

Correlating and Predicting the Air Infiltration Through the Cracks of Suspended Timber Floors

P.T. McGrath* and E. Lai**

* B.Sc. M.Sc. C.Eng. M.Inst.E., Snr.Lecturer Dept of Building and Environmental Health, Nottingham Trent University

** B.Sc. Ph.D. C.Eng. M.I.Mech.E, Snr.Lecturer, Dept. of Mechanical and Manufacturing. Engineering, Nottingham Trent University

This paper shows that the visible gap length may be used as a physical parameter when correlating pressure difference to volume flow rate (or air velocity) through the cracks between floorboards and can be termed the *Equivalent Crack Length*. The crack widths, which previously have been determined separately from the edge effect coefficient and the laminar flow coefficient, were significantly different. When analysed graphically they can be shown to correlate by an empirical relationship. A generalised equation is proposed that, in conjunction with the empirical relationship, allows predictions to be made of the volume flow rate through the cracks between floorboards for a known pressure difference.

Symbols

Q = volume flow rate,

ΔP = pressure difference

n = exponent

A & B = constants that relate to crack parameters

C_2 is a constant, found by regression analysis,

μ = dynamic viscosity

z = total distance through the crack

L = length of the crack as measured on the horizontal plane of the floor

d = crack width or thickness

ρ = air density

C_b = a constant that relates to the number of bends in the crack.

w_{lam} = equivalent crack length calculated from the Laminar coefficient

w_{edge} = equivalent crack length calculated from the Edge coefficient

1.0 Introduction

It is established that air infiltration from a basement or sub-floor void is a drain on the heat requirement of a building⁽¹⁾ as well as a potential medium for the transportation of ground contaminants^(2,3). In previous work⁽⁴⁾ the authors presented the results of an investigation of three methods for correlating air infiltration through timber floors with pressure difference, namely the power relationship, the linear relationship and the quadratic relationship. It was shown that both the power relationship and the quadratic relationship offer an effective means of describing the flow characteristics associated with air infiltration through timber floorboards for the pressure difference range of 2 – 50 Pascals.

In the case of the quadratic relationship, knowledge of its coefficients allows the physical parameters of the crack geometry to be estimated. However, the determination of the coefficients is likely to be affected by (a) the nature and type of the experiment being undertaken; (b) the availability and spread of data; and (c) the

method of data analysis. Consequently, the parametric values thus deduced are strictly applicable only to the case under investigation. Furthermore, caution must be exercised when using measurements taken at low flow rates, i.e. for pressures differences less than 5 Pa because of the practical constraints. In extreme cases (where the pressure difference is less than 2 Pa), extrapolation of data offers the only means of analysis. Although the quadratic relationship is well established and its coefficients can be related to crack parameter, the following two items need addressing;

Can the quadratic relationship be made to be independent of case studies?

Can the uncertainty associated with measurements at flow rates be minimised?

The main emphasis of the present study is devoted to tackling these two issues and the purpose of this paper is therefore two-fold

to provide more experimental data to enable the search of a universal quadratic relationship;

to show the effectiveness of using an apparent floorboard crack length for parametric calculations.

2. The Experiment

For this study a purpose-built floor has been constructed to investigate the flow characteristics associated with low flow rates through a suspended timber floor. This would enable the crack dimensions to be readily measured, so that comparison could be made with predicted values from mathematical models. The technique used to construct the floor was typical of that used in current U.K. housing stock.

