

# VAULTED CEILINGS

*SOLUTION GUIDE*



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# GLOSSARY

## Air stratification

&52 1 6A6 OA9F276 4 <3- 8 12=2; 12; A<; 6@  
A2: =2?- AB?2 O?2- A6 4 - C2?A6- 9A2: =2?- AB?2  
4?- 16; A 3<: 0<<9A< D- ?.

## HVAC

I 2- A6 4 ( 2; A6 A6; -; 1 8' <; 1 6<; 6 4  
6@0<; O2?; 21 D 65 A52 =?<C66<; <3A52?; - 9  
O<; 3-?A6 / B6 6 4@

## Radiant cooling

&52 ?2: <C- 9<352- A3<: - @=- O2 1B2 A< A52  
- OA6<; <3A52?; - 9?- 16 A6<; ?2>B66 4 9 2 <3  
645A 9.D @D 69<OOB? 3<: </ 2OA@- @9<; 4  
- @A528 A2: =2?- AB?2 ?2: - 6 @- / <C2 A5- A<3  
<A52?2?2: 2; A@

## Thermal mass

&52 - / 6AF <3: - A2?6 9A< - / @<?/ @A<?2 -; 1  
?2?2- @2 52- A

## Reflectance

\* 2fi; 2@- : - A2?6 9@- / 6AF A< ?2fi20A@<9?  
2; 2?4F 6 6@- 9< 0<: : <; 9 ?232??21 A< - @  
- 9' 21 <

## Thermal comfort

\* 2@?6 2@- =2?@<; @@A A2 <3: 6 1 6 A2?: @  
<3D 52A52? A52F 3229A<< 5<A<? 0<9

## Diurnal temperature variation

&52 1- 6 A2: =2?- AB?2 @56A A5- A<OOB?@  
/ 2AD 22; 1- FA6 2- ; 1 ; 645A A6 2  
A2: =2?- AB?2@

## Fabric energy storage

&52 BA6@ A6<; <3A52?; - 9. - @@6 / B6 6 4@  
-; 1 6@- / 6AF A< @A<?2 2; 2?4F

## Perimeter zone

?2- D 656 - / B6 6 4 A5- A 6AF=6- 9  
: <@A 64; fi0-; AF - ff20A21 / F <BA1 <<?  
0<; 1 66<; @ @B05 - @; <6@ A2: =2?- AB?2  
-; 1 @<9??- 16 A6<;



ž B? - ==?<- 05 A< 0<; @A?BOA&; 2; 0<; == @@@  
6; <C-A62 @B@A-6- / 2 =?<1BOA@ effi02; A  
/ B6 6 4 @A2: @-; 1 =?- 0A6- 9@<BA&; @  
) 2?20<4; @2 A52 6 =<?A; A?<2 D 2 5- C2  
6 =?<; <A6 4 @B@A-6- / 2 0<; @A?BOA&; /F  
<=A6 @6 4 <B? =?<1BOA@ A526 B@ -; 1  
D 5<2 @2 =2?3<?; -; 02 &5@1<0B: 2; A  
@<; 2 <3- @B@2 A5- A6 2; Afi2@@=20fi0  
0<; @A?BOA&; @<BA&; @A5- A0-; 529  
12@2? - @B@A-6- / 2 / B@A 2; C6<; ; 2; A  
&52F 2E=9?2 A52 12A- @<<32- 05 @A2:  
@@=2?3<?; -; 02 / 2; 2fiA@ 5<D @A0-;  
/ 2 6 =2; 2; A21 6 - =?<20A-; 1 A52;  
0<; ==-?2@A@2; C6<; ; 2; A-9=2?3<?; -; 02  
-4-6 @A-92?; -A62 @<BA&; @

&5@1<0B: 2; A6 A?<1B02@(- B921 ` 266 4@  
D 5@5 3<?; ==-?A<3- / B6 6 4 @A?BOA&?- 9  
3?; 2 @ 2; A6F 6 4 -; -==?<- 05 A< @9 / @<fffiA  
0<; @A?BOA&; A5- A0-; / 2 B@21 A< =?<C6 2  
A52?; -90<; 3<?A / 2; efiA@A< <00B=-; A@

### Typical Applications

` B6 6 4 @20A?@ ž ffi02 -; 1 0<; : 2?06 9  
/ B6 6 4@ @05<<@ B; @2?@A@ 0<; C2; A&;  
02; A2@-; 1 =B/ @ 3-0@A@



ULTIMATE STRENGTH

*Vaulted ceilings utilised in an open office environment.*

# INTRODUCTION

( - B9A21 0266 4@- ?2 =?<fi921 0<; 0?2A2 0266 4@D 5605 3<?: =- ?A<3-  
/ B61 6 4 @A?BOAB?- 93-: 2 &5?<B45 0- ?23B91 2@4; A52F 0-; 3<?: =- ?A<3  
A52 @<BA6<; A<: 664- A2 - / B61 6 4 @0<<9 4 -; 1 C2; A6 A6<; 12: -; 1@ D 65  
A52 - / 6AF A< - 11?2@@ 3BAB?2 0<<9 4 12: -; 1@1B2 A< 2E=20A21 6 0?2- @2@  
6 49/- 9A2: =2?- AB?2@

## ADVANTAGES

&52 =?<fi921 @5- =2 2; - / 92@- 9 ?42?  
@B?3 02 - ?2- <3A52: - A2?6 9A< / 2  
2E=<@21 <=A6 @6 4 - 002@@A< A52  
0<; 0?2A2 @A52?: - 9: - @@D 5605 0-;  
- AA2: B- A2 6 A2?; - 952- A2; 2?4F 4- 6 @  
/; <=2; <ffi02 - == 96- A6<; @D 65 D - 92@  
AF=6- 9F 0<; @A?BOA21 <32EA2; @62 49 G6 4  
-; d fl<<?@0<C2?21 6 @AF=6- 9F <; 9 A52  
0266 4 A5- A <ff2?@- 9 ?42 2; <B45 2E=<@21  
2E=-; @2 A< =?<C61 2 @Bffi06; A A52?: - 9  
: - @@0- =- 06AF

ž A52? - 1C-; A- 42@6 0912  
&52?: - 90<; 3<?A  
/; A24?- A6<; <3@2?C602@  
/ : =?<C21 1- F945A6 4  
/ : =?<C21 C2; A6 A6<;  
1 - =A / 6AF A< 3BAB?2 096 - A2 05-; 42  
%A?BOAB?- 9F 2ffi06; A  
"; 2?4F 2ffic6; 0F





· %" %&' ° +

# PORTLAND HOUSE, SOLIHULL

## TARMAC HEAD OFFICE

3A2? A52 - 0>B@A6; <3` B2` 602` 2: 2; AA< 2; 5-; 02 A52 <ff2?6 4 3<; &- ? - 0  
A52?2 D - @- ; 221 A< 0?2- A2 - =B?=<@ / B@A5<; 2 A< /?6 4 A52 AD < / B@6 2@@@A<42A52?  
/; <?1 2? A< 0<; =9 2; AA52 @B@A 6 - / 2 -; / @6; @<3A52 0<; =-; F A52 /?623D - @@2AA<  
0?2- A2 - @B@A 6 - / 2 -; 1 2ffi0@; A / B@A 6 4 D 5@5 D <B@ @A@F A52 ?2>B@2; 2; A@<3A52  
; 2D 9 2E=-; 1 21 / B@6 2@@D 5@A: - 6 A- 6 6 4 A52 =<A2; A6 93<? 3B@B?2 4?<D A5  
&52 @<B@A<; D - @- =B?=<@ / B@A@B@A 6 - / 2 12C29=; 2; AA5- ABA@6@21 6 =?<C21  
: 2A5<1@<30<; @A?B@A<; -; 1 <=A6 @21 A52 3 /?@ <3A52 / B@A 6 4 A< <ff2?; <?2 A5-;  
B@A@A?B@AB?- 9=2?3<?: -; 02

Client: Tarmac  
Developer: Stoford Developments  
Architects: Webb Gray and Vincent and Gorbng  
Year: 2007  
Office space: 5,570 m<sup>2</sup>  
Project Value: £22 million  
Green Rating: BREEAM Office 'Very Good'

%A<3?1 ° 2C29=: 2; A@D 272 -==?<-0521 A<  
2-1 A52=?<20A-; 1 D 65 -705620A@) 2 / /  
` ?-F 12C621 - @A2293-: 2 @<B A6; A< 3B919  
A52: 6 6 B: ?2>B62: 2; A@<3A52=?<20A  
&-?: -0 D<?821 6 09&0<9 /<?- A6; D 65  
A526-705620A@ ( 6 02; A-; 1 ° <?/ 6 4 -; 1  
A52=?<20A A2-: A< <=A6 62 -; 1 12C29=  
A52=?<20A ° <; 072A2 D -@6 A?<1 B021 -@-  
3B; 1-: 2; A 9@A?BOAB?- 9: -A2?6 9 2; 5-; 06 4  
A52 @B@A 6 - / 2 0721 2; A6 9<3A52 / B6 6 4  
° <; 072A2 072- A21 A52 <==?<?AB; 662@3?<  
@ C6 4@A< / 2 72- 9621 A5?<B45<BAA52  
/ B6 6 4 @962

