail	Powder coated steel profile rail to support framed solar modules	4700 x 61.9 x 47.5	
<mark>4 BauderSOLAR VT 745</mark> BauderSOLAR VT 545 V-beams	Pre-assembled V-shaped module carrier rail support manufactured from powder coated steel	L 745 x 399 x 54 S 545 x 343 x 54	
5 BauderSOLAR DLE Diagonal profile	Support rail to add rigidity to mounting system—Powder coated steel	1245 x 30 x 15	
6 & 7 BauderSOLAR MKL (mid) or BauderSOLAR EKL (End)	Mid and end pre-assembled module clamps	n/a	
8 Module rail end cap	Polypropylene end cap to protect module mounting rail ends	n/a	
9 Solar module	Framed crystalline solar photovoltaic module	Variable	
	Total system weight (kg/m²)*		176kg/m2

*Includes weight of Bauder BTRS roof system with 160mm PIR insulation and saturated Biodiverse green roof based on a substrate depth of 100mm

SYSTEM OPTIONS

Solar mo	dule options**		Recommended planting mix:			
Madula	Ci=o		Name	Description		
Module	Emclency	Size		Bauder Flora 3	A broad mix of low growing and some	
JAM60S-20-385-MR	20.7%	20.7% 1052mm x 1769mm		Seed Mix	shade tolerant species ideal, for most	
				GB50120403	roof environments. Recommend for	
LG Neon H—380Wp	20.4%	1016mm x 1700mm			BioSOLAR installations.	

**Bauder BioSolar is a universal mounting system. The listed modules are for reference only, please contact Bauder for advise on project specific module selection.

UNITED KINGDOM Bauder Ltd 70 Landseer Road, Ipswich, Suffolk IP3 oDH T: +44 (0)1473 257671 E: info@bauder.co.uk bauder.co.uk

IRELAND Bauder Li

Bauder Ltd O'Duffy Centre, Carrickmacross, Co. Monaghan T: +353 (0)42 9692 333 E: info@bauder.ie bauder.ie

APPENDIX

iv) LOADING ASSESSMENT CALCULATIONS – BAUDER ROOF PROPOSAL



 Contract No:
 21173.D040

 Date:
 Jan 2023

 By:
 MA

21173 – D040

KINGSTON BRIDGE

RICHMOND - LONDON

STRUCTURAL CALCULATIONS

LOADING ASSESSMENT



DOCUMENT INDEX SHEET

Contract: Kingston Bridge

Project No: 21173

Title: Structural Calculations	Sheets/Page No 20
Loading Assessment	03 - 18

Date	Detail of Revision	Rev No
23.01.2023	First Issue	-

Prepared By:	Mujtaba Ahmed	Checked By:	James Spencer	Authorised By:	Tony Spencer		
Signed:	CEng, MIStructE	Signed:	CEng, MICE	Signed:	CEng, MICE		
Date of Issue:	23.01.2023						

LOADING ASSESSMENT

Internal Column

4 Storey Building - Existing Loads (Offices)

	Slab Construction	S.W of Floor	Finishes	Finishes 2	Ceiling Grid	Plaster Board	Services	S.W. of col/wall	Partitions	mposed	EXISTING LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	0	0.05	0.3	0.1	0	0	0.75	7.65
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0.05	0.3	0.1	0.56	1	2.5	18.18
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0.05	0.3	0.1	0.56	1	2.5	28.71
Existing 1st (Transfer)	150mm THK Slab with Ribs	5.87	0.15	0	0.05	0.3	0.1	0.56	1	2.5	39.24
Existing Ground	Ground Bearing Slab	0	0	0	0	0	0	0.56	0	0	39.8
Foundation								0.56			39.8

4 Storey Building - Propose	ed Loads (Apartments)										
	Slab Construction	S.W of Floor	Finishes	Green Roof	Ceiling Grid	2xFire Board	Services	S.W. of col/wall	Partitions	Imposed	PROPOSED LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	2.75	0	0.25	0.1	0	0	0.75	10.3
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	20.23
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	30.16
Existing 1st (Transfer)	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	40.09
Existing Ground	Ground Bearing Slab	0	0	0	0	0	0	0.56	0	0	40.65
Foundation								0.56			41.2

PAGE 1.0

4 Storey Building - Existing Loads (Offices)

	Slab Construction	S.W of Floor	Finishes	Finishes 2	Ceiling Grid	Plaster Board	Services	S.W. of col/wall	S.W. of Perimeter wall	Cladding	Partitions	Imposed	EXISTING LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	0	0.05	0.3	0.1	0	0	0	0	0.75	7.65
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0.05	0.3	0.1	1.15	1	0.83	1	2.5	20.6
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0.05	0.3	0.1	1.15	1	0.83	1	2.5	33.55
Existing 1st (Transfer)	150mm THK Slab with Ribs	5.87	0.15	0	0.05	0.3	0.1	1.15	1	0.83	1	2.5	46.5
Existing Ground	Ground Bearing Slab	0	0	0	0	0	0	0.5	0	0	0	0	47
Foundation								0.5					47.5

4 Storey Building - Proposed Loads (Apartments)

	Slab Construction	S.W of Floor	Finishes	Green Roof	Ceiling Grid	2xFire Board	Services	S.W. of col/wall	S.W. of Perimeter wall	Cladding	Partitions	Imposed	PROPOSED LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	2.75	0	0.25	0.1	0	0	0	0	0.75	10.3
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	22.65
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	35
Existing 1st (Transfer)	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	47.35
Existing Ground	Ground Bearing Slab	0	0	0	0	0	0	0.5	0	0	0	0	47.85
Foundation								0.5					48.4

PAGE 2.0

7 Storey Building - Existing Loads (Offices)

	Slab Construction	S.W of Floor	Finishes	Finishes 2	MF Ceiling	Plaster Board	Services	S.W. of col/wall	Partitions	Imposed	EXISTING LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	0	0.15	0.3	0.1	0	0	0.75	7.75
Existing 6th	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	0.56	1	2.5	18.38
Existing 5th	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	0.56	1	2.5	29.01
Existing 4th	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	0.56	1	2.5	39.64
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	0.56	1	2.5	50.27
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	0.56	1	2.5	60.9
Existing 1st	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	0.56	1	2.5	71.53
Existing Ground	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	0.56	1	2.5	82.16
Foundation											82.2

7 Storey Building - Proposed Loads (Apartments)

	Slab Construction	S.W of Floor	Finishes	Green Roof	Ceiling	2xFire Board	Services	S.W. of col/wall	Partitions	Imposed	PROPOSED LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	2.75	0	0.25	0.1	0	0	0.75	10.3
Existing 6th	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	20.23
Existing 5th	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	30.16
Existing 4th	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	40.09
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	50.02
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	59.95
Existing 1st	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	69.88
Existing Ground	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	0.56	1	2	79.81
Foundation											0

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7 Storey Building - Existing Loads (Offices)

	Slab Construction	S.W of Floor	Finishes	Finishes 2	Ceiling Grid	Plaster Board	Services	S.W. of col/wall	S.W. of Perimeter wall	Cladding	Partitions	Imposed	EXISTING LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	0	0.15	0.3	0.1	0	0	0	0	0.75	7.75
Existing 6th	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	1.15	1	0.83	1	2.5	20.8
Existing 5th	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	1.15	1	0.83	1	2.5	33.85
Existing 4th	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	1.15	1	0.83	1	2.5	46.9
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	1.15	1	0.83	1	2.5	59.95
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	1.15	1	0.83	1	2.5	73
Existing 1st (Transfer)	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	1.15	1	0.83	1	2.5	86.05
Existing Ground	150mm THK Slab with Ribs	5.87	0.15	0	0.15	0.3	0.1	1.15	1	0.83	1	2.5	99.1
Foundation													99.1

