

BS4142 (2014) Rating and Assessment

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Proportionate and relevant assessment

Key differences- assessment

1997	2014
Single correction of 5 dB for one or several features	Graduated corrections for tonal and impulsive. Corrections for other features. May be additive
Subjective	Subjective or objective
Likelihood complaints	Adverse impacts
Rating minus background	Rating minus background plus context
20 dB range (-10 to +10dB)	10 dB range (0 to +10dB)

Assessment framework

Given the range of sources and acoustic environments it is not possible to be prescriptive about impact from industrial and commercial sources relying upon objective noise rating procedures alone

A + B = significant effect is simply not appropriate

Therefore, BS4142 (2014) provides an assessment framework

Competent assessors need to use the framework and justify their opinions and conclusions

Acoustic Features

Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

- a) subjective method;
- b) objective method for tonality;
- c) reference method.

When should objective and reference methods be used?

Ans: When the subjective method is not sufficient

Annex C: If the presence of audible tones is in dispute

Tonality

For sound ranging from not tonal to prominently tonal the method gives a correction of between 0 dB and +6 dB for tonality.

Subjectively: 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

One-third octave method

Add a 6 dB correction if the sound pressure level in the one-third-octave band of interest exceeds sound pressure levels of both adjacent one-third-octave bands by:

- 15 dB in the low-frequency one-third-octave bands (25 Hz to 125 Hz);
- 8 dB in middle-frequency one-third-octave bands (160 Hz to 400 Hz);
- 5 dB in high-frequency one-third-octave bands (500 Hz to 10 000 Hz).

Tonality cont

Reference method

The method includes procedures for steady and varying tones, narrow-band sound, low-frequency tones, and the result is a graduated 0 dB to 6 dB adjustment. Based on the Joint Nordic Method 2 and is to be found in ISO 1996-2.

The method has three steps:

- a) narrow-band frequency analysis [**preferably FFT analysis**];
- b) determination of the average sound pressure level of the tone(s) and of the masking sound within the critical band around the tone(s); and
- c) calculation of the tonal audibility and the adjustment.

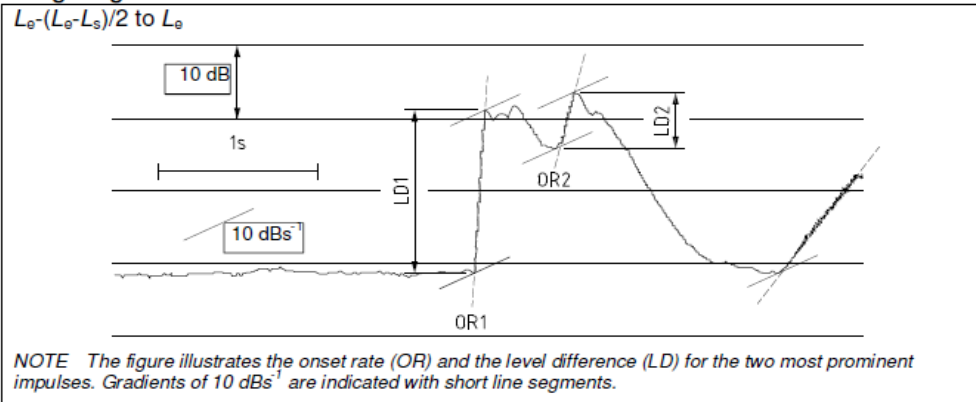
Impulsivity

Correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level.

Subjectively, a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Onset rate for measuring the prominence of impulsive sounds. A-weighted sound pressure level with time weighting F is sampled with time intervals in the range from 10 ms to 25 ms

Figure E.1 – Time history of the A-weighted sound pressure levels with time weighting F



Addition of corrections

Judgement required whether to add corrections or not

NOTE Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections should normally be added in a linear fashion.