&52 12@6; D -@/ -@21 -?<B; 1 - 0<; 072A2  
3-: 2 0<; =2: 2; A21 D 65 2EA2?; -9  
0<; 072A2 0<B: ; @-; 1 - 49G21 3 0-12  
ž =2; <ffi02-?2-@: -12 B@<3A52 0<; 072A2  
3-: 2 A5?<B45 2E=<@6 4 A52 @ffiA@<3@9 / @  
D 565 D 272 0<; @A?BOA21 6 - / -??29C- B9A21  
3<?: 002@@A< A52 @ffiA@- 9- D 21 A52  
@A?BOAB?2@A52?; -9: -@@A< / 2 BA6621  
&52 C- B9A21 65- =2 6 072- @21 A52 @B?3 02  
-72- 3? 52- AA?; @3? 6 072- @6 4 6@0<<9 4  
=<A2; A6 9

' A66 4 A52 A52?; -9: -@@072- A21 - 322  
0<<9 4 @A?2: A5- A529-21 A<: 66- A2 A52  
52- A6 4 eff20A<3<00B=-; A@-; 1 2>B6: 2; A  
-; 1 0<; =2: 2; A21 A52?; -90<; 3?A / F

=?<C6 6 4 - ?- 1 6; A0<<9 4 2ff20A &52  
6 =2: 2; A A6; <3A56-==?<-05 =?<C6 21  
@ C6 4@-@1 ( ° ?2>B62: 2; A@D 272  
721 B021

) 52: - @A?BOAB?2@A52?; -9: -@@@B@21  
A<- 6 0<<9 4 ; 645A=B?46 4 6?2>B621  
A< ?2- 1F A52: - A2?6 93<? A52; 2EA1- F @  
0<<9 4 12: -; 1 AF=6- 9 A5?<B45 <=2; 6 4  
D 6 1<D @ ° B2 A< A52 @A2@9 0- A6; ; 2EA A<  
° 6: 6 45- /; A2?; -A6; -9 6=<?A-; 1 &?- 6  
%A A6; A56D -@; <A =@@6 2 /; 6@=9 02  
-; - 6 16=9 02: 2; AC2; A9 A6; @A?2: D -@  
6 =2: 2; A21 D 565 -9< 6 072- @21 A52  
- 002@@A< A52 A52?; -9: -@@<3A52 / B6 6 4

&52 - 6 16=9 02: 2; AC2; A9 A6; @A?2:  
D <?8@/ F A?2- A21 - 6 / 26 4 6 A?<1 B021 6 A<  
- C<6 B; 1 2?; 2- A5 A5e fl<<? D 5272 6 0<; 2@  
6 A< 0<; A OAD 65 A52 2E=<@21 0<; 072A2  
@9 / 0<<9 4 A52 - 6 1 B2 A< A?; @3?<352- A  
2; 274F 3 066- A21 / F A52 A52?; -9: -@@  
&566A52; 1 6A?6 BA21 6 A< A52 =<=B9 A21  
@=- 02 A5?<B45 @ 691 6fB@2?@ 072- A6 4 - 9 D  
C29 06F - 6 fl<D D 656 A52 ?<:

@66D -?; 21 / F ?<: 52- A @B?02@  
<00B=-; A@-; 1 2>B6: 2; A ?2- 056 4  
A52 - 6 ?62@B= A< 026 4 2C29D 5272 6 @  
A? =21 D 65 A52 C- B9A21 / -F @ &562; - / 2 @  
A52 D -?; - 6 A< 6 A2? - OAD 65 A52 A52?; -9  
: -@@<3A52 C- B9@-; 1 / 246 A< / 2 0<<21

=?6? A< 2EA?- OA6; & 52 2EA?- OA21 - 6 @: 6 21  
 D 65 3265 - 6 A< =?<C6 2 -; - 002=A / 2  
 2C29<3- 6 >B- 9AF / 23:?? 2 060B9 A6; 6 A<  
 <00B=621 @=- 02@ - A - ==?<E6 - A2F  
 Z < 0<<6 4 6 @A2: @?2>B621 - @A52 5645  
 A52?: - 9. - @2E=<@21 6 A52 @A7BOAB?2  
 5- @6ffio6; A0- == 06F A< 0<<9A52 - 6  
 A2: =2?- AB?2 3<: A<  
 %64; 6i0-; A- 11 66; - 9/ 2; 2fiA@D 2?2 - 9<  
 ?2- 621 A5?<B45 A52 6 066; <3/ - ??29  
 C- B921 0266 4@ 6 0616 4 6 =?<C21

- 0<B@A6 0<; A?<9-; 1 6 0?2- @21; - AB?- 9  
 1- F 645A6 4 & 52 2ff20A62 6 0?2- @ 6 0266 4  
 5264 5AD 656 A52 C- B9@-; 1 A52; - AB?- 9F  
 945A0<9-B? <3A52 0<; 0?2A2 <ff2?21 5645  
 2C29<3?2fi20A-; 02- 9-D 6 4 645A A<  
 =2; 2A?- A2 3B?A52? 6 A< A52 <=2; <ffio2  
 @=- 02 /; =2; 2; A6 4 - C- B921 0<; 0?2A2  
 0266 4 @<6A6; 0<; A?6 BA21 A< 0?2- A6 4 -  
 ?21 BOA6; 6 <ffio2 2; 2?4F 0<@A@D 52;  
 0<; =- ?21 A< - AF=@- 9- 6 0<; 1 66; 21  
 =?2@A2 <ffio2

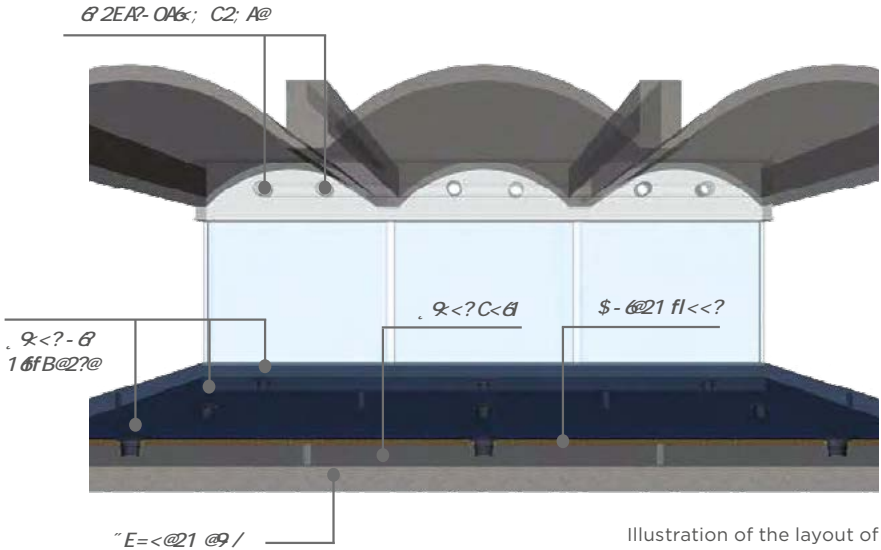


Illustration of the layout of Portland House utilising vaulted ceilings and air displacement ventilation

( - B921 0266 4@- ?2 = - ?A < 3A52 6 A76 @6 3- / ?6 < 3- / B6 6 4 - ; 1  
0- ; = 9F - @4 ; 6i0- ; A? < 2 6 6 = ? < C6 4 A52 0 < < 6 4 - ; 1 C2 ; A9 A6 ;  
@A? A24F < 3- / B6 6 4 & 526 3- ?2 : < @A - == 90- A6 ; @A- 3B9i9A52  
@A?BOAB?- 9= 2?3<? : - ; 02 ?2 > B62 : 2 ; A@ < 3A52 / B6 6 4 D 52?2 A52F  
0- ; / 2 B@21 6 = 9 02 < 3 : < ?2 A?- 1 66 ; - 90 < ; @A?BOA6 ; @F @A2 : @  
@B05 - s fl- A @ / @A2291 2086 4 < ? 0 < : = < @A2 @ / @F @A2 : @

) 65 A52 6 = 2 : A A6 ; < 3A5@ @F @A2 : @ @ = < @ @ 2 A- ?- 92 A52 D 6 2 ? = < A2 ; A6 9A5-A  
82F @A?BOAB?- 9- - A2?6 00- ; < ff2? A- 6 = ? < C2 A52 < = 2?- A6 ; - 9= 2?3<? : - ; 02 < 3 / B6 6 4 @  
12@= 62 5- C6 4 / 22 ; 5 @A?6- 9 @220A21 < ; = 5F @6- 9= ? < = 2?A2@ - 9 ; 2

( - B921 0266 4@0- ; / 2 0?2- A21 / F 2652? A52 6 096 ; < 3= ? < fi21 OBA-BA@D 656 -  
A?- 1 66 ; - l fl- A @ / @- ffiA < ? A52 0 < ; @A?BOA6 ; < 3- ?0521 @A?BOAB?- 922 : 2 ; A@  
~ < A5 : 2A5 < 1 @- ?2 C6 / 2 3- ? = ?20- @A - ; 1 6 @6B 0 < ; 0?2A2 0 < ; @A?BOA6 ; @- BA6 ; @  
/A @A52 9 AA2? - ?0521 @A?BOAB?- 922 : 2 ; A@ D 565 0?2- A2 A52 : < @A 1 66 0A05- ; 42  
3< : 0 < ; C2 ; A6 ; - 9- == ? < - 052@