2.1 Test rig

In order to exercise greater control over the air flow rate and pressure difference across the chamber floor, a rig of 1.8 m x 1.2 m x 0.60 m (Figure 1) was constructed with a suspended timber floor dividing the rig into two 300 mm deep chambers. The rig was constructed of clear 6 mm perspex held together by 25 mm aluminium and mild steel angles. The angle-section/perspex interface and corners of the rig were sealed with silicone sealant to achieve a near perfect air-tight seal. The chamber lid was made of 1.8 m x 1.2 m x 6 mm perspex that was screwed on to the angle sections and a seal achieved by using a silicone sealant bead as the gasket. The floor was built of 125 mm x 25 mm (nom) tongue and groove boards on 50 mm x 50 mm carcassing timber. Air was supplied to the chamber through 51 mm flanged copper tubes and the flow rate was regulated by a variable speed centrifugal fan (250 mm) and a damper connected to a 1000 mm (*l*) x 51 mm (*i.d.*) copper tube. The mean velocity pressure through the inlet pipe was determined by means of a micromanometer connected to a Pitot-static tube located 1 m downstream of the entry point and 20 mm from the exit point where it was anticipated that the air flow would be reasonably developed. Bulk pressure across the floor was measured by an inclined manometer that was connected to pressure tappings above and below the floor, which enabled static pressure differences as low as 0.5 Pascals to be recorded.

2.2 Procedure

The purpose of the investigation was to measure volume flow rates and corresponding pressure differences across the timber floor for a pressure range of 0-50 Pascals

Observations of the flow conditions at the measuring station revealed a flattened velocity profile similar to that pertaining to a turbulent flow. Therefore, it was concluded that the air flow at the measuring station would always be turbulent and fully developed. The volume flow rate was calculated from *the Area of the pipe x Mean Air Velocity* which was found from a single, centre-line velocity pressure reading. Since the air velocity near the pipe wall is lower than that of the mean velocity, the calculated flow rate would slightly differ from the true flow rate. From recorded measurements the difference is estimated to be of the order of 10%.

2.3 Background Theory

Previous work⁽⁵⁾ identified that the flow rate through the floorboards could be calculated by subtracting the leakage (Q_{leak1}) from the total flow into the chamber (Q_1). Although infiltration through the floorboards is measured directly, the flow between the skirting board and the floorboards is deduced from the difference between the measured flow rate through the *floor* and the measured flow rate through the *floor and skirting*. Measurement of the infiltration through the floorboards is possible by sealing the gap between the skirting and the floor with plastic tape.

Background leakage from the chamber was determined by closing and sealing the chamber lid and comparing the inflow with the outflow. The inflow/outflow velocity pressure was measured in a 22 mm pipe and the measured leakage was calculated as less than 1% of the inflow rate in preliminary investigation and was subsequently neglected in other tests. Four test floors were prepared, each with pre-determined visible gap sizes between the floorboards and were separately tested (tests 1-4). All the tests had a skirting board at the edge of the floor that was sealed to the chamber

wall by silicone sealant to prevent unmeasured leakage. This arrangement simulated the typical construction detail of a wooden floor over a basement or floor-void. The results are analysed as the variation of the volume flow rate (through the floor and from the opening between the floor and skirting board) with pressure difference between the chambers and are subjected to regression analysis using the following relationship:

2.3.1 The quadratic equation

$$\Delta P = AQ + BQ^2 + C_2 \quad (1)$$

where Q = volume flow rate, ΔP = pressure difference, A & B are constants that relate to crack parameters that were defined by Etheridge⁽⁶⁾ and subsequently extended by Baker⁽⁷⁾ as Equations 2 and 3. C_2 is a constant, found by regression analysis, that is indicative of instrument error at zero pressure difference. By sealing the inlet tube and setting of the instruments to zero before each set of readings, instrument error was assumed to be negligible and set at zero for the analysis.

$$A = 12\mu z / Ld^3 \quad (\text{Laminar flow coefficient}) \quad (2)$$

$$B = \rho C_b / 2d^2 L^2 \quad (\text{Edge effect coefficient}) \quad (3)$$

where μ = dynamic viscosity, z = total distance through the crack, L = length of the crack as measured on the horizontal plane of the floor, d = crack width or thickness, ρ = air density and C_b = a constant (described by Baker⁽⁷⁾) that relates to the number of bends in the crack.

