Legend

1 Noise Sensitive Receptor Locations (External to Site)

N

0 100m

CASCADE

Note: All locations are approximate

Drawing Source: HoK Number SK-042

Project Title:

Richmond Education and Enterprise Campus Development

Figure Title:

Noise Sensitive Receptor Locations (External to Site)

For Information Only

Figure Number:	Date:
Figure 9.2	June 2015

Legend

S1 Noise Receptor Locations (Internal to Site)

N

0 100m

CASCADE

Note: All locations are approximate

Drawing Source: HoK Number PL-17

Project Title: Richmond Education and Enterprise Campus Development

Figure Title: Noise Sensitive Receptor Locations (Internal to Site)

For Information Only

Figure Number: Figure 9.3

Date: June 2015

9.7 IMPACT ASSESSMENT

9.7.1 This section describes the results of the construction and operational noise and vibration calculations carried out at the noise sensitive receptors, as well as mitigation measures, where required, and the residual effects

Site Enabling, Demolition and Construction

Introduction

9.7.2 Detailed construction noise levels have been calculated at each of the identified noise sensitive receptors surrounding the Site, at positions 1-11. The phasing information presented in **Appendix 6.1** was used to provide detailed information on each stage of the construction programme. Lists of plant and construction equipment have been assumed for each activity as well as information on the likely usage of each item of plant. A summary of this information is shown in **Appendix 9.2**.

Predicted Effects

9.7.3 The construction (and demolition) noise levels were calculated at each sensitive receptor according to the methodology of BS5228. For each construction activity, source noise levels and percentage on-times were allocated to each item of plant. Using this information, noise levels were calculated at each receptor position, taking account of distance attenuation and intervening screening according to BS5228. The calculations were for the worst day in each three month period during which each particular activity was taking place.

9.7.4 The table shows the calculated noise levels at each receptor external to the Site (as listed in **Table 9.9**) for each 3 month period throughout the construction programme. These results are summarised in **Table 9.11**. The table also shows the significance of the levels according to the criteria defined in **Table 9.1**.

Table 9.11: Predicted Noise Levels and Assessment of Effects for Each Three Month Period of Construction at Noise Sensitive Receptors 1-11

	2015	2016				2017				2018				2019			
Cumulative Level at Positions	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**
1	68	68	66	66	66	66	66	67	54	52	52	52	65	65	65	65	65
2	73	73	72	72	72	72	72	72	58	57	57	57	55	52	52	53	52
3	75	75	72	72	72	72	72	72	64	57	57	57	59	58	58	61	58
4	61	61	63	63	63	63	63	63	68	68	68	68	54	51	51	55	51
5	53	53	62	62	62	62	62	62	72	72	72	72	55	52	52	60	52
6	47	47	46	46	46	46	46	58	54	52	52	52	51	48	48	51	48
7	51	51	51	51	51	51	51	62	76	76	76	76	60	59	59	62	59
8	53	53	50	50	50	50	50	56	72	71	71	71	78	76	76	76	76
9	54	54	53	53	53	53	53	54	71	61	61	61	72	70	70	70	70
10	53	53	46	46	46	46	46	47	60	55	55	55	62	61	61	61	61
11	45	45	44	44	44	44	44	54	52	49	49	49	49	47	47	48	47

Minor		Over 55dB and >3dB above ambient for less than 8 weeks
Moderate		Over 55dB and >3dB above ambient for more than 8 weeks
Major		Over 55dB and >10dB above ambient for more than 8 weeks

9.7.5 The results show **negligible** effects at positions 1 (31 Talma Gardens), 6 (71 Craneford Way), 10 (8 Gladstone Avenue), and 11 (20 Heatham Park). There are likely to be longer periods of **moderate** to **major adverse** effects occurring at positions 2 (33 Egerton Road), 3 (9 Egerton Road), 4 (78 Heathfield South), 5 (96 Court Way), 7 (78 Craneford Way), 8 (148 Craneford Way), and 9 (1 Challenge Court). It must be noted that these effects represent a worst day within the three month period and do not signify the effect lasting for the whole of each period. It is envisaged that there would be no need for piling (see Section 6.4 in Chapter 6), however, in the even that piling is required, continuous flight augur piling has been included in the calculations in order to cater for a worst case noise impact assessment.