; C2; A6; - 9; 1 A? 1 A6; - 9 =?= ?<- 052@  
 AF = 0 - 9 B A6 e a fl- A @ ffiAD A5 A52  
 ?2> B62; 2; AA; @B@=2; 1 - 3 92 0266 4 6  
 <?1 2? A< 0?2- A2 - @?2C62 C<6 3? 2@@; A6 9  
 -; 1 | ( ' ' @?A2: @ C- B921 @?A2:  
 0-; ?2=9 02 A5 @C<6 1 B2 A< A52 0B?C- AB?2  
 <3A52 @9 / 0?2- A6 4 - C<6 / 2AD 22; A52  
 B==2? @B?3 02 <3A52 22; 2; A-; 1 A5e fl<?<?  
 <3A52 @A<?2F - / <C2 /A @A52; =<@@ 9 A<  
 BA6 @2 A5 @C<6 A< ?B; @?2C62 @?- A52? A5-;

A52 A?- 1 A6; - 90<; @?BOA6; <3- @2=-?- A2  
 @B@=2; 1 21 0266 4 @?A2: -; 1 3 06A A2@  
 A52 =<@@ 6 A< - 11 ?2/- A2@-; 1 - 002@@  
 =<6 A@3? @?2C62 @D A56 A52 @?BOAB?2  
 &52 =?2@: 02 <3A5 @C<6 - 92- 0?2- A2@  
 -; <==<?AB; @F A< 6 = 2; 2: A-; B; 1 2?fl<?<?  
 C2; A9 A6; @?A2: D 565 - 9D @3?A52?  
 - 002@@A< A52 @?BOAB?2 @6 52?2; A  
 A52?; - 9; - @@



( - B921 0266 4 22; 2; A

~ 2-: @B==<?A3-?  
 C- B921 0266 4

%B==<?A6 4 0<B; ;

## THERMAL COMFORT

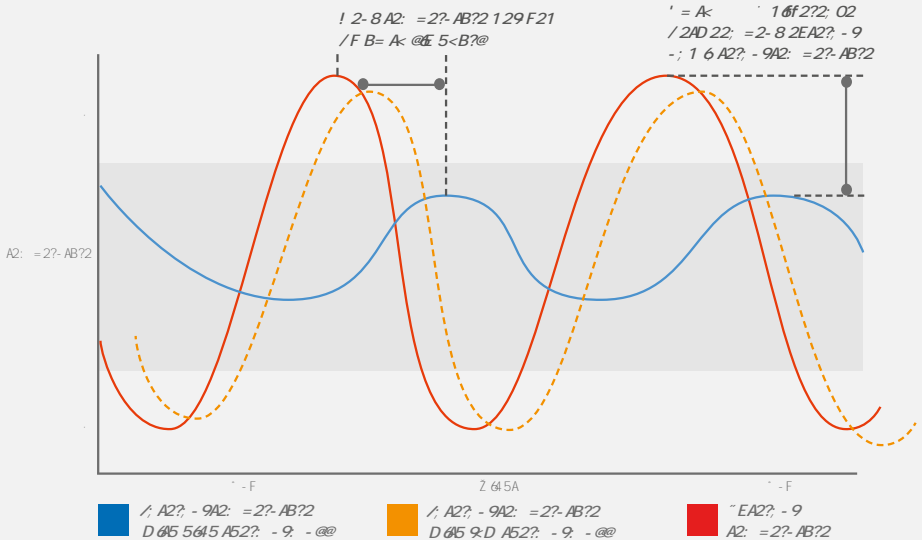
/; <ffi02 2; C6<; : 2; A@D 52?2 - 0<; @6A2; A 2C29<3A52?: - 90<; 3<?A0-;; ; <A / 2; - 6 A- 6 21  
A52?2 @-; 201 <A- 9-; 1 >B-; Afi21 2C6 2; 02 @A- A6 4 A5-AA56@0-; 5-C2 - 1 2A?6 2; A- 92ff20A<3  
<00B=-; A=2?3<?: -; ; 02  
; <; 0?2A2 0-; <ff2?- 5645 2C29<33 / ?6 2; 2?4F @A<?- 42 ; " % =?<C6 6 4 A52 0-=- 06F A<  
@A<?2 9?42 -; <B; A@<352-A2; 2?4F &56@- 9&D @B; D -; A21 52-A4-6 <?42; 2?- A21 52-A  
2; 2?4F A< / 2 - / @<? / 21 529-6 4 A<; - 6 A- 6 A52?: - 90<; 3<?A 2C29@  
( - B9A21 <? =?<fi921 0266 4@6 0?2- @2 A52 2E=<@21 @B?3- 02 - ?2- <30<; 0?2A2 <=A6 66 4 - 002@@  
A< A52?: - 9- -@@ D 565 0-; 529- A< =?<C6 2- 0<<96 4 2ff20A /; 0<?=<?- A6<; <3A56@F @A2:  
<ff2?@A52 =<A2; A6 9A< ?21 B02 - / B6 6 4 @0<<96 4 2; 2?4F 12: -; ; 1

*Diagram right:  
Representation of the effect that thermal mass  
has on thermal comfort<sup>11</sup>.*

1 2-A2; 2?4F @=?6 -?@ -/@?/21 C6  
 ?-16 A6<; D 52A52? 3<; <00B=-; A@  
 2>B6: 2; A<?</ 20A@ -@9; 4 -@A52F  
 -?2 <3- 56A52? A2; =2?-AB?2 A5-; A52  
 0<; 0?2A2 @@@9

/@?=?A6<; D 690<; A6 B2 A5?<B45<BAA52  
 1-F D 56A <00B=-; A@D @- 9< 2E=2?6; 02 -  
 ?-16; A0<< 9 4 2ff20A 1B2 A< 56A5 2C29@<3  
 3-/?6 2; 2?4F @A<?-42 &5@-=-=?<-05 529@  
 @A / 6@ 6 A2?; -9A2; =2?-AB?2 -; 1 0-; 129F  
 A52 =2-8 A2; =2?-AB?2@/F <? 5<B?@ A<  
 AF=6- 9 3 9<BA@ 2 <3<ffi02 5<B?@

) 52; A52 5<B?0<<9 4 0F09<3- AF=6-9  
 <ffi02 @0<; @ 2?21 : : <30<; 0?2A2  
 5-@/22; @A A21 A< / 2 @Bffi06; AA< : @A- A2  
 A52@ 52- A4-6 @ 1 <D 2C2? <C2? 9; 4?2  
 =2?6 1 @<36 0?2- @21 A2; =2?-AB?2@ 62  
 D 228@<?; <; A5@ 0<; 0?2A2 6 2E02@@<3  
 : : 0-; / 2 / 2; 2fi06 9-@A5@=?<C@ 2@  
 @Bffi06; A-11 @6<; -90=-@0AF A< : <12?-A2  
 A52@ -@@<06 A21 2; 2?4F 4-6 @  
 \* @=9 02; 2; AC2; A9 A6<; @F@A2; @- 9<  
 6 0?2- @ A52 2ffi06; 0F <3A52?; -9 -@@/F  
 2; - / 9 4 - 002@@A< A52 A< =@B?3 02 <3@9 / @







## INTEGRATION OF SERVICES

&F=6-9-==?<-052@A< @?C62@6A24?-A6<;  
@22@A52: -7?6F 56 12; D 656 @B@-2; 121  
0266 4@ (-B921 0266 4@-; 1 2E=<@21 @<ffia@  
=?2C2; AA56A?-1 66<; -9-==?<-05 -@-002@@  
A< A52?: -9- -@@6?2>B621 5<D 2C2?A56@  
1<2@-9D -@6 =2-; 1 02-; 12@64; A< /2  
-056C21

"E=<@21 @<ffia-==?<-052@0-; -9<  
/2 2-@6F 6A24?-A21 D 65 1@-9 02: 2; A  
C2; A9 A6<; @F@A2: @ D 565 ?2>B62 - ?-@21  
fl<<?072-A6 4 - C<6 856C<6 0-; /2  
BA6621 -@- 82F @?C62 ?<BA2 ?2: <C6 4 A52  
; 221 3<?: -; F <C2?52-1 @?C62@

/A @- 9<=<@6F 2 A< 12@64; @9 /@D 65 C<6 @  
-; 1 ?2/ -A2@A< -0A -@@?C62 ?<BA2@1 B2 A<  
A5e fl2E66 66F <ff2?21 /F 0<; 072A2

## IMPROVED DAYLIGHTING

' -F 945A6 4 0-; /2 6 =?<C21 A5?<B45  
6 072-@6 4 945A=2; 2A?-A6<; -; 1  
?efl20A-; 02 (-B921 0266 4@=?<C6 2 -;  
6 072-@2 6 @<ffia52645A 2; - /9 4 D 6 1 <D @  
A< /2 =9 021 56452? <; 2EA2?; -9D -99@  
=?<; <A6 4 945AA< =2; 2A?-A2 3B?A52? 6 A<  
- /B6 6 4