Other features

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Intermittency

When the specific sound has identifiable on/off conditions, and the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

11 Assessment of the impacts

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level

- a) Typically, the greater this difference, the greater the magnitude of the impact.
- b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

11 Assessment of the impacts

NOTE 2 Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration

Following slides deal with the pertinent factors

Absolute noise

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

- * Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.
- * Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

Character

The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound.

Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

** NOTE 3 Consideration should be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the “Effects on humans of industrial and commercial sound” portion of the “Further reading” list in the Bibliography.*

Sensitivity of the receptor

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i) facade insulation treatment;

ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and

iii) acoustic screening.

Examples

Following examples illustrate the importance of context

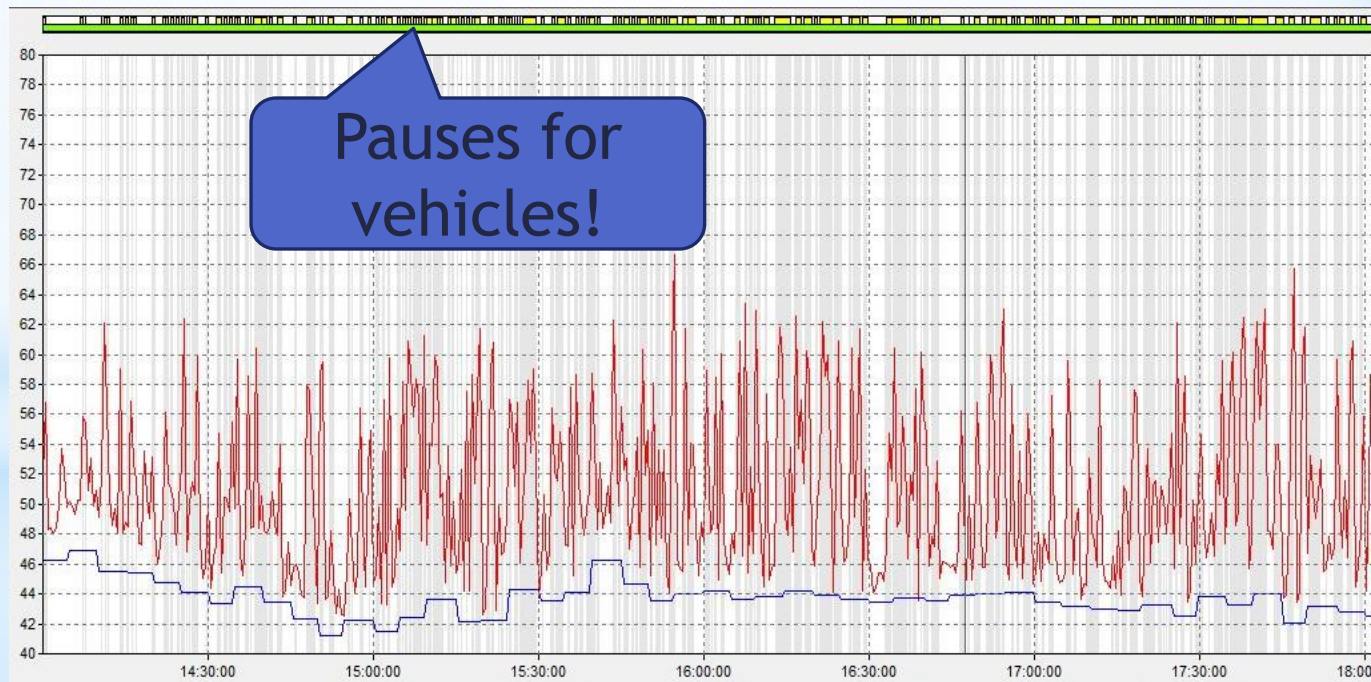
Based upon the examples provided by Jon Tofts of the Environment Agency