9.7.6 Construction noise levels were also calculated at the receptors inside the site described in **Table 9.10**, for the phases of development likely to cause significant disturbance. The results are shown in **Table 9.12**

Table 9.12: Predicted Construction Noise Levels at Sensitive Receptors Within the Development Site

Receptor	Location	Affected by	Predicted Level
S1	South façade of College	1d demolition	68.5
		2a Construction	75.4
		2b Construction	61.7
		2d Demolition	75.4
		3a Construction	74.5
		3b Construction	60.8
S2	West façade of School	1d demolition	73.2
		2a Construction	67.3
		2d Demolition	65.2
		3a Construction	60.8
		3b Construction	62.5
S3	South/west façade of SEN	1d demolition	76.1
		2a Construction	69.6
		2b Construction	73.2
		2d Demolition	75.8
		3b Construction	67.6
S4	South façade of Sports	2b Construction	63.6
		2d Demolition	80.6
		3b Construction	70.0
S5	West end of Residential	2d Demolition	76.1
		3b Construction	76.7
S6	North façade of STEM	2d Demolition	76.1
		3a Construction	72.0

9.7.7 With respect to receptors within the development Site, **Table 9.12** shows high levels of construction noise at occupied new buildings during later phases of the site development. All buildings will be constructed with a façade sound reduction of at least 30dB (as explained later in operational noise effects). This reduction can therefore be applied to the predicted construction noise levels, resulting in internal noise levels ranging from 30 to 50dB(A). The design guide for educational and residential buildings during daytime is 35dB(A) but levels of up to 40dB(A), while not ideal, would probably be acceptable for a temporary noise source. Thus where external noise levels exceed 75dB(A), disturbance is likely to occur.

9.7.8 The significance of the effect would be described as **minor adverse** for external construction noise levels of 75 to 80dB(A) and **moderate adverse** for noise levels over 80dB(A). Thus at receptor S2 the effect would be **moderate adverse** and **minor adverse** at all remaining receptors.

Vibration

9.7.9 Vibration from demolition and construction activities is generally estimated on the basis of historical data. Piling and compaction works tend to produce the highest levels of vibration during construction. Levels of vibration can be estimated in accordance with Appendix C of BS5228 Part 4 which provides summaries of historical measurements of vibration taken during various types of piling operations.

9.7.10 This section provides a preliminary assessment in the event piling is required. Vibration levels from continuous flight augur piling at a distance of 10m would vary between 0.45 and 1.1mm/s Peak Particle Velocity (PPV). This would be expected to attenuate to less than 0.5mm/s PPV at the nearest property distance of 30m. Thus according to the criteria of **Table 2.5** in Chapter 2, vibration impact would be minor adverse at positions 2 (33 Egerton Road), 3 (9 Egerton Road), 7 (78 Craneford Way) and 8 (148 Craneford Way). Piling is not currently anticipated to be required (see Section 6.4 in Chapter 6) for the REEC development and is not considered further. Other sources of construction vibration would be unlikely to be perceptible at the nearest receptors thus the effect would be **negligible**.

Construction Traffic

9.7.11 Construction traffic generated during the works will cause an increase in flows on local roads and consequently, a potential increase in noise. A traffic assessment has been carried out, as described in Chapter 8 – Transport. Data has been supplied on baseline flows, the likely increases in traffic by 2019 and the additional construction traffic. This included information on the percentages of HGVs and average road speeds to enable the calculation of traffic noise levels according to CTRN[14]. The peak construction traffic occurs during Phase 3 in 2019.

9.7.12 The traffic data and basic noise levels were calculated at 10m from the roadside, a distance typical of residential property. The results of traffic noise calculations during construction are shown in **Table 9.13** alongside the likely effects.

[14] *'Calculation of Road Traffic Noise'* Department of Transport, 1989.