7 Storey Building - Proposed Loads (Apartments)

	Slab Construction	S.W of Floor	Finishes	Green Roof	Ceiling	2xFire Board	Services	S.W. of col/wall	S.W. of Perimeter wall	Cladding	Partitions	Imposed	PROPOSED LOAD
Existing Roof	150mm THK Slab with Ribs	5.87	0.58	2.75	0	0.25	0.1	0	0	0	0	0.75	10.3
Existing 6th	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	22.65
Existing 5th	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	35
Existing 4th	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	47.35
Existing 3rd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	59.7
Existing 2nd	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	72.05
Existing 1st (Transfer)	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	84.4
Existing Ground	150mm THK Slab with Ribs	5.87	0.15	0	0	0.25	0.1	1.15	1	0.83	1	2	96.75
Foundation													0

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Section design to Eurocode 2 (BS EN 1992-1)										
	BS	6.		(((n	1pa 06				
code	Originate	d from TCC11.xl	s, v 4.3 on CD © 2003-2	2010 TCC		The Concrete Cen	itre			
INPUT	Location									
٨	A kNm/m	<u>1.5</u>	fck	N/mm²	25	γc = 1.50				
ć	δ	<u>1.00</u>	fyk	N/mm²	<u>500</u>	$\gamma s = 1.15$				
spai	n mm	<u>1000</u>	gk	kN/m⁺	<u>20.00</u>					
I	h mm	<u>150</u>	qk	kN/m²	<u>2.50</u>					
Bar (ð mm	<u>10</u>	S	teel clas	s 🛆					
cover, C non	י mm	<u>40</u>	to this steel		Usage	Roof				
∆c _{de}	× mm	<u>10</u>		Sectio	n location	SIMPLY SUPPORTED				
ħ:				brittle p	artitions?	NO				
OUTPUT	0.00									
	d = 150 - 4	0 - 10/2 =	105.0 mm							
3.1.7 (3)	x = [105 - 1	/(105² - 20	000/0.85 x 1.5	x 1.5/25)]/0.8 = 1	3 mm				
5.5 (4)	(x/d) limit =	= 0.600	x/d	actual =	= 0.012 <	0.600 ok				
Fig 3.5	z = 105 - 0	.4 x 1.3 = 1	04.5 > 0.95d :	= 99.8 m	nm	•				
	As = 1.5E6	/500/99.8	8 x 1.15 = 35 <	As min =	= 140 mm²	/m				
9.2.1.1 (1)	As min = 1.	33 x 105 =	= 140 mm²/m							
	As def = 3!	5 mm²/m								
	Provide H	10 @ 550) = 143 mm²/n	n						
Table A1.1 EN1990	ψ ₂ =	O (Roof)								
	SLS udl = 2	20 + 1 x 2.5	5 = 22.50 kN/n	n², n = 2	0 x 1.35 +	2.5 x 1.5 = 30.75				
7 4 2 4 2 1	SLS M = 1.5	5 x 22.50/	30.75 = 1.10 kM	Vm Tool	σs =	180.1 N/mm²				
7.4.∠ (∠) Table 7.4	Permissible	10dification factor = 310/180.1 = 1.500(max) Permissible L/d = 1.500 x 979 13 = 1.468 70								
	Actual L/d	= 1000/10	05 = 9.52 ok	,100.70		•				



Section design to Eurocode 2 (BS EN 1992-1)

RECTANGULAR BEAMS

Originated from TCC11.xls, v 4.3 on CD © 2003-2010 TCC



INPUT	Location	<u>230x200</u>	0x200 Beam type SIMPLY SUPPORTED								
Μ	kNm	<u>66.0</u>	fck	30	N/mm²	γc = 1.50					
δ		<u>1.00</u>	fyk	<u>500</u>	N/mm²	γs = 1.15					
span	mm	<u>6000</u>	Steel class	Δ		Δc_{dev} <u>10</u>					
h	mm	<u>230</u>	REBAR	Ø	COVER	to main bars					
b	mm	<u>200</u>	Tension	<u>25</u>	25						
gk	kN/m	<u>10.00</u>	Comp'n	<u>16</u>	<u>25</u>	•					
qk	kN/m	<u>5.00</u>	Side		<u>25</u>						
ψ2 =	0	Roof	brittle par	titions	NO						
OUTPUT	22020	•	54U.C								
COTPOT	23UX2U		FAILS on - D	eflecti	on . As > 4	!%. ●●●●● ;p					
Effective depth,	a = 25	0 - 23 - 23/ 3 5 1/103 5:	Z = 192.5 mm			10.0 10000 0					
Neulrai axis,	x – [19. (v/d) lii	2.5-V(192.5)		5/U.85/	200/30)]/	10.8 = 10000.0 mm					
l quar arm	(x/a) III = -197	$= 1925 - 0.4 \times 1155 = 1463 \text{ mm}$									
Lever arm,	d2 = 192	$z = 192.5 - 0.4 \times 115.5 = 146.3 \text{ mm}$									
	Gross	5 + 10/2 - 3	N/mm² from	otroin	dioarom						
	Net for	= 434.8 = 1	0.85 v 30 /14	5 = 417	alagram 8 N/mm²						
	Freess	M = 66 - 4	$60 = 200 \mu$) 17. Vm	O NYMIM						
Compression steel.	As2 =	20.0E6./417	7 8 /(192 5 - F	33) = 3	01 mm^2						
,	PROVI	DE 2H16 C	OMPRESSIO	N STEE	L = 402 n	nm²					
Steel stress,	fyd = 4	34.8 N/mm ³	² from strain	diaara	m						
Tension steel,	As = 4	6.0E6/146.3	3/434.8 + 30)0.7 x 4	 17.8/434.8	$B = 1012 \text{ mm}^2$					
9.2.1.1 (1)	As min	= 0.00151 x	(200 x 192.5	= 58 m	1m ²						
7.3.2 (2)	As cra	ck = 0.4 x 1.(07 x 2.896 x	21.1/fyk	= 52 mm²	•					
7.4.2	As def	= 2183 mm ²	2	5							
	PROVI	DE 5H25 T	ENSION STE	EL = 2	454 mm ²						
DEFLECTION	SLS M	=66 x 15 /2	1.0 = 47.1 kNr	n		$\sigma_{\rm S} = 173 \rm N/mm^2$					
7.4.2 (2)	Modific	ation facto	r = 310 /172.6	5 = 1.50	O(max)						
	Permis	sible L/d = 1.	500 x 1.000	x 13.98	2 = 20.97						
	Actual	L/d = 6000) /192.5 = 31.1	7		FAILS					

	Project Title: (Cincistan Bridge	Proj. No: 01173
SHEA	Element Title:	Sheet No:
Consulting Civil and S 7 Ashtree Court - Woodsy Close - C	Structural Engineers Des'd by: Date: Chk'd by: Chk'd by: Date: Chk'd by: Chk	Date:
REF	INPUT	OUTPUT
	4 Botoraci Building	
*	Internal Column to u/s 3rd Flour.	
	- Column Size = (520 + 720.) mm.	
	- loaded Area = (7.2 . 6.0)m	1
	- Column loud = 20.23 . 7.2.6 =	875 ku.
		Pass.
		(min Keinf)
×	Internal Column to Ground Floor.	
	- Colomn Size = (320-720)_	
	louded Area = 7,2.60 -	
	- Column load : 40.6517.2.6.	1756 EN
		Acess
		(min Rein)
	FI alus L V 2 l	
Å	Edge Glomn to Uls Koot:	
	-(alumn Size = (250.380)	
	- loaded Arec = (36,1.5)m ²	
	- Glumn loud = 10.3, 3.6.1.5	= S6 10J
		Pass (min feat)
БĽ	Edge Column tobore Transfer level:	
	- load = 30-16. 8.6 -1.5 =	163 KJ.
		Pass (min Red)
45	Edge colom to v/s Transfer (Ground) = 40.65 = 3.6.6=	875 ki pass (nin