3.0 Results and Discussion

3.1 Floorboard Crack Size

The experimental data for this work are plotted (Figures 2 – 5) using the regression technique, based on the volume flow rate - pressure difference quadratic relationship as defined in Equation 1. The results confirm the authors' previous observation⁽⁵⁾ that the greatest pressure loss within the joint/crack is attributable to edge effects .

Substitution of the regression curve coefficients into Equation 3 enables the calculation of an approximate value of an *equivalent crack width* of the floorboard joint (Table I). Although the term *equivalent crack length* is used to describe the total length of the visible gap between floorboards it does not represent the true crack length because the tongue of one board rests on the lip of the adjoining board.

Inspection of the calculated values (Table I) shows that an equivalent crack width determined by using the laminar flow coefficient can result in vastly different values. However, because the laminar flow predominates at lower pressure differences, it is not wise to disregard it completely. When the calculated equivalent crack widths based on the laminar flow coefficient were plotted against those determined from the edge effect coefficient (Figure 7), a relationship is identified which can be represented by the following expression

$$w_{lam} = 0.0711(w_{edge})^{0.2805} \quad (4) \quad \text{where}$$

w_{lam} = is the equivalent crack length calculated from the laminar flow coefficient

w_{edge} = is the equivalent crack length calculated from the edge effect coefficient. Combining Equations 3 and 4 and substituting into Equation 1 yields

$$\Delta P = (\rho C_b / 2 (w_{edge})^2 L^2) * Q^2 + \{ 12 \mu z / L [0.0711 (w_{edge})^{0.2805}]^3 \} * Q \quad (5)$$

Thus, the empirical relationship given by Equation 4 allows the infiltration flow rate Q to be predicted based on a knowledge of the equivalent crack width deduced from

the *edge effect coefficient*, which can be calculated from the regression analysis of experimental data. .

The validity of this approach can be quantified as follows. When the pressure difference across the chambers was maintained at 2 Pa, the calculated flow rate (Q) was found to be within 3.5% of the values predicted using the regression analysis coefficients for tests 2- 4 This figure increases to 11 % for a full size test floor. It should be noted that the difference between Equation 5 predictions and those from the regression analysis can vary significantly at very low pressure. For example, the difference in predictions for test No.1 (figure 2) can be as high as 54% at 0.4 Pa and decreases logarithmically to 10 % at 50 Pa. The reason for the large discrepancy is unknown and this may be attributable to practical difficulties in measuring data at low pressures.

3.2 Normalised results

It is generally accepted that the upper pressure difference for testing air flow through building components should be limited to 50 Pa. . Because of the similarity between each curve, the data can be conveniently normalised with respect to a maximum pressure difference of 50 Pascals and the corresponding volume flow rate as follows;-

$$y = \Delta P_i / \Delta P_{50} \quad (6)$$

$$x = Q_i / Q_{50} \quad (7)$$

Where the subscript ‘i’ denotes a quantity measured at a pressure difference less than 50 Pa; and subscript ‘50’ denotes a quantity measured at 50 Pa.

The normalised results of this work are presented in Figure 8, along with the results of British Gas's work on crack flow⁽⁶⁾ and the authors' previous work⁽⁵⁾ for comparison. Presenting the data in a dimensionless form allows any operational bias from various experimental set-up to be minimised. With most of the data following a definite pattern, a generalised quadratic relationship (Equation 9) can be identified which has achieved a coefficient of Determination of 0.99.

$$y = 0.7635x^2 + 0.2621x \quad (8)$$

or

$$0.7635x^2 + 0.2621x - y = 0$$

By solving the generalised quadratic relationship, theoretical infiltration flow rates can be calculated for a given pressure ratio. The validity of Equation 8 has been assessed by comparing the predicted flow rates with measured flow rates. The comparison of all the results over the full range (0 – 50 Pa) appears encouraging although the error in the 0-3 Pascal pressure difference is higher than expected due to practical difficulties when measuring very low pressure differences. However, analysis of the 3 – 10 Pa range showed that out of thirty-five case studies taken from seventeen tests, thirty-one predictions (88%) are within 15% of the measured flow rates (Figure 9), while twenty predictions are within 10%. Thus, given the floorboard dimensions and an equivalent crack width, this approach allows acceptable estimations to be made of the air infiltration through the gaps between floorboards.