@- : -A2?6 9D 65 - 0<; =-?-/ 9 5645  
-9 21 < B; A2-A21 0<; 072A2 0-; <ff2?  
5645 9C29@<3?2fl20A-; 02 D 565 =?<; <A2  
945A=2; 2A?-A6<;

l2C29@<3-9 21 <-; 1 ?2fl20A-; 02 0-;  
/2 3B?A52? 2; 5-; 021 A5?<B45 A52 B@ <3  
D 562 02: 2; A<? @B/ @A6BA2: -A2?6 9@B05  
-@4?<B; 1 4?-; B9 A21 /9 @A 3B?; -02 @9 4  
~ ~ ~ %

## IMPROVED VENTILATION

&5?<B45 A52 6 A24?- A6<; <3C- B9A21 0266 4@  
6 1 ( ' @F@A2: @ 6 =?<C2: 2: A@6

C2: A9 A6<; >B- 9AF 0-; / 2 - 0562C21

1 B2 A< A52 - 0A6<; <3- 6 1 6=9 02: 2: A

&52 - C- 6 / 6AF <3A52?: - 9: - @6 =?<C2@

A52 <=2?- A6<; <3-; - 6 1 6=9 02: 2: A@F@A2:

1 B2 A< A@52- A2: 2?4F @A<?- 42 0- == 06F

) 65 A56@F@A2: - 6 6 A?<1 B021 6 A< A52

B: 1 2r fl<<? C<6 D 565 6 AB?n fl<D @6 A<

A52 ?<<: C6 fl<<? 1 6fB@?@

/; A?<1 B021 - 6 60<<? A5-; ??>B621 3<?

A52?: - 90<; 3<?A-; 1 0?2- A2@- 9 F2?<3

0<<9- 6 - t fl<<? 2C29 @A56- 6 2: A2?@A

1 6=9 02@A52 D -?: - 6 - /<C2 A D 565 5 -@

/ 22; @9 D 9 D -?: 21 / F 52- A2: A2?@D 656

A52 ?<<: &561 6=9 02: 2: A0?2- A2@- 05- 6

2ff20A1 6=9 06 4 A52 D -?: 2?- 6 - /<C2 A

B: A9A6A? - ==21 D 656 A52 C- B9@<3A52

0266 4

&5665<A- 6 62EA? - 0A21 - A 0266 4 2C29

D 52?2 662652? ?2: <C21 <? ?2 060B9 A21

D 65 3265 - 6 @A0<; 2@6 A< 0<; A- 0AD 65

A52 A52?: - 9: - @6 A52 C- B9A21 0266 4 -; 1

A52 2E=<@21 B: 1 2r fl<<? 6 / 660<<@21 A<

?2>B621 A2: =2?- AB?2@

&566=?<02@@0?2- A2@-; - 6 fl<D 1 B2 A< - 6

@A? - A510- A6<; D 565 =?2C2; A@A52: 6 6 4

<3D -?: - 6 D 65 0<<? 32652? - 6 D 656

A52 / B9 6 4 6 =?<C6 4 A52 >B- 9AF <3- 6 - A

<00B=621 2C29 ' - ?2: B@A / 2 A- 82; A<

2: @B?2 A5- A6 A?<1 B021 - 6 6; <AA< 0< 9

- @A560-; 0?2- A2 <30<9 @=<A@<? 6<?A

060B66 4 <3- 6 fl<D @ AF=6- 9 =?2@; AD 65

- 6 0<; 1 66<; 6 4 @F@A2: @ , 9<? diffB@?@

- C<6 A566@B2 - @A52F 0-; / 2 @=72- 1

2C2; 9 -?<B; 1 <ffi02 - ?2- @ D 52?2- @- 6

0<; 1 66<; 6 4 @F@A2: @AF=6- 9 <; 9 =?<C6 2

a fiE21 @<B?02 <3- 6

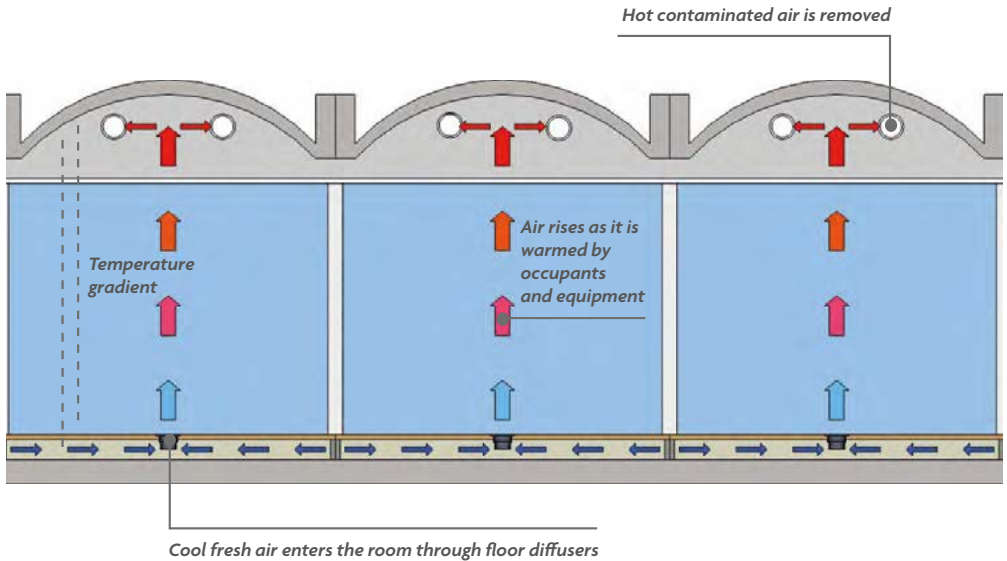


Illustration demonstrating the flow of air within occupied spaces and the subsequent temperature gradient.



## ADAPTABILITY TO FUTURE CLIMATE CHANGE

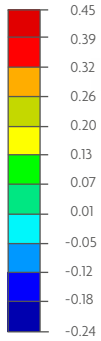
\$2=<?A@5-C2 @5<D; A5-A' fl A2: =2?- AB?2@  
- ?2?@6 4 -; 1 A5-A@B: : 2?=2-8  
A2: =2?- AB?2@0<B9 ?@2 / F -@: B05 -@  
' / F %B05- @4; 610-; A?@2 6  
A2: =2?- AB?2 D @?@2 - 6 0?2- @21 12: -; 1  
3<?0<<9 4 D @56 / B@ 6 4 @ ) 5@A  
0<; 0?2A2 C-B@21 02@ 4@<ff2? A52 - / @AF  
A<=?<C@ 2 ==@@@2 0<<9 4 A5?<B45  
6 0?2- @21 3 / ?@ 2; 2?4F @A<? 4 2 0- =- 0@F  
A5@: -F; <A / 2 2; <B45 A<: @A-A2 A52@2  
A2: =2?- AB?2 ?@2@  
1 <D 2C2? A52@ 0- =- / @@2@0-; / 2 6 0?2- @21  
A5?<B45 A52 6 A24?- A@; <30<<9 4 @?@2: @  
&52@ 0-; / 2 5<@D 0<?2 @?@2: @ D 52?2 - @  
@=- @@21 A5?<B45 C<@ <? D - A2? / - @21  
@?@2: @ 0?2- A21 / F A52 2: / 211 6 4 <3  
=6 2@ &52 0<; 0?2A2 0-; / 2 =B?421 <3  
2E02@@@A?21 52-A-@?D A2: =2?- AB?2 - @  
<? D - A2? @=- @@21 A5?<B45 2-05 @?@2:  
&52@ @-@A@; @0-; / 2 6 0<?=<?- A21 6 A<  
0<; 0?2A2 02@ 4@-; 1 ?2: - 6 1<? -; AB; A@  
?2>B@21 \* @=9 02: 2; AC2; A@ A@; @?@2: @  
0-; - @< / 2 / <<@A21 / F A52 6 A24?- A@; <3  
0<<9 4 0<@A? ?21 B02 A52 A2: =2?- AB?2 <3  
- @ 6 A?<1 B021 6 A< A52 @?@2:

## ENERGY EFFICIENCY

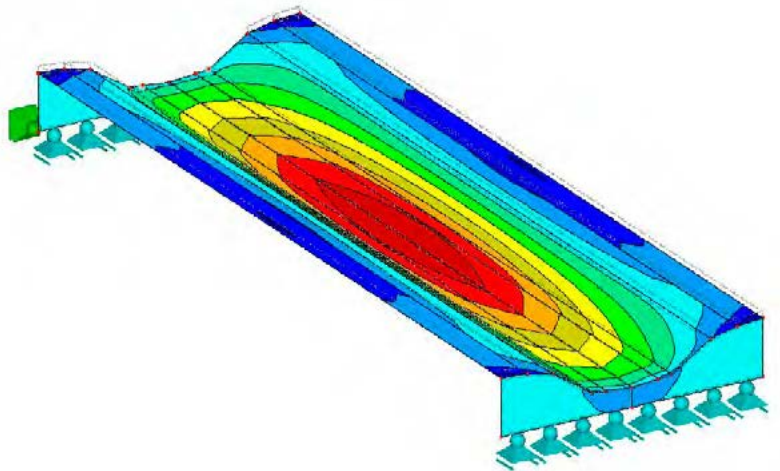
C-B@21 02@ 4 @?@2: 0-; 529 A< ?21 B02  
- / B@ 6 4 @0<<9 4 2: 2?4F 12: -; 1 D @5  
3B?A52? ?21 B0A@; @- 05@C- / @ @0<; / 6 21  
D @5 ==@@@2 0<<9 4 ) 5?2? A5@@; <A  
32- @? 2 - @ 1 @=9 02: 2: A @?@2: @0-;  
/ 2 B@@21 A< @ A@F / <A5 0<<9 4 -; 1  
C2: A@ A@; ?2>B@2: 2: A@ " -05 @?@2:  
@- @D 2: 2?4F @-@A@; D 5@5 B@@2@  
A52; -AB? 9=?<=2?A@ A52? - 9: -@@  
<? A2: 12: 0@ @ - @ A? A@iO- A@; <3A52  
: - A2?6 @6 C<@21  
: F ?21 B0A@; 6 2: 2?4F 12: -; 1 0-; / 2  
@22; A< / 2 / 2: 2fi06 9A< <=2?- A@; - 90<@A@  
<C2? A52 @2 @-; <3A52 / B@ 6 4 -; 1 0-;  
D @5 ?2@<; @? 2 1 2@4; =?<C@ 2 - ?29 A@2?F  
=?<: =A=-F / -08 =2?@1  
&52 B@ <3B; 1 2?fi<<? C2; A@ A@; 1 @A?@ BA@;  
@?@2: @- @< <ff2?@-; 6 =?<C2: 2: A 6  
-1 - =A / @AF D 52: 0<; @? 2?6 4 3B@?2 B@  
' @fB@@; =<6 A@2; - / @ - @ =@ =?<02@@<3  
?29 0- A@; @9 F<BA@05-; 4 2 D 52: 0<: =- ?21  
A< 02@ 4 / - @21 <r fiE21 @?@2: @

## STRESSES

$\sigma^x$  (kn/cm<sup>2</sup>)



Max: 0.45  
Min: -0.24



Finite element analysis of vaulted panel identifying steel requirements

The analysis carried out on the vaulted panel was completed with Dlubal Structural and Dynamic analysis software. The vaulted panel was compared against a 9m span reinforced flat slab for the design of a multi-storey office development

## STRUCTURALLY EFFICIENT

) 52; 0<; =-?21 A< 0<; C2; A6<; - l fl- A @ / @  
C- B921 <? =?<fi21 @ / @0-; BA52 2@@  
: - A2?6 9A< B?i9A52 @: 2 @- 20fi0- A6<;  
??>B82: 2; A@ &5@@- 052C21 1B2 A< A52  
@20A6<; - 942<; 2A?F A5- A2E@A@D 65 C- B921  
-; 1 =?<fi21 @ / @ D 565 =?<C6 2@- 56452?  
/2; 16 4 ?2@A-; 02

f - A2?6 9@ C6 4@<3B= A< 0-; /2  
- 052C21 D 52; 0<; C2; A6<; - 9@ / @- 2  
?2=9 021 D 65 C- B921 @ / @ %- C6 4@0-; /2  
A?; @3??21 A< <A52? @A?BOAB?- 922: 2; A@- @  
?21 BOA6<; @6 D 2645A0-; - 2< ?21 B02 A52  
=2?3<?: -; 02 ?2>B82: 2; A@<3@B==<?A6 4  
22: 2; A@ 6 AB? ?21 B06 4 A52 2: /<1 21  
6 =- 0A@<3A52 / B6 6 4

## AESTHETICS

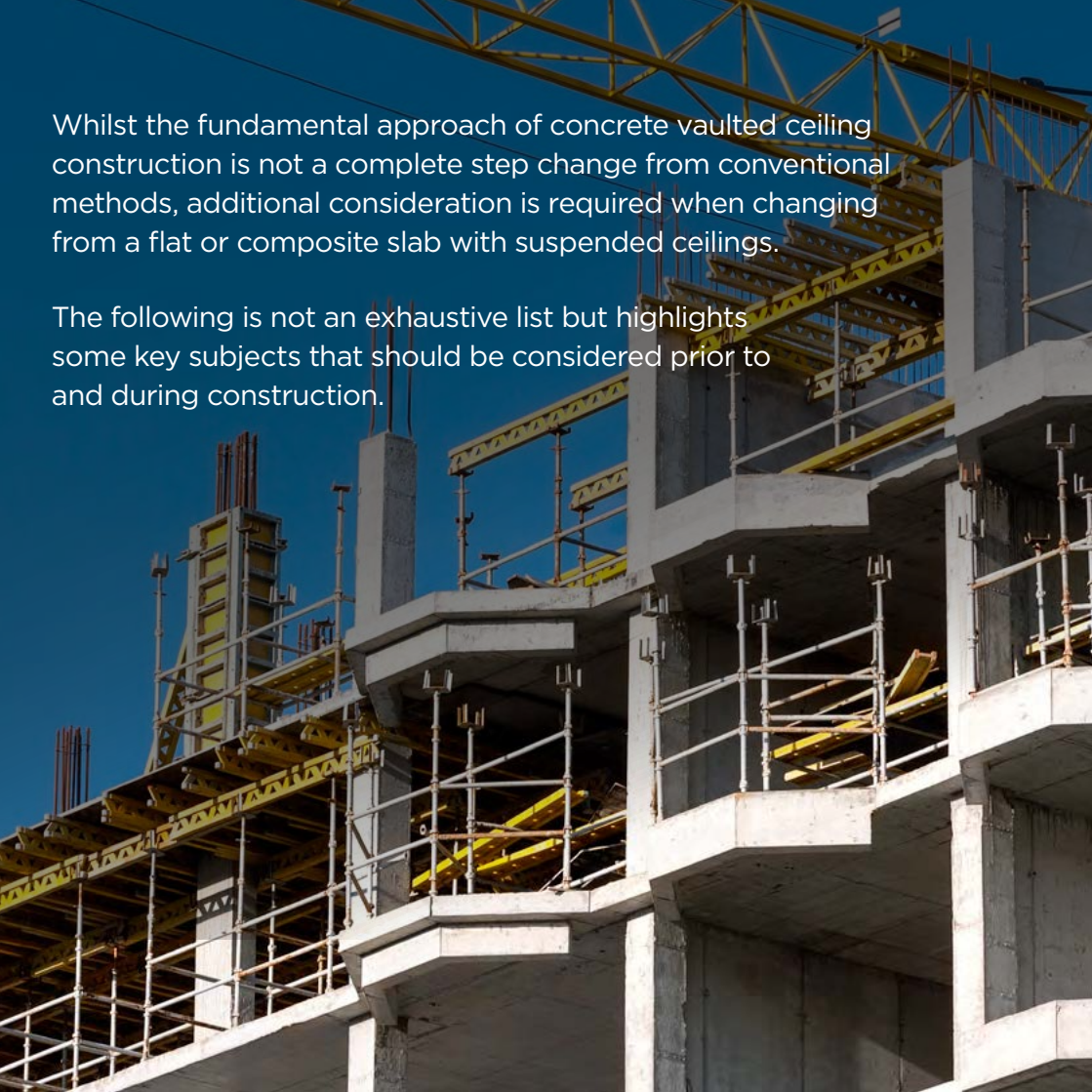
( - B921 0266 4@<ff2? - 1 ff2?2; A  
- ?05@20AB?- 93<?: A< D 5- A0-; /2 - 052C21  
A5?<B45 A?- 1 66<; - l fl- A @<ffiA@ 0?2- A6 4  
A52 <==<?AB; 6F A< 1 2C29= A52 - 2@452A6  
<ff2?6 4 <32E=<@21 0<; 0?2A2

' <; 0?2A2 / F @@; - AB?2 @- C2?@ A52: - A2?6 9  
D 565 0-; /2 ?2- 1 6 - 1 =A21 -; 1 1 2@6; 21  
A<: 22A- ?05@20AB?- 9?2>B82: 2; A@D 52A52?  
- 0<; =2E 1 2@6; <? @6 = F =64: 2; A- A6<;

l 645 >B- 94y fi; 652@0-; /2 - 052C21  
A5?<B45 A52 B@ <3@=206 921 0<; 0?2A2@  
@B05 - @@29 0<; =- 0A6 4 0<; 0?2A2 D 565  
0-; - 00B?- A2? ?2fi20A 3<?: D <?k fi; 652@  
D 565 0-; /2 2; 5-; 021 B6 4 3<?: D <?8  
6 2?@

Whilst the fundamental approach of concrete vaulted ceiling construction is not a complete step change from conventional methods, additional consideration is required when changing from a flat or composite slab with suspended ceilings.

The following is not an exhaustive list but highlights some key subjects that should be considered prior to and during construction.