Project		KINGSTON			(Carlow Carlow C			The C	oncrete	Centre
Client						mpa		Made by	Date	Page
Location	1	INTERNAL CO	DLUMN - 3RE	D FLOOR	N DESIGN, BENT	The Cor ABOUT TWO AXES	n crete Centre S	Made by	23-Jan-23	10
		Originate	ed from TCC53.xls	s v4.4 on CD	© 2000-	23 TCC	1.	Checked	Revision -	Job No 21173
MATERIALS	5									
	fck	<u>25</u>	N/mm²	γs	1.15	Cover	r to link, C _{nom}	<u>40</u>	mm	
	fyk	<u>500</u>	N/mm²	γc	1.5		dg	<u>20</u>	mm	
	φ	2.2		фef	1.21		$\Delta_{c,dev}$	<u>10</u>	mm	
SECTION				Steel class	<u>B</u>					
	h	<u>700</u>	mm	•						
	b	<u>320</u>	mm	•						
Ŵ	vith	2	bars per 320 ·	face			<u>Y</u>	•	Y	
á	and	7	bars per 700	face	luman a with G	leave.				
			ie, 7	00 x 520 co	iumns with o	bars				Pomoto
RESTRAINT	s	Storey	Тор	Btm			CONNECTI	NG BEAMS/	SLABS	end
		height (mm)	Condition	Condition	Braced ?	1	b (mm)	h (mm)	L (m)	(F) or (P)
Y-AX	(IS	3000	E	P	Y	Top West	1000	250	6	P
Z-AX	(IS	3000	E	Р	Y	Top East	<u>1000</u>	250	6	Ē
						Top North	1000	250	4	P
		L (mm)	L _o (mm)	he (mm)	l F	IOP JOUTH	1000	250	4	P
Y-AX	(IS	2750	2635	220	F	Bottom Fast				
Z-AX	(IS	2750	2710		B	ottom North				
					Bo	ottom South				
						Beam str	thesses are	<u>∕0%</u> ∨	of uncracked	stiffness
BAR ARRAN	IGE	MENTS			BAR CENT	RES (mm)		±	COI DEIOW?	T
B	Заг	Ø	Asc %	Link Ø	320 Face	700 Face	Nuz (kN)		Checks	1.1.1
	В	40	3.37	10	180	280	5705		ok	
	В	32	2.15	8	192	286	4794		ok	
	В	25	1.31	8	199	290	4162		ok	
	В	20	0.84	8	204	292	3806		ok	
	В	10	0.54	8	208	294	3578		ok	
	D	12	0.30	8	212	296	3401		ok	
LOADCASES	5 [AXIAL	TOP MOME	NTS (kNm)	BTM MOM	ENTS (kNm)	1			
		N (kN)	moy	m _{0z}	m _{ov}	moz				
<u>1</u>		875								
<u>2</u>							Moments	m _o at top o	and bottom of	^r column
<u>3</u>							(from analy	rsis) are con ue to impor	bined to find	m_{0e} . The
4							second ord	er moment i	(M_{2}) are then) and the
5							obt	ain M _{Ed} In t	he table belo	w.
<u>0</u>										
DESIGN	ſ	V AY		7 4	VIC	Critical	Dissist	Charle		
MOMENTS	ł	Med V	Mpd V	Med 7	Mp. 7	avie	Fauntin	(5 20)	DEDAD	
1	ł	20.4	288.1	5.8	1317	7		47	6 R12	
2				0.0		~	N =	0	UDIZ	
3							N =	0		
4							N =	0		
5							N =	0		
6							N =	0		
				SFF CHAR	TS ON NEX	T SHEET				

Project		KINGSTON			Ca			The C	oncrete	Centre
Client						mpa		Made by	Date	Page
Locatior	n	INTERNAL CC SYMMETRICALLY RE TO EN 1993-1 1 200	ULUMN - GRO	NGULAR COLUM	R N DESIGN, BENT A	The Cor ABOUT TWO AXE	n <mark>crete</mark> Centre 5	Made by	23-Jan-23	11
	2	Originate	d from TCC53.xls	v4.4 on CD	© 2000-	23 TCC		Checked	Revision -	Job No 21173
MATERIALS	S									
	fck	<u>25</u>	N/mm²	γs	1.15	Cover	r to link, C _{nom}	<u>40</u>	mm	
	fyk	500	N/mm²	γc	1.5		dg	<u>20</u>	mm	
	φ	2.2		фef	1.21		$\Delta_{c,dev}$	<u>10</u>	mm	
SECTION				Steel class	B		_			
	h	<u>700</u>	mm	•						
	b	320	mm	•						
l `	with	2	bars per 320	face			<u>Y</u>	•	Y	
	ana	2	bars per 700 1	face	luma with 6	have				
			ie. /	00 x 520 co	iumins with o	Dars				Remote
RESTRAINT	rs	Storey	Тор	Btm	1		CONNECTI	NG BEAMS/	SLABS	end
		height (mm)	Condition	Condition	Braced ?]	b (mm)	h (mm)	L (m)	(F) or (P)
Y-A	XIS	3000	E	P	Ϋ́	Top West	1000	250	6	P
Z-A	XIS	3000	<u> </u>	<u>P</u>	<u> </u>	Top East	1000	<u>250</u>	6	P
						Top North	1000	250	4	P
	- 1	L (mm)	L _o (mm)	ho (mm)	l f	TOP South Bottom West	1000	250	4	Ľ
Y-A	XIS	2750	2635	220	E	Bottom East				
Z-A	XIS	2750	2710		В	ottom North				
					Bo	ottom South		7.04		
						Beam sti	ttnesses are	<u>70%</u> Y	of uncracked	stiffness V
BAR ARRAN	NGE	MENTS			BAR CENT	RES (mm)		±	COI DEIOW:	-
	Bar	Ø	Asc %	Link Ø	320 Face	700 Face	Nuz (kN)		Checks	.C-1.17
	В	40	3.37	10	180	280	5705		ok	
	В	32	2.15	8	192	286	4794		ok	
	В	25	1.31	8	199	290	4162		ok	
	В	20	0.84	8	204	292	3806		ok	
	В	15	0.54	8	208	294	3578		ok	
	В	IZ	0.30	8	212	296	3401		ok	
LOADCASE	s	AXIAL	TOP MOME	ENTS (kNm)	BTM MOM	ENTS (kNm)				
		N (kN)	moy	m _{0z}	mov	moz				
1		1756								
<u>2</u>							Moments	m_0 at top of	and bottom of	f column
<u>3</u>							(from analy	/sis) are con	ibined to find	m _{oe} . The
4							second ord	er moment	(M_{2}) are then	n and the
<u><u>5</u></u>							obt	ain M _{Fd} In t	he table belo	W.
<u>6</u>	l							24		
DESIGN	ſ	VAV	/15	7.4	VIC	Californi			1	
MOMENTS		Med V	May	M 7	Ma 7	Critical	Biaxial	Check	DEBAD	
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2		11.0	JLL.J	11.0	140.0	2	N -	= 0	ODIZ	
3							N =	= 0		
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				SEE CHAR	TS ON NEX	T SHEFT				