Table 9.13: Predicted Traffic Noise Level Changes due to Construction

Location	18 Hour traffic flows				Predicted Noise Level*		Change dB	Effect
	Cumltv 2019	%HGV	2019 Cumltv+ Construction	%HGV	Cumltv 2019	2019 Cumltv + Construction		
Chertsey Road	46975	11.8	47023	11.9	75.4	75.4	0	Negligible
Whitton Road	10451	8.0	10459	8.1	68.1	68.1	0	Negligible
Court Way	1043	5.3	1043	5.3	57.3	57.3	0	Negligible
Langhorn Drive	2433	20.6	2481	22.1	64.1	64.3	+0.2	Negligible

*$L_{A10,18hr}$ dB

9.7.13 Although traffic flows will increase during construction the changes would be less than 3dB thus impacts are likely to be **negligible**.

Mitigation Measures

9.7.14 During construction measures will be adopted to keep noise and vibration to a minimum in accordance with best practicable means, as defined in Section 72 of Control of Pollution Act. No noisy plant will be allowed to commence work before 08.00 hours or continue working after 18.00 hours, Mondays to Fridays and between 08.00 hours and 13.00 hours on Saturdays, except in cases of emergency where safety is an issue, or as agreed under a dispensation to a Section 61 agreement of the Control of Pollution Act.

9.7.15 All plant brought on-site will comply with the relevant EC / UK noise limits applicable to that equipment or will be no noisier than would be expected based the noise levels quoted in BS 5228:1997. Plant will be properly maintained and operated in accordance with manufacturer's recommendations. Electrically powered plant will be preferred, where practicable, to mechanically powered alternatives.

9.7.16 Where feasible, all stationary plant will be located so that the noise effect at all occupied residential and commercial properties is minimised and, if practicable, every item of static plant when in operation will be sound attenuated using methods based on the guidance and advice given in BS 5228.

9.7.17 Areas of the Site where particularly noisy works are required, such as demolition and piling works, will be surrounded where practicable by a 2.4m hoarding, and will provide some acoustic shielding at ground level. Piling is not currently anticipated to be required. The hoarding will consist of plywood sheets or similar, with all knotholes, cracks and other joints sealed to minimise the escape of noise. It may be moved from time to time to suit the progress of the works. Typical locations are shown in **Figure 9.4**.

Legend

- Phases 1b and 1c
- Phases 1e and 2b
- Phases 2d and 3b

N

0 100m

CASCADE

Note: All locations are approximate

Drawing Source: HoK Number PL-17

Project Title:
Richmond Education and Enterprise Campus Development

Figure Title:
Suggested Locations of Site Hoardings During Phases of Construction

For Information Only

Figure Number:	Date:
Figure 9.4	June 2015

9.7.18 Residents living in locations identified as noise sensitive receptors will be kept informed of the progress of the construction works and will be contacted by letter prior to any activities which are likely to cause noise disturbance.

9.7.19 The above measures will be included within the Outline CEMP (see **Appendix 5.1**) which is designed to mitigate the likely noise and vibration effects on nearby noise sensitive premises.

9.7.20 Prior to the commencement of work on Site, a Section 61 agreement under the Control of Pollution Act[15] may be required. If necessary, this will confirm the noise limits, in line with the target noise levels, set out hours of working, and give further detail on the types of construction activity that may be undertaken. The Section 61 agreement would also set out a dispensation procedure under which consent can be applied for to carry out works which it is considered will exceed the agreed noise and vibration limits or must occur at times when such work is otherwise not approved. Such dispensations will be applied for where there are good engineering, safety or practical reasons for undertaking the works at these times.

Residual Effects

9.7.21 The effect of the mitigation measures and the site hoardings would be to reduce the predicted construction noise levels, as shown in **Table 9.11**, to the levels shown in **Table 9.14**.