## SYSTEM PERFORMANCE

) 52; 0<; @6 2?6 4 A52 6 =2; 2; A A6<; <3  
- C- B921 0266 4 @A2: @A=2?3<?: -; 02  
@<B9 / 2 - @2@21 - AA52 2- ?92@A=<@66 2  
@A 42 <3- =?<20A ; F - @2@2 2; A @<B9  
/ 2 0- ??21 <BA 6 6 2 D @5 D <?8 <; A52  
/ B9 6 4 @1 ( ' @A?- A24F

/A @<B9 / 2; <A21 A5- A3- /?6 2; 2?4F  
@A<?- 42 @A2: @5- C2 A52 =<A2; A6 9A<  
<ff@A- ==?<E6 - A2F ) : <3@<9?  
52- A4- 6 @ D 5@5 @<B9 / 2 A- 82; 6 A< 39  
0<; @6 2?- A6<;

## VENTILATION STRATEGY

&52' fl @1 @?; - 9A2: =2?- AB?2 C- ?6 A6<;  
- 9D @=- @62; - AB?- 9@A?- A24@A<  
2: =9F21 6 <?1 2?A< =B?42 @A<?21 52- A  
2; 2?4F 3<; A52 / B9 6 4 @3- /?6 &5@6  
AF=6- 9 <; 9 =<@66 2 D 52?2 @62 9 0- A6<;  
- 9D @3<? A52 <=2; 6 4 <3D 6 1 <D @

/; - ?2- @D 52?2 A5@6@ ; <A=<@66 2  
: 205-; 6- 9C2; A9 A6<; @A2: @D 9  
B@B- 9 / 2 ?2>B621 A< 2; @B?2 2ff20A62  
=2?3<?: -; 02 \* @=9 02: 2; AC2; A9 A6<;  
@A2: @0-; / 2 6 =2; 2; A21 A<=?<C6 2  
- 9D 2; 2?4F - 92?; - A62 D 5@5 0-; 529-  
<=A6 @2 A52 2E=<@21 A52?; - 9- - @

## THERMAL MASS

&52 A52?: -9. -@@A5-A@=?2@; AD 456 -  
0<; 0?2A2 C- B921 0266 4 @6 A24?- 9A: A52  
- 05@C2: 2; A<3A52 0<<@ 4 2ff20AA5- A0-;  
/ 2 - 05@C21 D 456 - / B9 6 4

( -?F6 4 ?2=<?A@-; 1 0<: : 2; A ?@@@A A2  
A5- A @ @<; F A52 A52?: -9. -@@A< - 12=A5  
<3 : : A5- A0-; / 2 - 002@@21 D 456 -;  
2@: 2; A /A @A?B2 A5- A- 12=A5 <3 : :  
D @=?<C@ 2 2; <B45 A52?: -9. -@@A< ?2- 0A  
A< 5<B? 0<<@ 4 0F0@ 5<D 2C2? A5@1 <2@  
<AA- 82 6 A< - 00<B; A 9; 42? A2: =2?- AB?2  
0F0@ @B05 - @D 228F <?: <; A5F =2?@ 1@<3  
6 0?2- @21 A2: =2?- AB?2@

/; 0?2- @21 12=A5@<30<; 0?2A2 0-; / 2  
@B002@@B@ B@21 A<: @6- A2 A52@  
A2: =2?- AB?2@ /A @=<@@@ ? A< - 002@@  
<?2 <3A52 A52?: -9. -@@0- == 0@F <3  
A52 0<; 0?2A2 / F BA@6 4 B; 12r fl<?<  
C2; A@ A<; <? 0<<@ 4 @F@2: @ 6 =?<C6 4  
@@=2?3<?: -; 02 -; 1 B; 9-086 4 : <?2 <3  
@@=<A2; A6 9

## DAYLIGHTING

( - B921 -; 1 =?<fi@ 0266 4@<ff2? A52  
- / @F A< - @D @45AA< =2; 2A?- A2 B?A52?  
6 A< <00B=@ 1 @- 02@1 B2 A< 6 0?2- @2@6  
0266 4 52@45A

\* 2@4; 1 20@6; @A< <=A6 @2 A52 1- F@45A6 4  
=<A2; A6 9@5<B9 0<; @6 2? A5e fi; @5 A5- A @  
?2>B@21 - AA52 3- 02 <30<; 0?2A2 2@: 2; A@  
f @ 12@4; @0-; / 2 <=A6 @21 A< =?<C@ 2  
@45A @B?3- 0e fi; @52@<? A52F 0-; / 2 @ =F  
=- 6 A21 A< 2; 5-; 02 @B?3- 02 ?2f120A-; 02

11 @6; -91 2@4; -==?<- 052@0-; / 2  
6 =@: 2; A21 @B05 - @ 5@45 @C29D 6 1 <D @  
- AA52 0?2@A <3=?<fi@-; 1 A52 B@2 <3@45A  
@52@2@ A< ?2f120A 6 0<; 6 4 @45A<; A< -; 1  
6 A< A52 C- B921 -; 1 =?<fi@ 1 @- 02@





Conran K Partners  
Varsity Hotel, Cambridge

## FORMWORK

&5e fi; 6521 >B- 9AF <30<; 0?2A2 @  
1 6A- A21 / F A52 >B- 9AF <33<?; D <?8 -; 1  
D <?8: -; 656 A5-A5- @/ 22; B@21 A< 0?2- A2  
A /A @; 202@@ ?F A< 2: =9F ?6<?<B@  
>B- 9AF @F @A2: @6 A< 2; @B?2 A5-A?2>B@6A2  
fi; - I fi; 652@- ?2- 056C21 2; 3-?021 / F -  
@-206i0- A6<; /- @21 <; 12066<; @A- 82;  
=?6<? A< 0<; @A?BOA6<;

&52 Z - A6<; - 9%A?BOAB?- 9' <; 0?2A2  
%=206i0- A6<; =?<C6 2@- 4<<1 4B6 2 3<?  
A52 0?2- A6<; <3- 7/ @-206i0 @-206i0- A6<;

@-206i0- A6<; 65<B9 0<; @6 2? - 9- @-20A@  
<30<; @A?BOA6<; 6 0916 4 3<?; D <?8 -; 1  
=9 02: 2: A=?<02@@@/ BA- 9<- 002=A / 9  
@A; 1- ?1 @3? A5e fi; 6521 29: 2: A A?6 9  
=-; 29-; 1 @: =9 -; 29- ?2 2ff20A6 2 6  
1 296276 4 A5@

## MATERIAL

/; 56459 C6B- 9- == 90- A6<; @A52 0<??20A  
@-206i0- A6<; -; 1 @220A6<; <3: - A2?6 9@  
6 A24?- 9A< - 056C6 4 5645 >B- 9AF ?2@B9@  
&?- 1 A6<; - 90<; 0?2A2: 6 1 2@64; 3<?  
- ?05@20AB?- 9- == 90- A6<; @@22@A52 6 09B@6<;  
<35645 =?<=<?A6<; @<f fi; 2: - A2?6 9@- @A5@  
- 6 @A52 fi; 65

I <D 2C2? ?202; A 1 2C29-=: 2: A@5- C2  
@22; A52 6 A?<1 BOA6<; <3@29 0<: =- OA6 4  
0<; 0?2A2@ D 565 0-; 2E0221 A52  
=2?3<?; -; 02 -; 1 >B- 9AF <30<; C2: A6<; - 9  
0<; 0?2A2@ D 56A- 9<: 664- A6 4 ?68 -; 1  
=<A2; A6 9@6B2@@B?<B; 1 6 4 D <?8: -; 656

/A @?20<: : 2: 1 21 A5- AA52 1 2@64; A2-:  
9@ 62 D 65 A52: - A2?6 9@B== 92? - A-; 2- ?9  
=?< 20A @A- 4 2 A< 1 2A- 92E- 0A: - A2?6 9  
?2>B62: 2: A@-; 1 A< 2: - / 9 A52 @B== 92? @  
2E=2?A6@ -; 1 =?2C6 B@2E=2?62: 02 A< / 2  
BA6@21 2ff20A6 29

% %& /Z ~ A/&+

) 52; C-B921 026 4 @-BA6; @-72 @20A21 6 =9 02 <3; <?2 A?-1 A6; -I fl-A @ /  
@-BA6; @B?A52? 2; C6<; : 2; A-96 =?<C2: 2; A@0-; / 2 1 2 6 2 7 2 1

## MATERIAL EFFICIENCY

) 52; 0<; =-?21 A< A?-1 A6; -I fl-A @ / 0<; @A?BOA6; A52: <?2 2ffi06; AC-B921  
=?<fi2: 2-; @A5-A 2@@: -A276 96?2>B621 A< 0<; @A?BOA- @ 6 7 9 =273<?: 6 4 @ /  
, B?A52? 2ffi06; OF 6 =?<C2: 2; A@0-; / 2 @-B45A- 0?<@@A52 D 5<2 <3A52 / B6 6 4  
-@9- 1 6 4 @-?2 ?21 B021 -; 1 0<??2@<; 1 6 4 =273<?: -; 02 ?2>B62: 2; A@3?  
@B==<?A6 4 @A?BOAB?2@

## EMBODIED ENERGY

&52 =?<1 BOA6; <3@A229726 3<?02: 2; A@-; 2; 274F 6 A2: @62: -; B3-0AB?6 4 =?<02@@  
-9<; 4 D A5 A52 =?<1 BOA6; <302: 2; A-@B05 A52 2: / <1 6 1 2; 274F 6 0<; 072A2 0-; / 2  
?29 A6 2 9 5 6 4 5 1 <D C2? 05<6 2 <3- C-B921 026 4 <C2? - A?-1 A6; -I fl-A @ / -; 1 A52  
?2@B96 4 ?21 BOA6; <3: -A276 960-; ?21 B02 A52 2: / <1 6 1 2; 274F <3A52 0<; @A?BOA21  
22: 2; A