Client Location Experiment from To L/S ROOF The Connected Current Page Page Made by 23-Jan-22 12 ENCERCE In the With 7: 300 The Connected Current Page	Project	KINGSTON	1		Ca		The Concrete Centre			
Location EDEC ECULINN TO U/S ROOF The Concrete Cerum Ande by 23-Jan-23 12 Viewerscurve Reconcels Rectinguate acculant ac	Client					mpa		Made by	Date	Page
Line Description Description <thdescription< th=""> <thd< th=""><th>Location</th><th>EDGE COLU</th><th>MN TO U/S R</th><th>ROOF</th><th></th><th>The Co</th><th>ncrete Centre</th><th>Made by</th><th>23-Jan-23</th><th>12</th></thd<></thdescription<>	Location	EDGE COLU	MN TO U/S R	ROOF		The Co	ncrete Centre	Made by	23-Jan-23	12
CONNECTING BEAMS/SLABS Part of the second of t	Section 1	TO EN 1992-1 : 20	004	ANGULAR COLUM	N DESIGN, BENT	ABOUT TWO AXE	S	Checked	Pevicion	Job No.
AATERIALS fck 25 N/mm ² Ys 1.15 Cover to link, C _{nom} 40 mm fck 5000 N/mm ² Yc 1.5 dg 20 mm section 2500 mm . Accle 10 mm section 2500 mm . Y Y Y Y with 2 bars per 350 face Y Y Y Y Y-VAIIS Storey Top Bar Omm L(mm) L(mm) L(m) Remote end CONNECTING BEAK/SLABS Remote end Y-VAIIS Storey Top Bar O Zin Top Vest Doco Zin Zin Y Y-ANIS Zince P Y Top Vest Boottom Rest Doco Zin Y Zin P Zin </th <th></th> <th>Origina</th> <th>ted from TCC53.xl</th> <th>s v4.4 on CD</th> <th>© 2000-</th> <th>23 TCC</th> <th></th> <th>Checked</th> <th>-</th> <th>21173</th>		Origina	ted from TCC53.xl	s v4.4 on CD	© 2000-	23 TCC		Checked	-	21173
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	MATERIALS									
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I. 350 x 250 columns with 4 bars RESTRAINTS Storey Top Btm Y-AXIS 2000 E P Y Y-AXIS 2000 E P Y Top Top Top Top Top Y-AXIS 2000 E P Y Top West 1000 250 6 P Y-AXIS 2000 E P Y Top North 1000 250 6 P Y-AXIS 2750 2419 146 Bottom West 1000 250 4 P Bar Ø Asc % Link Ø 275 Carea 320 Column above? Column above? Column above? Column above? BAR ARRANGEMENTS BAR CENTRES (mm) BAR CENTRES (mm) Bar Ø Column above? Column above? BAR ARRANGEMENTS 3.68 8 122 222 2320 ok B 32 3.68 8 122 222 2320 ok B 16 0.92 8 136 238 150 ok B 12 0.52 8 142 242 1392 ok B 10 S 6 136	an	d <u>2</u>	bars per 350	face			·			
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$\begin{array}{c c c c c c c c c c c c c c c c c c c $	7-AXIS	3000			Υ Υ	l lop West	1000	250	6	P
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Y-AXIS L (mm) L_0 (mm) h_0 (mm) Bottom West Bottom Nest 2750 2470 146 Bottom North Bottom North Bottom North Bar Ø Asc % Link Ø 250 Face 350 Face Nuz (kl) Checks Bar Ø Asc % Link Ø 250 Face 350 Face Nuz (kl) Checks B 32 3.68 8 122 222 2320 ok B 32 2.68 8 122 222 1899 ok B 16 0.92 8 138 238 1510 ok B 12 0.52 8 142 242 1392 ok B 10 8 144 234 1662 ok B 10 8 144 234 1662 ok B 10 8 144 242 1392 ok B 10 56 1 Moments m ₀ at top and bottom of column (from analysis) are combined to find m _{0*} . The moment due to imperfections (e ,N) and the second order moment (M 2) are then added to obtain M _{kel} in the table below. DESIGN Y AXIS </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>Top South</td> <td>1000</td> <td>250</td> <td>± 4</td> <td>P</td>						Top South	1000	250	± 4	P
Y-ANS Z-AXIS 2750 2750 2419 2470 146 Bottom North Bottom North Beam stiffnesses are Column above? Y 70% TO of uncracked stiffness Col below? Y BAR ARRANGEMENTS BAR CENTRES (nm) Bar Ø Asc % Link Ø 250 Face 350 Face Nuz (kN) Checks B32 3.68 8 122 222 2320 ok B 32 3.68 8 122 222 2320 ok B 25 2.24 8 129 229 1899 ok B 16 0.92 8 134 234 1662 ok B 10 25 8 142 242 1392 ok B 10 8 144 244 As or Ø < minimum		L (mm)	L ₀ (mm)	h _o (mm)	E	Bottom West				_
E-MAS Z/20 Z470 Bottom North Bottom North Bottom South Gold uncracked stiffness Column above? Y BAR ARRANGEMENTS BAR CENTRES (mm) BAR CENTRES (mm) of uncracked stiffness Column above? Y Bar Ø Asc % Link Ø 250 Face 350 Face 350 Face Note Name Bar Ø Asc % Link Ø 250 Face 350 Face 350 Face Note Name Checks B 32 3.68 8 122 222 2320 ok B 20 1.44 8 134 234 1662 ok B 16 0.92 8 138 238 1510 ok B 10 Z 0.52 8 142 242 1392 ok LOADCASES AXIAL TOP MOMENTS (kNm) BTM MOMENTS (kNm) Moments m ₀ at top and bottom of column (from analysis) are combined to find m ₆₄ . The moment due to imperfections (e , N) and the second order moment (M $_2$) are then added to obtain M _{Ea} In the table below. DESIGN Y AXIS Z AXIS Critical axis Biaxial Check Equation (5.39) REBAR 1 1.1 35.5 0.3 24.4 <th< td=""><td>Y-AXIS</td><td>2750</td><td>2419</td><td>146</td><td>] [</td><td>Bottom East</td><td></td><td></td><td></td><td></td></th<>	Y-AXIS	2750	2419	146] [Bottom East				
ARC ARRANGEMENTS Asc % Link Ø 200 km South L ZOX of uncracked stiffness Bar Ø Asc % Link Ø 200 cm Nuz (kN) Checks B 32 3.68 8 122 222 2320 Ok B 25 2.24 8 129 229 1899 Ok B 16 0.92 8 138 238 1510 Ok B 10 0.52 8 142 242 1392 Ok LOADCASES AXIAL TOP MOMENTS (kNm) BTM MOMENTS (kNm) Moments m _o at top and bottom of column (from analysis) are combined to find m _{oe} . The moment due to imperfections (e 1/N) and the second order moment (M ₂) are then added to obtain M _{E0} In the table below. 1 5 0.3 24.4 Z 0.024 4 B12 5 1 2 0.3 24.4 Z 0.024 4 B12 2 1 1 35.5 0.3 24.4 Z 0.024 4 B12 6 1 1 1	Z-AXIS	2/50	24/0]	B	ottom North				
Column above? Y Col below? Y BAR ARRANGEMENTS Bar Ø Asc % Link Ø 250 Face Nuz (kN) Checks B 32 3.68 8 122 222 2320 ok B 25 2.24 8 122 222 2320 ok B 16 0.92 8 138 238 1510 ok B 16 0.52 8 142 242 1392 ok B 10 0.52 8 144 244 As or Ø < minimum					D	Beam sti	ffnesses are	70%	of uncracked	stiffness
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bar Ø Asc % Link Ø 250 Face 350 Face Nuz (k) Checks B 32 3.68 8 122 222 2320 ok B 25 2.24 8 129 229 1899 ok B 10 1.44 8 134 234 1662 ok B 16 0.92 8 138 238 1510 ok B 12 0.52 8 142 242 1392 ok B 10 20 8 144 244 As or Ø < minimum	BAR AKKANG	EMENTS	A == 9/		BAR CENT	TRES (mm)				
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Image: b 2 J b 2		2 22	3.68	8	122	222	2320		ok	
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B 12 B 10 0.52 8 142 142 242 242 1392 ok As or Ø < minimum LOADCASES AxiaL TOP MOMENTS (kNm) m _{0y} BTM MOMENTS (kNm) m _{0z} BTM MOMENTS (kNm) m _{0y} Moments m ₀ at top and bottom of column (from analysis) are combined to find m _{0e} . The moment due to imperfections (e ₁ N) and the second order moment (M ₂) are then added to obtain M _{Ed} In the table below. DESIGN MOMENTS Y AXIS Z AXIS Critical Madd Z Biaxial Check Equation (5.39) REBAR 1 35.5 0.3 24.4 Z 0.024 4 B12 2 1 35.5 0.3 24.4 Z 0.024 4 B12 3 4 1 1 35.5 0.3 24.4 Z 0.024 4 B12 3 4 1 1 1 1 1 N = 0 N = 0 3 4 1 1 1 1 1 1 1 1 1	F	3 16	0.92	8	134	234	1510		OK	
B 10B 10B 10As or \emptyset < minimumLOADCASESAxialTOP MOMENTS (kNm) moyBTM MOMENTS (kNm) moyMoments (kNm) moy156	E	3 12	0.52	8	142	230	1392		ok	
LOADCASESAXIAL N (kN)TOP MOMENTS (kNm) moyBTM MOMENTS (kNm) moyMoments (kNm) moy1 2 3 4 5 656 $Moments (kNm)$ moyMoments m_0 at top and bottom of column (from analysis) are combined to find m_{0e} . The moment due to imperfections (e_1 N) and the second order moment (M_2) are then added to obtain M_{Ed} In the table below.DESIGN MOMENTSY AXISZ AXISCritical Med YBiaxial Check Equation (5.39)REBAR1 11.135.50.324.4Z0.0244 B123 4 5 611.135.50.324.4Z0.0244 B121 611.1010N = 0N = 03 4 5 611010N = 03 4 5 61101N = 0N = 04 5 611010N = 03 4 511000N = 03 4 51100N = 0N = 05 611000N = 04 5 6110000	E	3 10		8	144	244	1372	As a	$or \emptyset < minin$	
LOADCASESAXIAL N (kN)TOP MOMENTS (kNm) moyBTM MOMENTS (kNm) moyBTM MOMENTS (kNm) moy $\frac{1}{2}$ $\frac{3}{4}$ $\frac{6}{6}$ 56 56 $Moments m_0 at top and bottom of column(from analysis) are combined to find m_{0e}. Themoment due to imperfections (e_1N) and thesecond order moment (M_2) are then added toobtain M_{Ed} In the table below.DESIGNMOMENTSY AXISZ AXISCriticalMRd ZBiaxial CheckEquation (5.39)REBAR11.135.50.324.4Z0.0244 B12211.135.50.324.4Z0.0244 B12341111111561111111$										
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	LOADCASES	AXIAL	TOP MOM	ENTS (kNm)	BTM MOM	ENTS (kNm)]			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		N (kN)	m _{oy}	m _{oz}	m _{0y}	m _{oz}				
$\frac{2}{3}$ $\frac{4}{5}$ $\frac{5}{6}$ $\frac{1}{1}$ $\frac{1}{35.5}$ $\frac{2 \text{ AXIS}}{3}$ $\frac{2 \text{ AXIS}}{2 \text{ AXIS}}$ $\frac{2 \text{ AXIS}}{2 \text{ AXIS}}$ $\frac{2 \text{ Critical}}{2 \text{ Biaxial Check}}{2 \text{ Biaxial Check}}$ $\frac{1}{1}$ $\frac{1}{35.5}$ $\frac{1}{0.3}$ $\frac{2 \text{ AXIS}}{2 \text{ AXIS}}$	1	<u>56</u>					Momente	m of top	and bettern of	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	<u>∠</u>						(from analy	ing at top t isis) are com	na bolloni oj bined to fina	m. The
$\overline{5}$ 6Second order moment (M_2) are then added to obtain M_{Ed} in the table below.DESIGN MOMENTSY AXISZ AXISCritical axisBiaxial Check Equation (5.39)1 M_{Ed} y M_{Rd} y M_{Ed} z M_{Rd} z $axis$ 1 1.1 35.5 0.3 24.4 Z 0.024 4 B122 $N = 0$ $N = 0$ $N = 0$ $N = 0$ 3 A A A $N = 0$ $N = 0$ 6 $N = 0$ $N = 0$ $N = 0$	<u> </u>						moment d	ue to imper	fections (e , N) and the
\underline{G} obtain M_{Ed} in the table below.DESIGN MOMENTSY AXISZ AXISCritical M _{Ed} ZBiaxial Check Equation (5.39)11.135.50.324.4Z0.0244 B1221.135.50.324.4Z0.0244 B1231.135.50.324.4Z0.0244 B1261.10.31.10.30.30.30.361.10.30.30.30.30.30.310.30.30.30.30.30.30.310.30.30.30.30.30.30.310.30.30.30.30.30.30.320.30.30.30.30.30.30.330.30.30.30.30.30.30.340.30.30.30.30.30.30.350.30.30.30.30.30.30.360.40.40.40.40.40.450.40.40.40.40.40.460.50.40.40.40.40.4							second ord	er moment ((M_2) are then	added to
DESIGN MOMENTSY AXISZ AXISCritical Biaxial Check Equation (5.39)REBAR1 1.1 35.5 0.3 24.4 Z 0.024 4 B1221 1.1 35.5 0.3 24.4 Z 0.024 4 B1231 1.1 35.5 0.3 24.4 Z 0.024 4 B12611 1.1 35.5 0.3 24.4 Z 0.024 4 B121 1.1 35.5 0.3 24.4 Z 0.024 4 B122 $N = 0$ 3 $N = 0$ 5 0.4 0.6 0.7 0.7 0.7	<u>5</u> 6						obt	ain M _{Ed} In t	he table belo	w.
DESIGN MOMENTS Y AXIS Z AXIS Critical axis Biaxial Check Equation (5.39) REBAR 1 1.1 35.5 0.3 24.4 Z 0.024 4 B12 2 1 35.5 0.3 24.4 Z 0.024 4 B12 3 1 1.1 35.5 0.3 24.4 Z 0.024 4 B12 3 1 1.1 35.5 0.3 24.4 Z 0.024 4 B12 3 1 1.1 35.5 0.3 24.4 Z N = 0 4 N N N N N N N 5 N N N N N N N N 6 N N N N N N N N N N N	<u> </u>			· · ·]			
MOMENTS M_{Ed} y M_{Rd} y M_{Ed} z M_{Rd} z axis Equation (5.39) REBAR 1 1.1 35.5 0.3 24.4 Z 0.024 4 B12 2 1 1.1 35.5 0.3 24.4 Z 0.024 4 B12 3 1 1.1 35.5 0.3 24.4 Z 0.024 4 B12 3 1 1.1	DESIGN	YA	XIS	ZA	XIS	Critical	Biaxial	Check		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	MOMENTS	M _{Ed} y	M _{Rd} y	M _{Ed} Z	M _{Rd} Z	axis	Equation	n (5.39)	REBAR	
2 3 4 5 6 N = 0 N = 0	1	1.1	35.5	0.3	24.4	Z	0.0	24	4 B12	
3 N = 0 4 N = 0 5 N = 0 6 N = 0	2						N =	:0		
4 N = O 5 N = O 6 N = O	3						N =	• 0		
5 N = O 6 N = O	4						N =	0		
0 N=0	5						N =	0		
	0				70.0		N =	0		