Worked example 1

Houses 200m from a heavily industrialised area

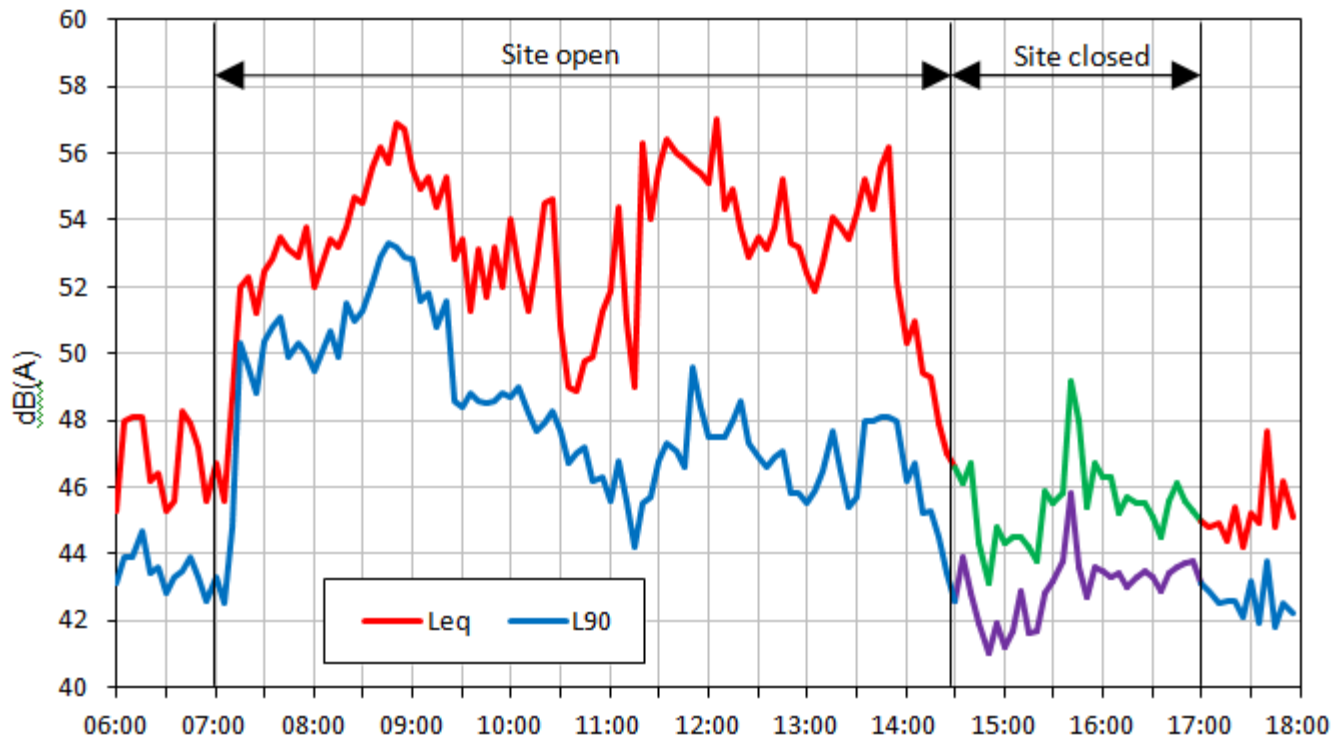
Materials handling noise - cascading crashes as material was being stockpiled by tall grabs

Difficult to isolate the site noise behind vehicle noise



Worked example 1

With the vehicles removed, the influence of the site was clear:



Worked example 1

Using BS4142:1997

Measured noise level	54
Residual noise level	46
Measured minus Residual	8
Correction	-1
Corrected measured level	53
Specific noise level from site	53
Acoustic correction feature	+5
Rated noise level	58
Background noise level	43
Rating over Background	+15

Cascading
crashes

Worked example 1

- ➔ Using the BS4142 (2014):
- ➔ No tonalities
- ➔ Impulse correction (K_i) of 5.7dB
- ➔ Would result in a Rated Sound Level +16dB over Background

but.....