# RECYCLING

&52 0<; 072A2 6 1B@A7F 5-@A-82; @G; #iO-; A  
 @A2=@A< 6 =?<C2 @=@=2?3<?; -; 02 6 A2?; @  
 <3: -A276 972B@ ?21 B06 4 A52 1 2=@A6<;  
 <3- / &A6 ?2@<B?02@ 6 072- @6 4 2; 274F  
 effi02; 0F -; 1 ?21 B06 4 0-? / <; 2: @66<; @  
 %64; #iO-; A6 =?<C2: 2; A@5- C2 - 92- 1F  
 / 22; - 052C21 0<; =-?21 A< A52 6 1B@A7F @  
 / - @29 2

) @5 ?2@- 20AA<; - A276 972B@ -; 1 A52  
 1 2=@A6<; <3- / &A6 ?2@<B?02@ 0<; 072A2  
 ?2- 1 & B@6@?20F0921 -; 1 @20<; 1-?F  
 : - A276 @- 9<; 4 D @5 02: 2; A?2=9 02: 2; A@  
 &5@5-@2; - / ?21 A52 6 1B@A7F A< / 2- ; 2A  
 B@?<3D-@A2 B@6 4 A6 2@: <?2 D-@A2  
 A5-; @A42; 2?-A2@ -; 1 0<; 072A2 @6296@  
 - @< ?20F09 / ?2

# BES 6001\*

&-?: - 0 5-@- 052C21 - ( ?2F ~ <<1 ?- A6 4  
 3<? - 9@=@=?<1 B0A6<; @62@-; 1 =?<1 B0A@  
 &52 6 1 2=2; 1 2; AA561 =-?AF @052: 2 - @2@2@  
 ?2@=<; @6 ? @<B?06 4 =<9@2@-; 1 =?- 0A62@  
 A5?<B45<BA A52 @B==F 05- 6



# ISO 14001

&-?: - 0 @B@ - 00?21 @21 D @5 /%  
 5-C6 4 6 = @2: 2; A21 ~; C6<; : 2; A- 9  
 f -; - 42: 2; A%F @A2: @A5?<B45<BA<B?  
 / B@6 2@2: - 6 A- 6 6 4 <B? 0<; : @ 2; AA<  
 ?21 B06 4 <B? 2; C6<; : 2; A- 96 =- 0A

&-?: - 0 0<; 072A2 =?<1 B0A@<ff2? A52 - / @A7F A< 0<; 3<?; D @5 - D @ 2 ?-; 4 6 4 ; B: / ?2 <3- @2@2 2; A07@276 6 / <A5  
 ~ \$ ~ f -; 1 E ~ ~ ~ ~ ~ <?; <?2 6 3<?; -A6<; 0<; A- 0A&-?; - 0 @B@A- 6 - / @A7F A2-;

\* 2 B? ~ ~ % 02?A6i0- A2; B: / ?2 3<? <B? ?2- 1F: @ 0<; 072A2 =?<1 B0A@ @ ~ ~ %

# SUSTAINABILITY ASSESSMENT SCHEMES

1 <; 072A2 0-; =9F -; 2EA2; 1 21 ?<2 6 2; - / 9 4 -; 2 ffi06; A / B 6 4 A / 2 072- A21 1 <; 072A2  
 0-; 0<; A76/ BA2 6 - ; B; / 2? <3- @22 2; A@52: 2@-; 1 529 - 056C2 - ?; 42 <30721 6@

~ \$ " " †

£ " " °

### Man 03: Responsible construction practices

&- ? - 0 @ ' - ? / <; ' - 9 B 9 A ? 5 - @ A 5 2 0 - = - / 6 F A <  
 1 2 A 2 ? : 6 2 - : 1 = ? < C 6 2 1 - A - ? 2 9 A 6 4 A : A 5 2 ' z  
 - ? 6 6 4 3 < : A 5 2 = ? < 1 B O A < ; - ; 1 1 2 6 2 ? F < 3 < B ?  
 = ? < 1 B O A @

### MR Credit 4: Recycled content

1 <; 072A2 6- C2?@ A52 : - A276 9D 5 < @ 1 2 6 4 ; 0 - ;  
 / 2 ? 2 - 1 6 - 1 - = A 2 1 A < 2 ; - / 2 A 5 2 B @ < ? 2 0 F 0 2 1  
 @ 2 0 < ; 1 - ? F < ? ? 2 = 9 0 2 : 2 : A : - A 2 7 6 9

### Hea 01: Visual Comfort

1 <; 072A2 : - AB ? - 9 < ff 2 ? @ - ? 2 9 A 6 2 9 5 6 4 5  
 - 9 2 1 < D 5 2 ; 0 < : = - ? 2 1 A < < A 5 2 ? 0 < ; @ A ? B O A < ;  
 : - A 2 7 6 9 1 < ; 072A2 @ : 6 1 2 6 4 ; - ; d f i ; 6 5 2 @ 0 - ;  
 / 2 < = A 6 6 2 1 A < 3 ? A 5 2 ? 6 = ? < C 2 6 @ - 9 2 1 < - ; 1  
 ? e f i 2 0 A - ; 0 2

### MR Credit 5: Regional materials

1 <; 072A2 6 < : 2 < 3 A 5 2 3 D : - A 2 7 6 9 A 5 - A 6 @  
 = ? < 1 B O 2 1 9 0 - 9 A < D 5 2 7 2 6 6 B @ 2 1 / A 0 - ; A F = 6 - 9 F  
 / 2 @ B = = 9 2 1 3 < : D 6 5 6 : 6 2 @ < 3 - ; F 4 6 2 ; @ 6 2

### Ene 01: Reduction of CO<sub>2</sub> Emissions

z = A 6 6 A < ; < 3 1 2 @ 4 : A < B A 6 @ A 5 2 ? : - 9 - @ @  
 2 : - / 2 @ 2 : 2 7 4 F ? 2 1 B O A < ; @ A 5 ? < B 4 5 ? 2 1 B O 2 1  
 0 < < 9 4 5 2 - A 6 4 - ; 1 C 2 : A 9 A < ; 1 2 : - : 1 @

### IEQ 8.1: Daylight and Views - Daylight

1 <; 072A2 : - AB ? - 9 < ff 2 ? @ - ? 2 9 A 6 2 9 5 6 4 5 - 9 2 1 <  
 D 5 2 ; 0 < : = - ? 2 1 A < < A 5 2 ? 0 < ; @ A ? B O A < ; : - A 2 7 6 9

### Mat 03: Responsible sourcing of materials

1 <; 072A2 6 = ? 6 - ? 6 0 < ; @ 6 B A 2 1 < 3 9 0 - 9 F - C - 6 / 2  
 : - A 2 7 6 9 - 9 9 0 < ; 072A2 = ? < 1 B O A @ = ? < 1 B O 2 1 / F  
 &- ? : - 0 - ? 2 ' ' % - - 0 0 7 2 1 6 2 1 A < -  
 ( 2 F ' < < 1 @ A : 1 - 7 1

### Wst 02: Recycled Aggregates

1 <; 072A2 6- C2?@ A52 : - A276 9D 5 < @ 1 2 6 4 ; 0 - ;  
 / 2 ? 2 - 1 6 - 1 - = A 2 1 A < 2 ; - / 2 A 5 2 B @ < ? 2 0 F 0 2 1  
 @ 2 0 < ; 1 - ? F < ? ? 2 = 9 0 2 : 2 : A : - A 2 7 6 9

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# PEOPLE

Safety and health  
Our people  
Community involvement

# PLANET

Climate change  
Environmental stewardship  
Resource efficiency

# PERFORMANCE

Economic value  
Governance and ethics  
Communication

# SOLUTIONS

Sustainable supply chain  
Innovation and quality  
Sustainable construction

# OUR SUSTAINABILITY STRATEGY

%B@A-6- / 5NF @- / <BA @20B?6 4 9; 4 A2?: @B002@@3?<B? / B@6 2@@ 0B@A: 2?@-; 1 0<; : B; @62@/F 6 =?<C6 4 A52 2; C6<; : 2; A-9@<06 9-; 1 20<; <; @ =273<?; -; 02 <3 <B? =?<1 BOA@-; 1 @<@BA6; @A5?<B45 A526 92 OF02 &5@: 2-; @0<; @6 2?6 4 ; <A<; F A52 4<<1 @D 2 =B?05- @2 <B? <=2?- A6; @-; 1 9 4 @A6@/BA- 9< A52 =273<?; -; 02 <3<B? =?<1 BOA@6 B@2 -; 1 A526 ?2B@2 -; 1 ?20F09 4 -AA52 2; 1 <3A526 92 ~ F 1 <6 4 A5@ D 2 0-; B; 12?@A; 1 -; 1 A-82 -0A6; A-; 6 6 @2 -; F; 24- A62 -@-20A@ D 5@2: -E6 @6 4 A52: -; F =<@A62 @B@A-6- / 5NF / 2; 2fiA@<B? / B@6 2@@-; 1 =?<1 BOA@/?6 4

' @ 4 A5@ D 5<2 92 A56 86 4 D 2 5-C2  
2; 4- 421 D @5 <B? @A- 825<9 2?@A- 1 2C29 = <B?  
@B@A-6- / 5NF @A- A24F &52 @A- A24F 12fi; 2@A52  
: -6 @B@A-6- / 5NF A52: 2@-; 1 <B? 82F =?<?@62@  
A5<@2 @@B2@D 5@5 - ?2: <@A 6 =<?A; AA< <B?  
/ B@6 2@@-; 1 <B? @A- 825<9 2?@/A @A@<BA<B?  
0<; : @ 2; A@A- A?; @3<?; <B? / B@6 2@@B; 12?  
3-B?: -6 A52: 2@ **People, Planet, Performance  
and Solutions**