Project	KINGSTON			6			The C	oncrete	Centre
Client					mpa		Made by	Date	Page
Location	EDGE COLUN SYMMETRICALLY RI	IN TO U/S R	DOF 21	N DESIGN, BENT .	The Cor ABOUT TWO AXE	n <mark>crete</mark> Centre s	Made by	23-Jan-23	13
	TO EN 1992-1 : 200 Originate	ed from TCC53.xls	s v4.4 on CD	© 2000-	23 TCC		Checked	Revision -	Job No 21173
MATERIALS									
fck	25	N/mm²	γs	1.15	Cove	r to link, C _{nom}	40	mm	
fyk	500	N/mm²	γc	1.5		dg	20	mm	
φ	2.2		φef	1.21		Δ _{c day}	10	mm	
SECTION			Steel class	B		C,024			
h	<u>350</u>	mm							
b	250	mm	•						
with	2	bars per 250	face			Y		Y	
and	2	bars per 350	face						
		ie. 3	350 x 250 co	lumns with 4	bars				
RESTRAINTS	Storey	Top	Rtm	1				CL 4 D.C	Remote
	height (mm)	Condition	Condition	Bracod 2	1	b (mm)	h (mm)	SLABS	end
Y-AXIS	3000	F	P	V	Ton Wast	1000	250	L (m)	(F) or (P)
Z-AXIS	3000	F	P	, T	Top Hest	1000	250	<u>0</u> 6	E P
		<u> </u>			Top North	1000	250	4	P
					Top South	1000	250	4	Ē
MANUE	L (mm)	L ₀ (mm)	h _o (mm)	E	Bottom West				
Y-AXIS 7-AXIS	2750	2419	146	6	Bottom East				
27013		24/0	1	B	ottom North attom South				
				D.	Beam sti	ffnesses are	70%	of uncracked	stiffness
					Ca	umn above?	Y	Col below?	Y
DAK AKKANGE	MENIS	Acc 9/	111.0	BAR CENT	RES (mm)				
Dal	27	ASC /	Link Ø	250 Face	350 Face	Nuz (kN)		Checks	
B	JZ 25	5.00 2.74	0	122	222	2320		ok	
B	20	1.4.4	0	129	229	1662		OK	
B	16	0.97	0 8	129	234	1510		OK	
B	12	0.52	8	140	250	1202		OK	
B	10	0.52	8	144	242	1392	Ac	OK OK di di minim	
					277		A5 (
LOADCASES	AXIAL	TOP MOME	NTS (kNm)	BTM MOM	ENTS (kNm)	1			
	N (kN)	moy	m _{oz}	moy	moz				
<u>1</u>	<u>163</u>								
<u>2</u>						Moments	m_0 at top of	and bottom of	column
<u>3</u>						(from analy	isis) are con	ibined to find	m _{0e} . The
<u>4</u>						second ord	er moment i	(M ₂) are ther) and the
<u>5</u>						obt	ain M _{Ed} In t	he table belo	w.
<u>6</u>		L					Lu		
DESIGN	V AV	00						1	
MOMENTS	A Y A		ZA		Critical	Biaxial	Check		
1 1	med y	MRd Y	MEd Z	M _{Rd} Z	axis	Equation	(5.39)	REBAR	
2	5.5	40.0	1.0	32.1	L	0.0	49	4 B12	
3						N =	0		
4						N =			
5						IN = N			
6						N-	0		
l		<u></u>	SEE CHAR	TS ON NFX	T SHEF1		<u> </u>	· · · ·	