[15] Control of Pollution Act 1974

Table 9.14: Predicted Noise Levels and Assessment of Effects for Each Three Month Period of Construction after Mitigation and Installing Site Hoardings

Cumulative Level at Positions	2015	2016				2017				2018				2019			
	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
1	68	68	66	66	66	66	66	67	54	52	52	52	65	65	65	65	65
2	63	63	62	62	62	62	62	62	56	53	53	53	55	52	52	53	52
3	65	65	62	62	62	62	62	62	64	55	55	55	59	58	58	61	58
4	56	56	53	53	53	53	53	54	61	58	58	58	54	51	51	55	51
5	53	53	52	52	52	52	52	54	65	62	62	62	55	52	52	60	52
6	47	47	46	46	46	46	46	58	54	52	52	52	51	48	48	51	48
7	51	51	51	51	51	51	51	62	68	66	66	66	57	54	54	60	54
8	53	53	50	50	50	50	50	56	67	61	61	61	68	66	66	66	66
9	54	54	53	53	53	53	53	54	62	57	57	57	62	60	60	61	60
10	53	53	46	46	46	46	46	47	60	55	55	55	62	61	61	61	61
11	45	45	44	44	44	44	44	54	52	49	49	49	49	47	47	48	47

Minor	Over 55dB and >3dB above ambient for less than 8 weeks
Moderate	Over 55dB and >3dB above ambient for more than 8 weeks
Major	Over 55dB and >10dB above ambient for more than 8 weeks

9.7.22 Thus the site hoardings would considerably reduce the noise impact at the external receptors, with **negligible** effects at positions 1 (31 Talma Gardens), 2 (33 Egerton Road), 4 (78 Heathfield South), 6 (71 Craneford Way), 9 (1 Challenge Court), 10 (8 Gladstone Avenue), and 11 (20 Heatham Park). **Moderate adverse** effects would be likely at positions 3 (9 Egerton Road), 5 (96 Court Way), 7 (78 Craneford Way) and 8 (148 Craneford Way) but for much shorter time periods.

9.7.23 Construction noise at receptors within the development site would be mitigated using site hoardings located close to the nearest works. This would be effective in reducing noise at ground and possibly first floor levels but would have little effect at higher floors. It must be remembered, however, that the predicted levels represent a worst case where activities are taking place at the closest approach to the receptors, thus the highest noise levels would occur for a relatively short time within the relevant construction phase. The effects for internal receptors would therefore be **negligible** at rooms on the ground and first floor levels but would remain as **minor to moderate adverse** within rooms at higher floor levels.

Monitoring

9.7.24 If required, low vibration piling methods will be used and impacts are likely to be

minor adverse as shown above, however, monitoring should be carried out when piling activities take place at the closest approach to sensitive properties. Noise monitoring is not considered necessary unless complaints are received by the contractor or local authority, in which case levels should be measured in order to establish the cause of any deviation from the predicted levels.

Operation

Introduction

9.7.25 Once the construction is complete and the site becomes operational, the main sources of noise that would affect the users of the site would be due to road traffic and aircraft using Heathrow, much the same as at present. The site operation is likely to generate noise levels very similar to existing levels resulting in insignificant change to levels experienced by existing sensitive receptors.

Predicted Effects

Site users

9.7.26 The educational buildings would be designed to the acoustic performance standards required by BB93. This means that internal ambient noise levels should not exceed $L_{Aeq,30min}$ of 35dB for typical classrooms and maximum noise levels (e.g. due to aircraft) should not exceed $L_{A1,30min}$ 55dB.

9.7.27 The commercial (Tech Hub) and residential buildings would be designed to meet the acoustic standards of BS8233. Thus ambient noise levels inside offices should not exceed $L_{Aeq,T}$ 40dB, where T is the period of occupation. Noise levels inside residential living rooms should not exceed $L_{Aeq,16hr}$ 35dB and should not exceed $L_{Aeq,8hr}$ 30dB in bedrooms at night.

9.7.28 Thus the baseline noise measurements can be used to determine the minimum sound insulation of the building facades needed to meet the required standards, as shown in **Table 9.15**.