~ B6 6 4 <; =?<4?2@@- 92- 1F; - 12 D 2 5-C2 @2A  
-; / @<B@ : @2@A; 2 A-742A@3? 2- 05 <3<B?  
82F =?<?@62@ &52@2 -; / @<B@A- ?42A@5- C2 / 22;  
@2A- A- 82 B@ / 2F<; 1 6 072: 2; A- 96 =?<C2: 2; A  
=?<4?; : 2@A- / B@6 2@@A?; @3<?; 6 4 @<@BA6; @

## FOUR THEMES

Twelve key priorities

Twelve commitments

Twelve 2020 milestones

Forty four other performance targets

ž B? : @2@A; 2@- ?2 @B==<?A21 / F  
- ?-; 42 <3<A52? =273<?; -; 02 A-742A@  
&5@562?- 705F 529@: - 82 @2- @6? A- / B6  
B; 12?@A; 1 6 4 1?62 6 =?<C2: 2; A-; 1  
2; - / ?@B@A- ?2=<?A=?<4?2@@6 -; -2; 6 4 @B9  
-; 1; 2- @B? / ?D - F

\$ " , " \$ " Z " ' " %

**1. US Department of Energy – Radiant Cooling**

D D D 2: 2?4F 4<C 2: 2?4F@ C2? -?A6Q@?-16; A  
0<<9 4

**2. The Mineral Product Association and  
The Concrete Centre**

&52?: -9! -@@ " E=9 6 21

**3. Marceau, M. and Vangeem, G.**

%<9? \$2fi20A-; 02 (- 92@3<? ' <; 0?2A2 ' <; 0?2A2  
/ A2?; -A<; -9 B4B@A

**4. Health and Safety Executive**

&52?: -9' <; 3<?A  
D D D 5@2 4<C B8 A2: =2?-AB? A52?: -9 6 1 2E 5A

**5. Reinforced Concrete Council**

./ - / ?@ " : 2?4F %A<?- 4 2 ' @ 4 0<; 0?2A2 @?B@AB?2@  
3<? 2: 5-; 021 2: 2?4F  
effi0@: 0F

**6. Center for the Built Environment, University of  
California**

./ -@- 12-; 1 | 1?6 2A2? , <; 2 | 2?3<? -; 02  
. @9 %AB1F  
D D D 0 / 2 / 2?82?F 21 B ?2@-?05 3 0- 1 2  
fi29 @AB1F 5A

**7. Hacker, JN, Belcher, SE and Connell, RK (2005)**

" 2- A6 4 A52 1 2- A fi22=6 4 ' fi / B@ 6 4 @0<<96 -  
D -?: 6 4 0% - A2 ' fi ' / ' ?@fi; 4 \$ 2=<?A ' fi ' /  
Z E3<?1

**8. The Government's Energy Efficiency Best Practice  
programme**

" : 2?4F ' <; @B; =A<; ' B@ 2 " : 2?4F B@2  
6 <ffi0@2

**9. From reactive to proactive: quantifying  
on-site benefits of self-compacting concrete  
(SCC)**

" \$ @5 E<B45/ <?<B45

**10. The Mineral Product Association and The Concrete  
Centre**

" <; 0?2A2 , 9<? %<9A<; @3<?! - @@@2 -; 1 0A@2  
" <<@ 4

**11. European Project ThermCo**

&52?: -9' <; 3<?A 6 " B@ 6 4 @D @5 E<D " : 2?4F  
" <<@ 4 " &52?: -9' <; 3<?A-; 1 ! ?<1 B@A@A@F

D D D A52?: 0< <?4

**12. GreenSpec® – Thermal Mass (2013)**

D D D 4?22; @-20 0< B8 A52?: -9: -@@=5=

**13. Center for the Built Environment, University of  
California**

" : 1 2?fi<<? @ &205; <9 4F  
5AA= 0 / 2 / 2?82?F 21 B B; 1 2?fi<<?- @ 4 9 @ @ ?F  
5A %

**14. European Concrete Platform** " <; 0?2A2 3<?

2: 2?4F 2ffi0@: A / B@ 6 4 @ &52 / 2: 2fiA@<3A52?: -9  
: -@@

**15. The Concrete Centre** ' A@B A<; <3&52?: -9! -@@  
6 Z <; \$ 2@2; A6 9' B@ 6 4 @

**16. Hamilton, S., Roth, K. and Brodrick, J.,**

" @-9 02: 2: A ( 2; A@ A<; % \$ " fi<B?; -9  
%2=A2: / 2?

17. **BSRIA** ( 2; A6 A6; 2ff20A62: 2@@ i <D D.2911 <  
C2: A6 A6; @F@2: @D <78  
D D D / @6 0< B8 : 2D @ C2: A6 A6; 2ff20A62: 2@@  
5<D D.2911 < C2: A6 A6; @F@2: @D <78

18. **Hulme, M., Jenkins, G.J., Lu, X., Turnpenny, J.R., Mitchell, T.D., Jones, R.G., Lowe, J., Murphy, J.M., Hassell, D., Boorman, P., McDonald, R. & Hill, S.**  
' 6 - A2 ' 5-; 4.2 %02: - ?6 @3? A52 ' ; 6A21  
fl 6 41< ; &52 ' fl ' / ! %062: A6i0 \$2=<?A &F: 1- 99  
' 2: A2 3? ' 6 - A2 ' 5-; 4.2 \$ 2@- ?05 %05 < <9 <3  
' ; C6<: ' 2: A- 9%062: 02@ ' ; 62?@6F <3 ' - @A ; 4 6  
Z <?D 65 ' fl ==

19. **City of Melbourne**  
' <B; 06i <B@ z B?4?22: / B6i 6 4  
D D D : 29 <B?; 2 C6 4 < C - B @B@A- 6 - / 6F ' i  
== 42@ ' i z B?4?22: / B6i 6 4

20. **Irish Concrete Federation**  
&52?; - 9i - @@-; 1 %B@A- 6 - / 2 ' B6i 6 4 / A: =?<C6 4  
' ; 274F ! 2?3?; -; 02 -; 1 z 00B--; A ' <: 3?<A

21. **European Concrete Platform**  
' 2: 27- 94B6 26 2@3?; B66 4 A52?; - 9: - @@6  
0<; 072A2 / B6i 6 4@

22. **CONSTRUCT Concrete Structures Group**  
Z - A6; - 9%A?B0AB?- 9' <; 072A2 %=206i0- A6; A5  
' 1 66;  
D D D 0<; @A?B0A <?4 B8

23. **The Mineral Product Association and The Concrete Centre on behalf of The Sustainable Concrete Forum**

' <; 072A2 /; 1 B@F %B@A- 6 - / 6F ! 273?; -; 02  
\$ 2=<?A A5 \$ 2=<?A = 273?; -; 02 1 - A-

24. **GreenSpec®**  
\$ 21B06 4 A52 /; =- 0A <3 ' <; 072A2  
D D D 4?22: @-20 0< B8 4?22: 6 4 <3 0<; 072A2 =5=

25. **Green Book Live**  
D D D 4?22: / <<8%62 0<; @2- ?05 @52: 2 7@- 6

26. **The Carbon Trust**  
D D D 0- ? / <; A?B@A 0<;

27. **ISO 14001**  
D D D / 6i <B= 0< B8 2: @@@ 2: A  
' ; 1 ' 27A6i0- A6; @2?C62@ i -; - 4.2: 2: A  
@F@2: @ %A: 1- ?i @-; 1 %052: 2@ /%2  
406i ' z ) ?; %4?i ' ; 0?A <1 ( 5D ' i

28. **The Mineral Product Association and The Concrete Centre Concrete, Material Efficiency (2010)**

&560-A- 9-4B2 6=?<C6 21 3-?6 3?; - A6; =B?<@2@<; 9 &- ?; - 0.2E=72@6F 16906 @- 9D - ??; A2@<3-; F 86 1  
D 52A52? 2E=72@@<?6 =921 - @A< A52 - 00B?- 0F ?26 / 6F -; 1 C- 6i 6F <3A52 0<; A2: A-; 1 - 002=A@< 6 / 6F 3?; -; F  
9<@<? <A52? 0<; : 2706 9i -; - 4.2@6 0B??21 - @- 72@B9A <3B@6 4 -; 1 ?29 6 4 <; A52 6 3?; - A6; =?<C6 21 &5272 6<; <  
=-?A 27@56 / 2AD 22; &- ?; - 0-; 1 A52 0<; =; 6@; 2: A6; 21 6 A560-A- 9-4B2 9=?<1B0A@-; 1 6 A2920AB- 9-?<=27AF  
?6A5A@<3A52@ 0<; =; 6@- 72 <; 9 B@21 3?; 6 2: A6i0- A6; -; 1 6 3?; - A6; =B?<@2@<- 1 ?2: - 6 - A- 9A6 2@ A52  
2E09@62 =?<=27AF <3A526 ?2@-20A62 <D; 2?@



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