	Project Client						((mpa		Th
	Location	EDGE CO	LUMN TO US	1ST FLOO		ANSFER)		The Co	ncrete Centre	Mad
e	UCO.	CIRCULAR COL	UMN DESIGN TO B	N 1992-1 : 2004						Chee
C		Originate	d from TCC54.xls	v4.1	on CD	0	2004-2023 TCC			
MA	TERIALS									
	fcl	< <u>25</u>	N/mm²		γs	1.15	steel	Cover	<u>40</u>	
	fyl	< <u>500</u>	N/mm²		γc	1.5	concrete	dg	20	
	¢) <u>2.81</u>		c	þef	<u>1.43</u>		$\Delta_{c,dev}$	<u>5</u>	
	Steel class	; <u>А</u>							CONNECTI	NG BEAN
DES	IGN SECTION	ИС			RI	ESTRAIN	TS		b (mm)	h (r
	ł	<u>375</u>	mm	I	_ =	<u>3500</u>	mm	Top left	1000	15
	with	<u>6</u>	bars	1	op	P	Pinned	Top right	<u>1000</u>	15
				B	tm	<u>P</u>	Pinned	Bottom left	<u>1000</u>	15
				Brad	ed	Y		Bottom right	1000	15
								Beam st	iffnesses are	e <u>70</u>
RAR	APPANGE	AFNTS						C	olumn above?	ن ،
		Type	Bar (A	Asc 9		Link Ø	Deside	Data on cor	nnecting bea	ms only a T
		Н	40	ASC /0		10	Bar c/c	N _{bal} (KN)	N _{uz} (KN)	4
		Н		0.03 A 27		R R	123.0			
		н	25	7.57		o g	129.5	E011		
		Н	20	171		8	135.6	559.5	2070.0	
		н	16	1.09		8	137.7	5613	1986.9	
		Н	12	0.61		8	139.8	613.5	1802.2	
14.1	3000						for	375 diameter c	olumn, grad	de C25/.
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			٢	M ₀₂ M ₀		MOM	ENT M _{Rd}	(kNm)		Moz
LOA	DCASES	Loadcase	N _{Ed} (kN)	(kNm)	M	ed (kNm)		Loadcase	N _{Ed} (kN)	(kN
		1	878	18 0		25.2	6 H12	4	1	1
moi	ment input	2	1	1 1		1.0	6 H12	5	1	
	ok	3		1 1		10	6 H12	6	- 1	

		Project Title:		Proj. No: 21173
SHEA	Rdesign	Element Title: Localing Asser	isment.	Sheet No: 15
Consulting Civil and S 7 Ashtree Court - Woodsy Close - C Tel Weichel Work - Exercised 2004	Structural Engineers andiff Gale Business Park - Carditt - CF23 8RW - www.shravkhidrover-religion - Theoreman	Des'd by: Date: 28.01.23	Chk'd by:	Date:
REF		INPUT		OUTPUT
	Internel R	C Becim		
	dh	Span = 6m c/c		
		Spacing: 7-2m		
	-	UIS = 1.35 (9.55)+1.5.(0.75)	
		= 14 LW/m2.		
	Forcesa	Continuus Becom (Edge	span)	
		Monet = 0.077 FL = 0.077 (14 x 7	2 = 6) = 6 =	280 KJ.m
	¢	sheer = 0.6 · (14.7	12.6) ,	360 KN -
		Η		

Section design to Eurocode 2 (BS EN 1992-1)

RECTANGULAR BEAMS

Originated from TCC11.xls, v 4.3 on CD © 2003-2010 TCC



INPUT	location	1900x380			Beam type	END SPAN
M	kNm	280.0	fck	25	N/mm ²	$v_{c} = 150$
δ		1.00	fvk	500	N/mm ²	yc = 1.50 ys = 115
span	mm	6000	Steel class	A		$\Delta c_{dev} = 10$
h	mm	380	REBAR	ø	COVER	to main bars
b	mm	1900	Tension	16	40	
gk	kN/m	10.00	Comp'n	20	40	
qk	kN/m	5.00	Side		40	
ψ2 =	0	Roof	brittle par	titions	? NO	
			ľ			
OUTPUT	1900x3	80	•			
Effective depth,	d = 38	0 - 40 - 16/.	2 = 332.0 mi	n		
Neutral axis,	x = [3:	32-V(332 ² -2	2E6x280x1.5	/0.85/1	900/25)]/(0.8 = 41.2 mm
,	(x/d) lir	nit = 0.600	x/da	actual =	= 0.124 ok	
Lever arm,	z = 33.	2 - 0.4 x 41.2	2 = 315.5 > 0	.95d =	315.4 mm	
Tension steel,	As = 2	80.0E6/315	5.4/434.8 = 2	.042 mi	m²	
9.2.1.1 (1)	As min	= 1.3 x 1900) x 380 = 84	1 mm²		
7.3.2 (2)	As cra	ck = 0.4 x 0.	.8 x 3 x 380/	2 x 190	0/500 = 4	72 mm²
for deflection,	As def	= 821 mm²				
	PROVID	DE 11H16 TEN	ISION STEEL	= 2212	mm²	
Service stress,	SLS M	=280 x 15 /	21.0 = 200.0	kNm		$\rho = 300 \text{ N/mm}^2$
	Modific	ation factor	r = 310 /300	.3 = 1.0	32	
	Permis	sible L/d = 1.	032 x 1.000	x 45.49	92 = 46.97	
	Actual	L/d = 6000) /332 = 18.0	7 ok		8
	·					
	•					
	25					

Section design to Eurocode 2 (BS EN 1992-1)

BEAM SHEAR

fck

fywk

6.2.2 (1)

6.2,1 (8)

6.2.2 (1)

9.2.2 (5)

9.2.2 (6)

equation (6.6)

equation (6.9)

equation (6.2)

equation (6.9)

equation (6.7)

INPUT

OUTPUT

Originated from TCC11.xls, v 4.3 on CD © 2003-2010 TCC



ok

ok

PROVIDE 4 legs H10 @ 200

 $V_{Rd,c} = 0.12 \times 1.791$ cube root(0.364 x 25) = 272.7 kN

 $A_{sw}/s \text{ (max)} = 0.5 \text{ x } 1900 / 500 \text{ x } 1.15 \text{ x } 0.540 \text{ x } 16.7 = 19.665 \text{ mm}$

A_{sw}/s = 359.7E3 /(288.0 × 434.8 × 2.50) = 1.149 < 1.520

 $V_{Ed} @ d = 360 - 1 \times 0.32 = 359.7 \text{ kN}$

 $k = 1 + \sqrt{200/320} = 1.791$.