Time	Level change	Onset rate	P	K_i
0.25	18.6	74.4	8.2	5.7
0.5	21.8	43.6	7.6	4.7
0.25	13.7	54.8	7.5	4.5
0.25	12.5	50	7.3	4.1
0.5	18.4	36.8	7.2	4.0
0.25	12	48	7.2	4.0
0.25	12	48	7.2	4.0
0.75	22.2	29.6	7.1	3.8
1	25.2	25.2	7.0	3.6
0.75	20.4	27.2	6.9	3.5
1	23.8	23.8	6.9	3.4
0.5	15.9	31.8	6.9	3.4
0.25	9.2	36.8	6.6	2.9
1	20.6	20.6	6.6	2.8
1	20.6	20.6	6.6	2.8
1	19.9	19.9	6.5	2.7
1.5	22.7	15.1	6.3	2.3
0.75	14.7	19.6	6.2	2.2
0.75	14.7	19.6	6.2	2.2
0.75	14.7	19.6	6.2	2.2
1	16.7	16.7	6.1	2.0
0.5	10.9	21.8	6.1	2.0
1.75	22.5	12.9	6.0	1.9
1.25	18.2	14.6	6.0	1.8
1.5	19.2	12.8	5.9	1.6
1.25	17	13.6	5.9	1.6
1.25	17.3	13.8	5.9	1.6
1.25	16.6	13.3	5.8	1.5
1	14.7	14.7	5.8	1.5
0.75	12	16	5.8	1.4
1.5	17.9	11.9	5.7	1.3
2	15.4	7.7	5.0	0