4.0 Conclusions

The above discussion examines the results of the present investigation , the authors' previous study and the work of Etheridge's. Some interesting points have been highlighted that enables the following conclusions to be made.

A new parameter known as the *equivalent crack length* has been proposed to describe the total length of the visible gap between floorboards..

An empirical relationship has been proposed for determining floorboard equivalent crack width based on edge effect coefficient, that can be used with Equation 5 to calculate air infiltration across a traditional wooden floor.

The correlation between pressure difference and volume flow rate can be normalised onto a single curve which can be used to predict infiltration, within a range of 3-10 Pa, through a traditional wooden floor with better than 85% agreement.

References

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TABLE

Table I Comparison of Calculated Crack widths for Differing Floorboard Configurations					
Gap width (mm)	Edge Coefficient A	Crack width (mm) $w_{ A}$	Laminar Coef.* B	Crack width (mm) w_B	Widths Ratio w_B/w_A
0	$1.81 \cdot 10^8$	0.01	6750	1.4	140
1.25	246466	0.21	1605	2.8	13.3
3.5	600324	0.14	1585	2.9	20.7
Random ₁	21819	0.71	397	5.8	8.2
1.75 ²	4507.1	0.25	109.3	4.2	16.8

¹ The floor was laid with large non-uniform, random size cracks between the boards and 2.5mm is a reasonable approximation of the average gap size

² The tests were performed on a full-size test floor that had settled with non-uniform gap widths. An estimation of the average size of the gap width is approximately 1.75mm

* This is included for comparison with the edge effect coefficient

LIST OF FIGURES

Fig.1 Diagram of the Test Rig

Fig.2 Pressure Difference versus Flow Rate (Test 1)

Fig.3) Pressure Difference versus Flow Rate (Test 2)

Fig.4 Pressure Difference versus Flow Rate (Test 3)

Fig.5 Pressure Difference versus Flow Rate (Test 4)

Fig.6 Pressure Difference versus Flow Rate (^{Ref.5})