Table 9.15: Minimum Façade Sound Insulation to Meet Required Noise Criteria Inside Buildings

Building	External Noise Level	Internal Noise Level Standard	Minimum Façade sound Insulation
		dB	dB
Educational	$L_{Aeq,30m}$ 69dB	35	34
	$L_{A1,30m}$ 84dB	55	29
Commercial	$L_{Aeq,T}$ 69dB	40	29
Residential	$L_{Aeq,16h}$ 64dB	35	29
	$L_{Aeq,8h}$ 58dB	30	28

9.7.29 The northern facade of the Tech Hub is affected by higher levels of traffic noise from the A316, at 69dB, and this would require a sound reduction of 29dB. The northern facade of the College building is also affected by traffic noise from the A316, at 69dB, and would require a sound reduction of 34dB. These sound insulation standards would ensure that the effects on internal receptors are **negligible**.

Existing Sensitive Receptors

9.7.30 The increases in operational traffic noise have been determined and are shown in **Table 9.16**. This shows the likely change of noise levels due to traffic generated by the development in the design year of 2034.

Table 9.16: Operational Traffic Noise Levels

Location	18 Hour traffic flows				Predicted Noise Level*		Change dB	Effect
	Cumltv 2034	% HGV	2034 Cumltv+ Development	% HGV	Cumltv 2034	2034 Cumltv + Development		
Chertsey Road	50497	11.5	52354	11.5	75.6	75.8	+0.1	Negligible
Whitton Road	11206	8.0	11501	7.8	68.4	68.4	0	Negligible
Court Way	1122	5.3	998	5.0	57.6	57.1	-0.5	Negligible
Langhorn Drive	2616	20.6	4446	13.5	64.4	65.5	+1.1	Negligible

9.7.31 It is clear that changes in traffic noise levels would have **negligible** effect on sensitive receptors. Noise from fixed plant, such as mechanical ventilation plant, would be designed to ensure that the effects are negligible according to the criteria in

Chapter 2, **Table 2.5**.

9.7.32 The potential effect of increased noise from sports activities on properties in Craneford Way and Heatham Park has also been assessed. There are no established criteria or methodologies for assessing the impact of noise from sports activities. Thus an assessment has been made by comparing predicted sports noise with baseline levels.

9.7.33 Noise from sports activities has been assessed using reference data on noise generated by typical senior football and hockey games. Results for both sports across a number of sites gave a reasonably consistent average noise level of L_{Aeq1hr} 60dB, within a range of 2dB, as measured at a distance of 10m from the edge of the pitch. Details of the measurements are given in **Appendix 9.3**. Average maximum noise levels were L_{Amax} 75dB at 10m.

9.7.34 Considering the properties on Craneford Way facing the playing fields, the baseline daytime L_{Aeq} was 61dB with maximum levels of 81dB due to aircraft. The sports activities would give L_{Aeq} 57dB and L_{Amax} 69dB. Both levels are lower than the baseline and would not be expected to cause significant noise impact. However, noise from shouting, even at a lower level than that of aircraft, can cause disturbance to nearby residents due to the nature of the noise and would be audible during gaps between aircraft movements.

9.7.35 Considering the properties on Heatham Park the baseline daytime L_{Aeq} was 50dB with maximum levels of 67dB due to aircraft. The sports activities would give L_{Aeq} 53dB and L_{Amax} 68dB. The sports noise would therefore be above the baseline daytime level and could potentially cause disturbance, however, account should be taken of noise from existing use of the sports field which is closer to the properties than the new pitch, giving L_{Aeq} 59dB and L_{Amax} 73dB during a typical game.

9.7.36 Thus while the new pitches are likely to result in lower noise levels than the existing pitches, there would be a greater intensification of use of the new pitches and noise levels would be above ambient levels.

9.7.37 The noise impact would be assessed as **minor** to **moderate adverse** when considering the change of noise level.

Mitigation Measures

9.7.38 **Table 9.15** shows the façade sound reduction needed to achieve satisfactory noise levels inside the proposed buildings. Sound insulation values of 26-34dB are not difficult to achieve using standard construction methods, however, as the dominating noise source is from aircraft all facades of all buildings will be affected. This has

important implications for window design as the maximum sound reduction through an open window being used for ventilation purposes, is 15dB. Thus windows would need to remain closed to meet the required noise standards and alternative methods of ventilation considered for all buildings.