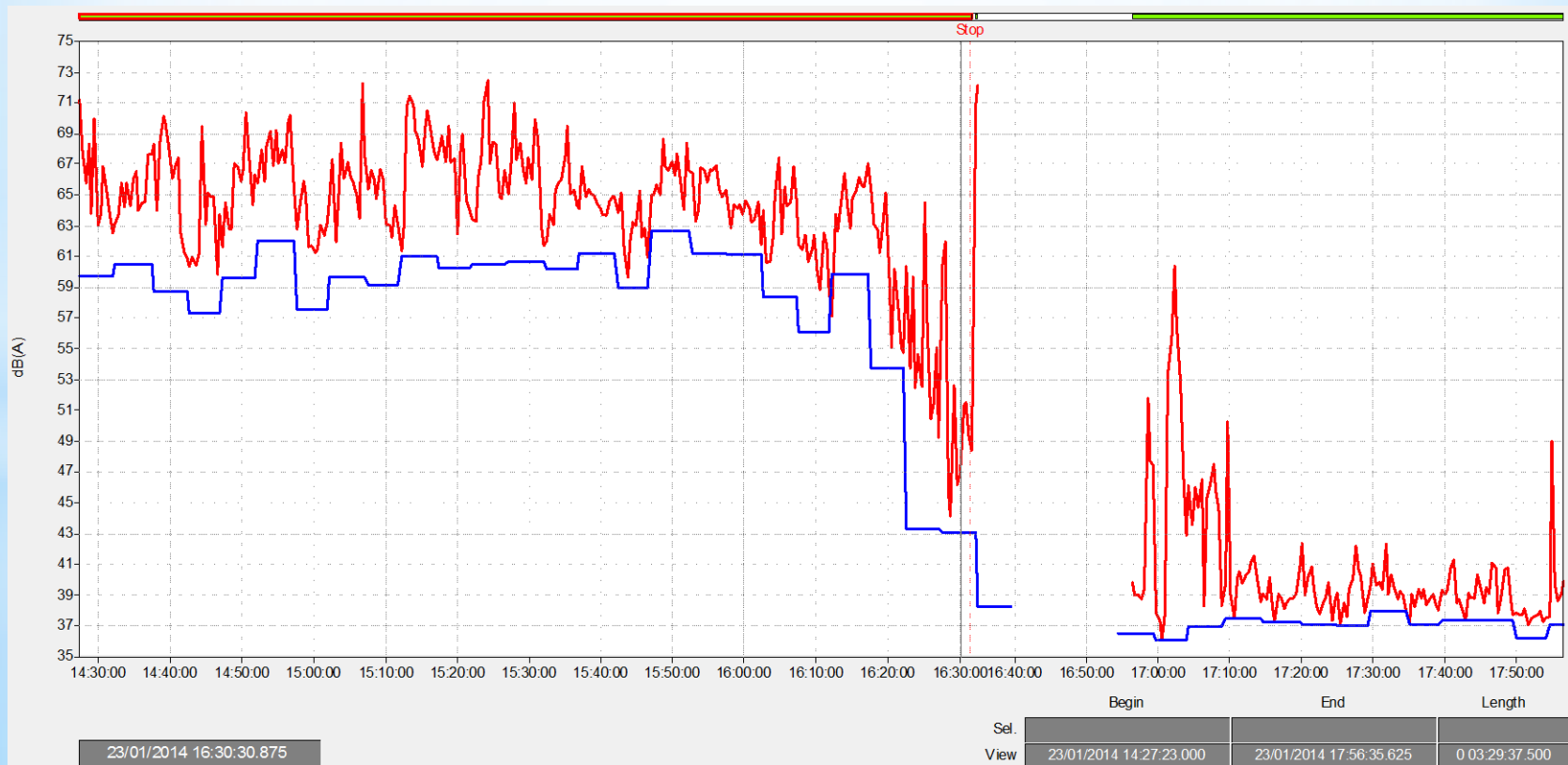
Worked example 1

- ➔ Only measurable by pausing out hundreds of car passes, which is not a true representation of the acoustic environment
- ➔ The car passes presented similar time profiles and frequencies as the materials handling noise, and were not dissimilar in terms of their noise character
- ➔ Even without the site noise, other industrial noise was still present in the environment

- ➔ No further action recommended in the context of the situation associated with the source and the acoustic environment

Worked example 2

Houses immediately adjacent to a single industrial site
Constant bangs and crashes and some tonal noise
Utterly intolerable level of noise impact



Worked example 2

Using BS4142:1997

Measured noise level	66
Residual noise level	45
Measured minus Residual	21
Correction	0
Corrected measured level	66
Specific noise level from site	66
Acoustic correction feature	+5
Rated noise level	71
Background noise level	37
Rating over Background	+34