Fig.7 Laminar Coefficient Width versus Edge Effect Coefficient Width

Fig.8 Normalised Pressure Difference versus Normalised Flow Rate

Fig. 9 Magnitude of Error With Pressure Difference

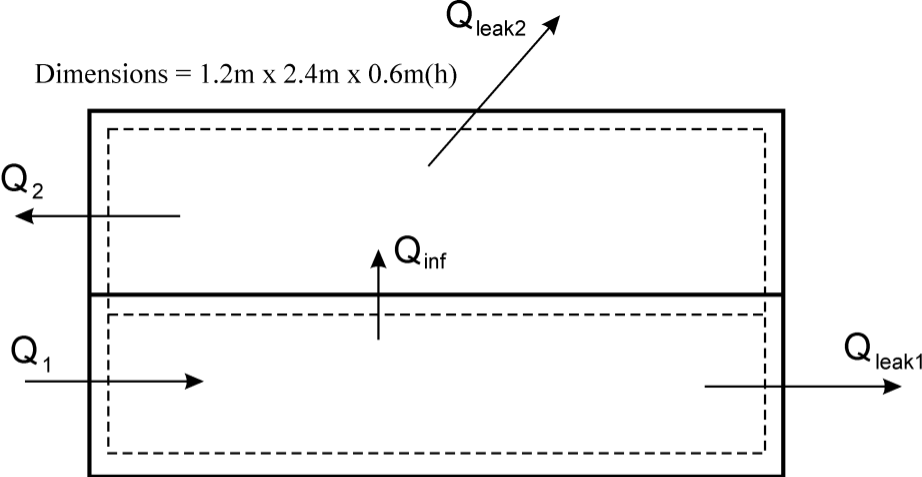
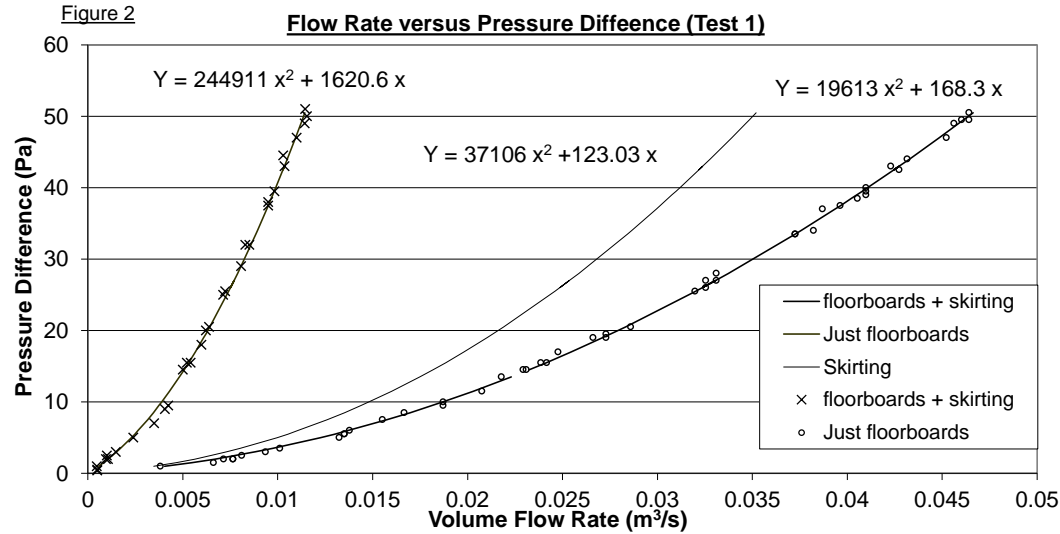


Figure 1 Diagrammatic of Test Chamber

Fig 2:



just fbds	1620.6	244911
fbds+skts	168.34	19613
flow rate	Pressure Difference	
0.000503	0.5	0.000295
0.001006	2.5	0.001291
0.002394	5	0.002292
0.00406	9	0.003598
0.005218	15.5	0.005307
0.006221	20	0.006315
0.007133	25	0.007323
0.008508	32	0.008591
0.009503	37.5	0.0095
0.010368	43	0.010349
0.011545	50	0.011358
0.000503	0.375	0.000224
0.000954	2	0.001063
0.00148	3	0.001508
0.00349	7	0.002979
0.004233	9.5	0.003744
0.005421	15.5	0.005307
0.006391	20.5	0.00642

	fbds+ sktng	jst fbds	jst sktng
1	0.00403936	0.000568	0.003471
1.5	0.005449979	0.000823	0.004627
2	0.00668072	0.001063	0.005617
2	0.00668072	0.001063	0.005617
2	0.00668072	0.001063	0.005617
2.5	0.007786695	0.001291	0.006496
3	0.008799566	0.001508	0.007292
3.5	0.00973951	0.001715	0.008024
5	0.012241767	0.002292	0.00995
5.5	0.012995551	0.002471	0.010525
5.5	0.012995551	0.002471	0.010525
6	0.013717814	0.002645	0.011073
7.5	0.015728867	0.003139	0.01259
8.5	0.016964125	0.003448	0.013516
9.5	0.018131437	0.003744	0.014388
10	0.018692871	0.003887	0.014806
11.5	0.020300391	0.004301	0.016
13.5	0.022292971	0.00482	0.017473