 $A_{sw}/s \text{ (min)} = 0.08 \times 1900 / 500 \times \sqrt{25} = 1.520 \text{ mm}$

 $s_{max,L} = 240 \text{ mm}$ $s_{max,T} = 240 \text{ mm}$

Provide for distance of -11600 mm from support face then nominal links = 4 legs H10 @ 200

9.2.2 (8)

	Project Title: Kingston Bridge	Proj. No: 21173
SHEA	Receipen Element Title: localing Assessment.	Sheet No: 18
Consulting Civil and 7 Add as Civil - Wowey Class - C 54 On 2664 Cont - Kix (Second Cont	Structural Engineers On Desid by: Date: Chkid by: Chkid	Date:
REF	INPUT	OUTPUT
	* 4-Stored Building:	
Refer-to	Lacid at Foundation level.	
Locading table	@Internal - Existing - 39.8 kul/m	
5	- Proposed : 41.2 m/m²	
	- Increcise = 3.5 % < 10%	- ok
	@ Edge - Existing = 47.5 kulu	
	- proposed = 48.4 ku/m²	
	- Increase · 1-9% < 10%	- ok.
Refer to	* 7-Storef Building:	
loady table.	D Internal. Existing = 82% w/m	
	proposed = 79-84 W/m	No Lacara
	(b) Edge Existing = 99.1 W/m	
	proposed = 96.75 in/i	No hereese.

APPENDIX

v) LOADING ASSESSMENT CALCULATIONS -BALCONY PROPOSAL



Contract No:	21173.D041
Date:	AUG 2023
By:	RM

21173 – D041

KINGSTON BRIDGE

RICHMOND - LONDON

STRUCTURAL CALCULATIONS

LOADING ASSESSMENT



DOCUMENT INDEX SHEET

Contract: Kingston Bridge

Project No: 21173

Title: Structural Calculations	Sheets/Page No
Loading Assessment	

Date	Detail of Revision	Rev No
22.08.2023	First Issue	-

Prepared By:	Ragy Mohammed	Checked By:	Mujtaba Al-Hadadd	Authorised By:	Tony Spencer
			CEng, MICE		CEng, MICE
Signed:	R	Signed:	- Steel	Signed:	Alexan
Date of Issue:	22.08.2023				

Par	Project Title:	Proj. No:
	KINGSTON BRIDGE	21173
SHFZ		Sheet No:
Consulting Civil and	Structural Engineers	DG/C
7 Ashtree Court - Woodsy Close - (Tel: 029 2054 7000 - Fax: 029 2054 7001	Cardiff Gate Business Park - Cardiff - CF23 BRW - www.shaer-design.com - englises@enar-design.com & & & & & & & & & & & & & & & & & & &	22/08/2023
REF	INPUT	OUTPUT
	STRUCTORAL LOADING ACCOMENT	
	ETRINCT MRE DUE TO THE PRODUCED BALLANY MADING	ф
	DEGIGN DATA	
	THE BRICONY HAG A PLAN AREA OF 3.7×1.6 m.	
	FRAME THERIAM A CANBUNATION OF ATTEL CHANNE	6
	AND THE RODS (STRUTC) AGOMED TO BE AT A 469	
	ANIGLE.	
	DEAD LOAD:	
	- TIMBER FLOOR DECK - 0.15 EN/MA	
	- STEELLADRY LMULTIBERMOS - 0.50 KN/M2	
	FLOOL FUNISTICS	
	IMPOSED LOAD:	
	- FLOOR (466) PENTIAL) - 1.50 KN/m/	
	BUNK YOA	
	LOADED WANTH $1-5/2 = 0.75m$	
	UPL = 0.76 x _0.80 + 7.5 > = 2.5 KN/M	
	01.000-0.701 (1.00x0.0051 0.0x 1.031-0.7 PM	
	22 101/2	
	acarian ZFV=0	
	TEA VIEW VIEW 2222210	
	D.TIM VINE DITACTUR	
	MmAx = 3.7 x 3.72/8	
	Can DITT IN MENDER THE S. B. BYNM	
	CONTRATING MEMER TOPICO:	
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	T = 7.7 KN TENSION 3	
2	THE THE CASE ATOUTAN ANDET OF	
	ABLE TO TRAVEMIT A TENOU E	
	1 1 6m JB FORLE OF 7.7 KN. THE REGIN	
	65 6.8 ANCHORE CAPACITIES MOET	
	AND AMERD EDOLES.	8
	INNO ALCHIEL LALOPA	

	Project Title:	Proj. No:
	KINGSTON BRIDGE	21178
SHFA		Sheet No:
Consulting Civil and	Structural Engineers Desid by: Date: Chkid by:	Date:
7 Ashtree Court - Woodsy Close - (Tel: 029 2054 7000 - Fax: 029 2054 7001	2ardilf Gate Business Park - Cardilf - CF23 BRW - www.shear-design.com - enquites@shear-design.com	2210812022
REF	INPUT	OUTPUT
	ADDEDDING LOAD ON FOUNDATION	
	NA RESEARCE THE ADDIMONIAL IDAD ON THE	
	FOUNDATIONS DUE TO THE PROPOSED POALLONIES	-
	- SALCANV PLAN AREA - 2 7 X L.K. M.	
	- LOAD ASSIMED TO BE TRANSMITTED TO EDGE	
	SLAR , WHERE IT'S THED TRANSFERRED TO LOWM	25
	SPACED @ 1.5m C/C.	· · · · · · · · · · · · · · · · · · ·
	CENTRALLY ABOUT THE WISTH OF THE BLOCK	
	I.C. 7 M FROM THE PERIMETER COLUMNS.	
	3.7m	
		i
	1.6m BALCONY	
	INDICATIVE ION CONY	
	LONDING	
	DEAD LOAD = 0.35 KN/MA	
	INTOJEU LOVU = IND KNIM	
	EQUIVALENT PREA LOAD IS	
	=>(0.86+1.5) × 3.7 × 1.6 = 13.9 KN	
	ASSUME THE LOAD IS SHUAPED BY TWO LOLUMNS	
	LOAD PER LOLUMIN = 13.9/2 = 7.0 KN	
	THERE ARE THAN RICK TO LATER VARYING MA ATPRICA	
	DH-STOPEY BLOCK	
· · · · · · · · · · · · · · · · · · ·	TOTAL ADDITIONAL LOAD 16	
	$= 7 \ 7 \ 7 \ 7 \ 1 \ 1 \ 1 \ 1 \ 1 \ 1 \$	
	@ 7 - GTOP BLOCK	
	TUTAL ADDITIONAL LAD 6	
	TOX X X X NOT CONTRACT	