Single
penalty

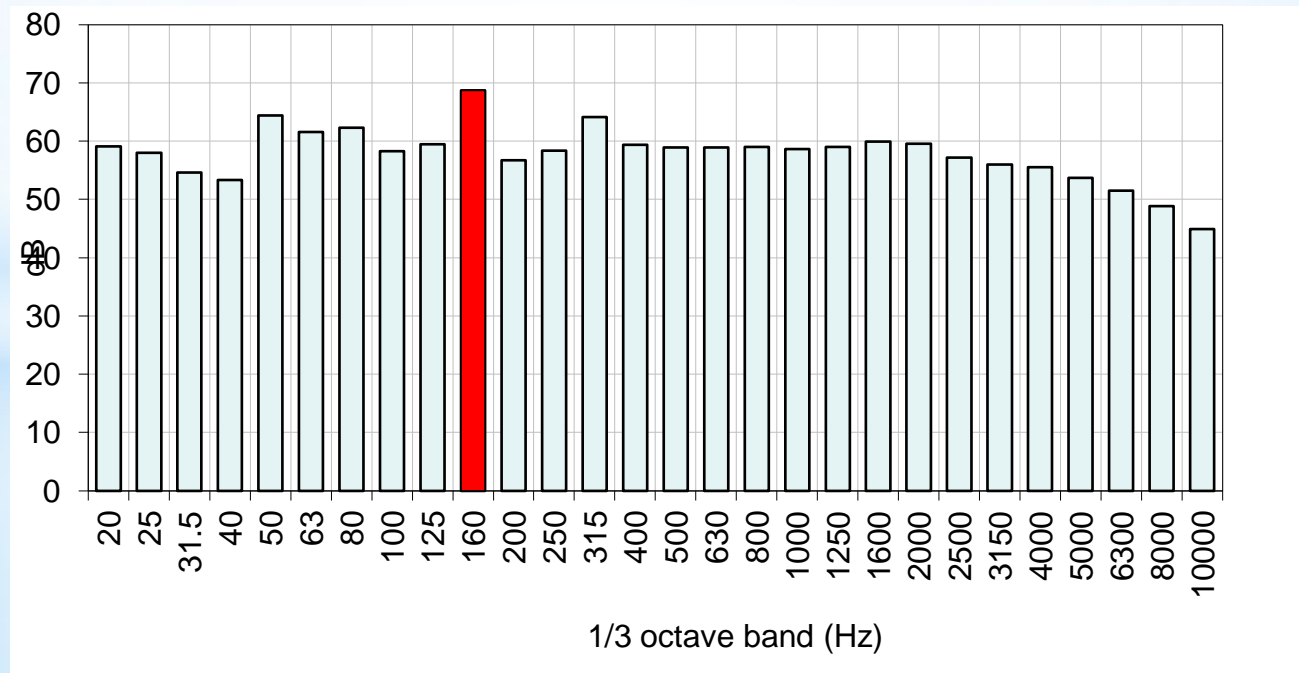
Worked example 2

Using BS4142 (2014):

Angle grinder was highly tonal, but not always present

Other sources did not pass the 1/3 octave band criteria for prominent tones

Decided on a +4dB penalty



Worked example 2

Using BS4142 (2014):

Highly impulsive noise source

Impulse correction (K_i) of 8.7dB

+4dB penalty for tones

+9dB penalty for impulses

+ Specific Sound level of 79dB(A)

+42dB over Background

Duration (sec)	Level change (dB)	Onset rate (dB/Sec)	P	K_i
0.125	26.5	212	9.8	8.7
0.125	25.9	207.2	9.8	8.6
0.125	16.9	135.2	8.8	6.9
0.125	16.4	131.2	8.8	6.8
0.25	24.8	99.2	8.8	6.8
0.375	28.8	76.8	8.6	6.4
0.25	22.3	89.2	8.5	6.4
0.25	21.9	87.6	8.5	6.3
0.125	13.5	108	8.4	6.0
0.25	18.7	74.8	8.2	5.7
0.25	18.4	73.6	8.1	5.6
0.375	22	58.7	8.0	5.4
0.25	17.5	70	8.0	5.4
0.25	17.1	68.4	8.0	5.3
0.375	20.6	54.9	7.8	5.1
0.375	20.6	54.9	7.8	5.1
0.25	16	64	7.8	5.1
0.125	10.4	83.2	7.8	5.0
0.375	19.4	51.7	7.7	4.9
0.125	9.9	79.2	7.7	4.8
0.625	25.7	41.1	7.7	4.8
0.375	19.2	51.2	7.7	4.8
0.5	22.5	45	7.7	4.8
0.5	21.8	43.6	7.6	4.7
0.375	18.5	49.3	7.6	4.7
0.25	14.3	57.2	7.6	4.6
0.25	13.5	54	7.5	4.4
0.25	13	52	7.4	4.3
0.5	20	40	7.4	4.3
0.75	24	32	7.3	4.1
0.25	12.2	48.8	7.2	4.0
0.375	14.8	39.5	7.1	3.8
0.625	18.8	30.1	7.0	3.6
0.5	16.6	33.2	7.0	3.6
0.5	14.9	29.8	6.8	3.2
0.25	9.5	38	6.7	3.1