Pressure D	Flow Rate	floorboards	Just floorbc	Skirting	floorboards	Just floorboards
1	0.004039	1				
1.5	0.00545	1.5				
2	0.006681	2				
2	0.006681	2				
2	0.006681	2				
2.5	0.007787	2.5				
3	0.0088	3				
3.5	0.00974	3.5				
5	0.012242	5				
5.5	0.012996	5.5				
5.5	0.012996	5.5				
6	0.013718	6				
7.5	0.015729	7.5				
8.5	0.016964	8.5				
9.5	0.018131	9.5				
10	0.018693	10				
11.5	0.0203	11.5				
13.5	0.022293	13.5				

0.008076	29	0.008065	0.008076
0.009503	38	0.00958	0.009503
0.011005	47	0.010934	0.011005
0.011421	49	0.011218	0.011421
0.000468	1	0.000568	0.000468
0.001063	2	0.001063	0.001063
0.005008	14.5	0.005067	0.005008
0.005986	18	0.005881	0.005986
0.007233	25.5	0.007418	0.007233
0.008294	32	0.008591	0.008294
0.009836	39.5	0.009815	0.009836
0.010299	44.5	0.010571	0.010299
0.011452	51	0.011496	0.011452

14.5	0.023235225	0.005067	0.018168
14.5	0.023235225	0.005067	0.018168
15.5	0.024146276	0.005307	0.018839
15.5	0.024146276	0.005307	0.018839
17	0.025460591	0.005656	0.019805
19	0.027127602	0.0061	0.021027
19	0.027127602	0.0061	0.021027
19.5	0.027530713	0.006208	0.021323
20.5	0.02832199	0.00642	0.021902
25.5	0.032020652	0.007418	0.024602
27	0.033058897	0.0077	0.025359
26	0.032370001	0.007513	0.024857
27	0.033058897	0.0077	0.025359
28	0.033735316	0.007884	0.025851
33.5	0.037259248	0.008846	0.028413
33.5	0.037259248	0.008846	0.028413
34	0.037564897	0.00893	0.028635
37	0.039353861	0.00942	0.029934
37.5	0.039644941	0.0095	0.030145
38.5	0.04022139	0.009659	0.030563
39	0.040506833	0.009737	0.03077
39.5	0.040790469	0.009815	0.030975
40	0.041072331	0.009893	0.03118
43	0.042728037	0.010349	0.032379
42.5	0.042456158	0.010274	0.032182
44	0.043267131	0.010497	0.03277
47	0.044848942	0.010934	0.033915
49	0.045875781	0.011218	0.034658
49.5	0.046129224	0.011288	0.034841
49.5	0.046129224	0.011288	0.034841
50.5	0.046632325	0.011427	0.035205

14.5	0.023235	14.5
14.5	0.023235	14.5
15.5	0.024146	15.5
15.5	0.024146	15.5
17	0.025461	17
19	0.027128	19
19	0.027128	19
19.5	0.027531	19.5
20.5	0.028322	20.5
25.5	0.032021	25.5
27	0.033059	27
26	0.03237	26
27	0.033059	27
28	0.033735	28
33.5	0.037259	33.5
33.5	0.037259	33.5
34	0.037565	34
37	0.039354	37
37.5	0.039645	37.5
38.5	0.040221	38.5
39	0.040507	39
39.5	0.04079	39.5
40	0.041072	40
43	0.042728	43
42.5	0.042456	42.5
44	0.043267	44
47	0.044849	47
49	0.045876	49
49.5	0.046129	49.5
49.5	0.046129	49.5
50.5	0.046632	50.5

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0.000823	1.5
0.001063	2
0.001063	2
0.001063	2
0.001291	2.5
0.001508	3
0.001715	3.5
0.002292	5
0.002471	5.5
0.002471	5.5
0.002645	6
0.003139	7.5
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0.003744	9.5
0.003887	10
0.004301	11.5
0.00482	13.5
0.005067	14.5
0.005067	14.5