110,000	Cc.						The Concrete Centre		Centre
Client					mpa		Made by	Date	Page
Location					The Con	crete Centre	Made by	22-Aug-23	BC/04
	SYMMETRICALLY RE TO EN 1992-1 : 2004	INFORCED RECTA	NGULAR COLUMN	DESIGN, BENT A	BOUT TWO AXES		Checked	Revision	lob No
	Originate	d from TCC53.xls	v4.4 on CD	© 2000-22	3 ТСС		RM	-	21173
00000	5								
MATERIALS									
fck	<u>25</u>	N/mm²	γs	1.15	Cover to	o link, C _{nom}	<u>40</u>	mm	
fyk	<u>500</u>	N/mm²	үс	1.5		dg	<u>20</u>	mm	
φ	<u>2.2</u>		φef	1.21		$\Delta_{c,dev}$	<u>10</u>	mm	
SECTION			Steel class	<u>B</u>					
h h	<u>350</u>	mm	•						
b	250	mm	•			V		V	
with	<u>∠</u> 2	bars per 250	face			<u> </u>		Y	
anu	<u> </u>	ie. 350	x 250 colur	mns with 4 b	ars				
									Remote
RESTRAINTS	Storey	Тор	Btm			CONNECTI	NG BEAMS/	SLABS	end
	height (mm)	Condition	Condition	Braced ?		b (mm)	h (mm)	L (m)	(F) or (P)
Y-AXIS	<u>3000</u>	<u>F</u>	<u>P</u>	<u>Y</u>	Top West	<u>1000</u>	<u>250</u>	<u>6</u>	<u>P</u>
Z-AXIS	3000		<u> </u>	<u>Y</u>	Top East	<u>1000</u> 1000	<u>250</u> 250		P P
					Top South	1000	250	$\frac{1}{4}$	<u>-</u> P
	L (mm)	L₀ (mm)	h₀ (mm)	B	ottom West				
Y-AXIS	2750	2419	146	E	Bottom East				
Z-AXIS	2750	2470		Bo	ottom North				
				DC	Beam stiff	nesses are	<u>70%</u>	of uncracke	d stiffness
					Colu	mn above?	<u>Y</u>	Col below?	<u>Y</u>
BAR ARRANGE	MENTS			BAR CENT	RES (mm)				
Dam	a	Acc 0/-	1201.0			Nuz (kN)			
Bar	Ø	Asc %	Link Ø	250 Face	350 Face	Nuz (kN)		Checks	
Bar B B	Ø 32 25	Asc % 3.68 2.24	Link Ø 8 8	250 Face 122 129	350 Face 222 229	Nuz (kN) 2320 1899		Checks ok	
Bar B B B	Ø 32 25 20	Asc % 3.68 2.24 1.44	Link Ø 8 8 8	250 Face 122 129 134	350 Face 222 229 234	Nuz (kN) 2320 1899 1662		Checks ok ok ok	
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Bar B B B B B	Ø 32 25 20 16 12 10	Asc % 3.68 2.24 1.44 0.92 0.52	Link Ø 8 8 8 8 8 8 8	250 Face 122 129 134 138 142 144	350 Face 222 229 234 238 242 244	Nuz (kN) 2320 1899 1662 1510 1392	As o	Checks ok ok ok ok ok or Ø < minin	num
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Bar B B B B LOADCASES	Ø 32 25 20 16 12 10 AXIAL N (kN) <u>62</u>	Asc % 3.68 2.24 1.44 0.92 0.52 TOP MOME m _{0y}	Link Ø 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	250 Face 122 129 134 138 142 144 BTM MOME m _{0y}	350 Face 222 229 234 238 242 244 244 SNTS (kNm) m _{0z}	Nuz (kN) 2320 1899 1662 1510 1392 Moments (from anal	As o s m o at top o ysis) are con	Checks ok ok ok ok or Ø < minin	num f column d m _{0e} . The
Bar B B B B LOADCASES $\frac{1}{2}$ $\frac{3}{4}$	Ø 32 25 20 16 12 10 AXIAL N (kN) <u>62</u>	Asc % 3.68 2.24 1.44 0.92 0.52 TOP MOME m _{0y}	Link Ø 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	250 Face 122 129 134 138 142 144 BTM MOME m _{0y}	350 Face 222 229 234 238 242 244 SNTS (kNm) m _{0z}	Nuz (kN) 2320 1899 1662 1510 1392 Moments (from anal moment of	As o s m o at top o ysis) are con due to imper	Checks ok ok ok ok ok or Ø < minin	num f column d m _{oe} . The I) and the
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Bar B B B B LOADCASES <u>1</u> 2 3 4 5 6	Ø 32 25 20 16 12 10 AXIAL N (kN) <u>62</u>	Asc % 3.68 2.24 1.44 0.92 0.52 TOP MOME m _{0y}	Link Ø 8 8 8 8 8 8 8 8 8 8 8 8 8 8 7 7 7 8 7 8 7 8 7 8 7 8	250 Face 122 129 134 138 142 144 BTM MOME m _{0y}	350 Face 222 229 234 238 242 244 XNTS (kNm) m _{0z}	Nuz (kN) 2320 1899 1662 1510 1392 Moments (from anal moment of second ord obs	As o s m ₀ at top o ysis) are con due to imper der moment tain M _{Ed} In t	Checks ok ok ok ok ok or Ø < minin and bottom o nbined to find fections (e 1 N (M 2) are thei he table belo	num f column d m $_{0e}$. The l) and the n added to ow.
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Bar B B B B B LOADCASES 1 2 3 4 5 6 DESIGN	Ø 32 25 20 16 12 10 AXIAL N (kN) <u>62</u>	Asc % 3.68 2.24 1.44 0.92 0.52 TOP MOME m _{0y}	Link Ø 8 8 8 8 8 8 8 5NTS (kNm) m _{0z}	250 Face 122 129 134 138 142 144 BTM MOME m _{0y}	350 Face 222 229 234 238 242 244 CNTS (kNm) m _{0z}	Nuz (kN) 2320 1899 1662 1510 1392 Moments (from anal moment of second orce obsections Biaxia	As of at top of a top	Checks ok ok ok ok ok or Ø < minin and bottom o nbined to find fections (e 1 N (M 2) are thei he table belo	num f column d m $_{0e}$. The l) and the n added to ow.
Bar B B B B B B B B B B B B B B B B B B	Ø 32 25 20 16 12 10 AXIAL N (kN) <u>62</u> Y AX M _{Ed} y	Asc % 3.68 2.24 1.44 0.92 0.52 TOP MOME m _{0y} KIS M _{Rd} y	Link Ø 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	250 Face 122 129 134 138 142 144 BTM MOME m _{0y}	350 Face 222 229 234 238 242 244 Critical axis	Nuz (kN) 2320 1899 1662 1510 1392 Moments (from anal moment of second ord obs Biaxia Equatio	As of A_{Ed} at top of A_{Ed} at top of A_{Ed} and A_{Ed} in the train M_{Ed} in the train M_{Ed} in the train M_{Ed} in the train A_{Ed} is the train A_{Ed} in the train A_{Ed} in the train A_{Ed} is the train A_{Ed} in the train A_{Ed} in the train A_{Ed} is the train A_{Ed} in the train A_{Ed} is the train A_{Ed}	Checks ok ok ok ok ok or \emptyset < minin and bottom of holined to find fections (e_1N (M_2) are the the table belo	num f column d m _{0e} . The I) and the n added to pw.
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APPENDIX

vi) CONCEPTUAL BALCONY DRAWINGS



D2B[®] Canopee





Inventing smarter steels for a better world

Inspiring Smarter Building

construction.arcelormittal.com



66 A balcony for a new outdoor living space

D2B[®] Canopee

Prefabricated lightweight balcony system

The presence of a balcony or terrace is certainly one of the most sought-after features when it comes to adding value to a property. Having an outdoor space has become an essential part of modern-day living. The larger the terrace, the higher the value it will add.

ArcelorMittal Construction is proud to be able to offer a new range of outdoor spaces with the launch of D2B[®] Canopee, a new lightweight prefabricated balcony system allowing for quick installation at new-build residences and as part of the rehabilitation of occupied sites.

The balconies are attached to the façade by a series of stainless steel tie rods positioned behind the guardrail. The underside of the balcony, visible from the lower floors, is made of highly durable pre-painted steel. Available in a wide variety of colours. Thanks to its lightweight design, the D2B[®] Canopee can be used to create terraces up to 3m in depth and 6m in length.

Quick and easy installation



Accessibility for people with reduced mobility

regulations in force.

Fire stability

In order to reduce the environmental footprint of your buildings, we offer a balcony solution that has no impact on the thermal calculation of the ensemble, with a self-stable hot-dip galvanised steel framework quaranteed for 20 years and made from entirely recycled steel. The terrace is finished with wooden decking from sustainable and certified forest management.



1 Top plate

- 2 Stainless steel tie rod
- **3** Rainwater drainage
- **4** Fireproof panel
- **5** Galvanised pre-painted UPE frame
- 6 Magnelis[®] multibeam
- 7 Wooden decking
- 8 Guardrail



5







A modern aerial design for a breathtaking view

Thanks to this new ultra-light prefabricated design, the installation does not require any foundations or ground-intrusive frameworks. The system allows for the easy installation of the quardrails chosen by the architect, which will be mounted on the ground before the finished balcony is lifted by means of the rings provided for this purpose and attached to its final attachment points.

> The D2B[®] Canopee is designed to meet accessibility requirements with a maximum threshold projection of 20mm, in accordance with the

Our balcony-terraces can be used with up to fourth family buildings. The non-combustible structural components are all A2-s1,d0 classified (EN 13501-1).

Rainwater runoff

The D2B[°] Canopee ensures the waterproofing of the terrace and invisibly incorporates a rainwater drainage system via vertical collectors. Rainwater collection is therefore a possibility.

A safer, more sustainable world

D2B[®] Canopee

ArcelorMittal Constructio