Noise from fixed plant that may affect existing sensitive receptors and internal receptors would be controlled by specifying plant with low noise emission and would be properly attenuated by the use of acoustic enclosures, local screening and silencers, ensuring that effects are **negligible**.

9.7.39 If mitigation of the sports noise was to be considered then a 2m noise barrier at the boundary of the field with the properties, could be considered subject to consultation with residents. This would reduce noise levels in the garden areas of the properties, by approximately 8dB, to below the baseline level and the impact would be assessed as **minor adverse** to **negligible**.

Residual Effects

9.7.40 Façade design mitigation measures would be designed and developed to achieve acceptable ambient noise levels inside all proposed buildings. Based on the implementation of these measures the residual effect of noise on the internal receptors of the proposed development is deemed to be of **negligible** significance.

9.7.41 Mitigation to fixed mechanical plant will be designed to meet criteria ensuring that noise effects on existing sensitive receptors and on internal receptors would be of **negligible** significance.

9.7.42 Effects of operational traffic noise on users of the site and on existing sensitive receptors are predicted to be of **negligible** significance and no mitigation would be required.

9.7.43 Effects of noise from sports activities on the College playing fields south of Craneford Way affecting existing sensitive receptors could be adequately mitigated to ensure that residual effects are of **minor to negligible** significance.

9.8 SUMMARY OF RESIDUAL EFFECTS

9.8.1 A summary of residual effects is given in **Table 9.17**.

Table 9.17: Summary of Residual Effects

Issue	Likely Predicted Effect	Mitigation Measures	Likely Residual Impact
Site Enabling, Demolition and Construction			
Construction Noise Enabling	Negligible to Major Adverse	Measures in CEMP	Negligible to Moderate Adverse
Construction Noise Phase 1 (2015-2017)	Negligible to Major Adverse	Measures in CEMP	Negligible to Moderate Adverse
Construction Noise Phase 2 (2017-2018)	Negligible to Major Adverse	Measures in CEMP	Negligible to Moderate Adverse
Construction Noise Phase 3 (2018-2019)	Negligible to Major Adverse	Measures in CEMP	Negligible to Moderate Adverse at 3 positions
Construction noise on internal receptors	Minor to Moderate adverse	Use of site hoardings	Negligible (ground floor); Minor to moderate adverse otherwise
Construction Vibration All Stages	Negligible	None	Negligible
Construction Traffic Noise	Negligible	None	Negligible
Operation			
Operational noise on internal receptors	Negligible	None	Negligible
Operational Traffic Noise	Negligible	None	Negligible
Operational Sports Noise	Minor to Moderate adverse	Screening	Minor adverse to Negligible

9.9 CUMULATIVE EFFECTS ASSESSMENT

Site Enabling, Demolition and Construction

9.9.1 No cumulative site enabling, demolition and construction effects have been identified.

Operation

9.9.2 No cumulative operation effects have been identified.

Mitigation

9.9.3 No mitigation measures are required.

Residual Effects

9.9.4 No residual effects have been identified.

9.10 SUMMARY AND CONCLUSION

9.10.1 The noise and vibration assessment has established that the main effects arising from the REEC development would be during the construction phase. Temporary **moderate adverse** effects are likely to remain after mitigation, at the rear of properties on Craneford Way on the southern boundary of the site during the Phase 2 demolition and Phase 3 construction. The same effects are likely to occur at properties near the eastern site boundary on Egerton Road during Phase 1 demolition and construction.

9.10.2 It should be emphasised that the construction noise calculations show the cumulative effect of the worst day of each activity within each three month period. The probability of all worst days occurring simultaneously is very low, thus for most of the time levels will be below the predicted levels. Construction noise impacts would be mitigated by measures described in the Outline CEMP (see **Appendix 6.1**) which includes the use of hoardings.

9.10.3 Construction vibration, noise from construction traffic and operational traffic noise and vibration were found to be of negligible significance. Noise from sports activities on the College playing fields south of Craneford Way was found to be of **minor** significance if mitigation is employed.