0.005307	15.5	
0.005307	15.5	
0.005656	17	
0.0061	19	
0.0061	19	
0.006208	19.5	
0.00642	20.5	
0.007418	25.5	
0.0077	27	
0.007513	26	
0.0077	27	
0.007884	28	
0.008846	33.5	
0.008846	33.5	
0.00893	34	
0.00942	37	
0.0095	37.5	
0.009659	38.5	
0.009737	39	
0.009815	39.5	
0.009893	40	
0.010349	43	
0.010274	42.5	
0.010497	44	
0.010934	47	
0.011218	49	
0.011288	49.5	
0.011288	49.5	
0.011427	50.5	
0.003471		1
0.004627		1.5
0.005617		2
0.005617		2
0.005617		2
0.006496		2.5
0.007292		3
0.008024		3.5
0.00995		5
0.010525		5.5
0.010525		5.5
0.011073		6
0.01259		7.5
0.013516		8.5
0.014388		9.5
0.014806		10
0.016		11.5
0.017473		13.5
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0.019805		17

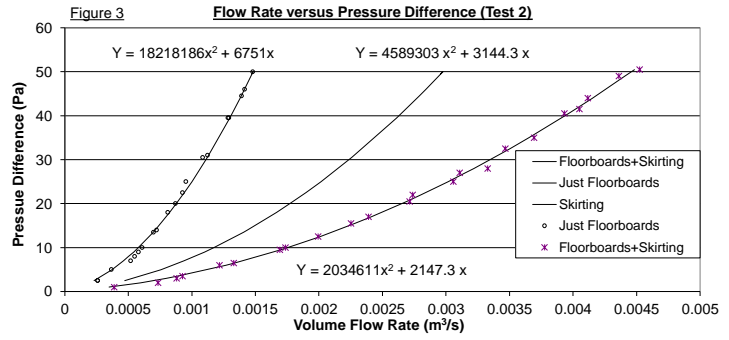
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0.028413	33.5	
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0.030145	37.5	
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0.030975	39.5	
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0.032379	43	
0.032182	42.5	
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0.010368		43
0.011545		50
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0.000954		2
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0.011005		47
0.011421		49
0.000468		1
0.001063		2
0.005008		14.5
0.005986		18

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0.008294	32
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0.007645	2
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0.009363	3
0.010113	3.5
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0.013514	5.5
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0.018726	10
0.020761	11.5
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0.032546	26
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0.038224	34
0.038699	37
0.039631	37.5
0.040542	38.5
0.04099	39
0.04099	39.5
0.04099	40
0.042306	43
0.042735	42.5
0.043161	44
0.045227	47
0.045629	49
0.046028	49.5

0.046423
0.046423

49.5
50.5

fig 3



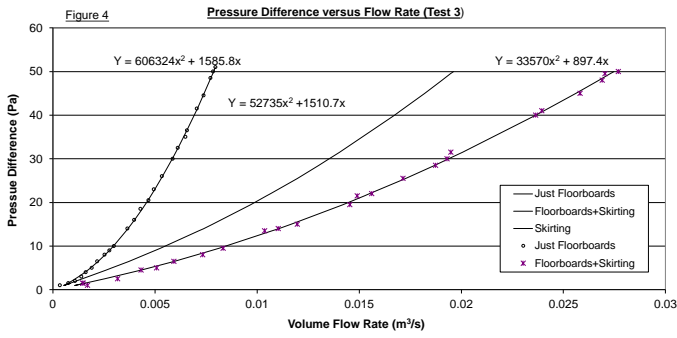
Flow Rate	Pressure C	Floorboards	Floorboard Skirting
0.00039	1	0.000113	0.00035
0.000734	2	0.000194	0.000595
0.000881	3	0.000261	0.000796
0.000927	3.5	0.000291	0.000886
0.001218	6	0.000418	0.001269
0.00133	6.5	0.00044	0.001336
0.001693	9.5	0.00056	0.001697
0.001737	10	0.000578	0.001751
0.001995	12.5	0.000664	0.002007
0.002253	15.5	0.000756	0.002282
0.002391	17	0.000798	0.002411
0.002714	20.5	0.000892	0.00269
0.002739	22	0.000929	0.002803
0.003059	25	0.001001	0.003017
0.003108	27	0.001046	0.003153
0.003328	28	0.001068	0.003219
0.003467	32.5	0.001163	0.003504
0.003693	35	0.001213	0.003653
0.003932	40.5	0.001317	0.003965
0.00405	41.5	0.001335	0.004019
0.004116	44	0.00138	0.004153
0.004361	49	0.001465	0.004408
0.004524	50.5	0.00149	0.004482
0.00026	2.5	0.000229	0.0007
0.00026	2.5	0.000229	0.0007
0.000367	5	0.00037	0.001126
0.000519	7	0.000462	0.001401
0.000551	8	0.000503	0.001524
0.000581	9	0.000542	0.001641
0.000609	10	0.000578	0.001751
0.000699	13.5	0.000695	0.002102
0.000723	14	0.000711	0.002148
0.000811	18	0.000826	0.002493
0.000871	20	0.000879	0.002652
0.000927	22.5	0.000941	0.002839
0.000954	25	0.001001	0.003017
0.001086	30.5	0.001122	0.00338
0.001124	31	0.001132	0.003411
0.001285	39.5	0.001299	0.00391
0.001292	39.5	0.001299	0.00391
0.001392	44.5	0.001389	0.004179
0.001416	46	0.001414	0.004256
0.00148	50	0.001482	0.004458
0.001509	49.5	0.001473	0.004433

a= 2034611.0 18218186
 b= 2147.0 6751
 c
 Y x(tot) x(floor)
 Pa
 Δ P(bulk)

Flow Rate	Floorboard	Just Floor Skirting	Just Floor Skirting	Floorboards+Skirting
0.00035	1	0.000595	2	0.000796
0.000595	2	0.000796	3	0.000886
0.000796	3	0.000886	3.5	0.001269
0.001269	6	0.001336	6.5	0.001697
0.001336	6.5	0.001697	10	0.001751
0.001697	10	0.002007	12.5	0.002282
0.002007	12.5	0.002282	15.5	0.002411
0.002282	15.5	0.002411	17	0.00269
0.002411	17	0.00269	20.5	0.002803
0.00269	20.5	0.002803	22	0.003017
0.002803	22	0.003017	25	0.003153
0.003017	25	0.003153	27	0.003219
0.003153	27	0.003219	28	0.003504
0.003219	28	0.003504	32.5	0.003653
0.003504	32.5	0.003653	35	0.003965
0.003653	35	0.003965	40.5	0.004019
0.003965	40.5	0.004019	41.5	0.004153
0.004019	41.5	0.004153	44	0.004408
0.004153	44	0.004408	49	0.004482
0.004408	49	0.004482	50.5	0.000229
0.004482	50.5	0.000229	2.5	0.000229
0.000229	2.5	0.0007	5	0.0007
0.0007	5	0.001126	7	0.001126
0.001126	7	0.001401	8	0.001401
0.001401	8	0.001524	9	0.001524
0.001524	9	0.001641	10	0.001641
0.001641	10	0.001751	13.5	0.002102
0.001751	13.5	0.002102	14	0.002148
0.002102	14	0.002148	18	0.002493
0.002148	18	0.002493	20	0.002652
0.002493	20	0.002652	22.5	0.002839
0.002652	22.5	0.002839	25	0.003017
0.002839	25	0.003017	30.5	0.00338
0.003017	30.5	0.00338	31	0.003411
0.00338	31	0.003411	39.5	0.00391
0.003411	39.5	0.00391	39.5	0.00391
0.00391	39.5	0.00391	44.5	0.004179
0.004179	44.5	0.004179	46	0.004256
0.004256	46	0.004256	50	0.004458
0.004458	50	0.004458	49.5	0.004433
0.004433	49.5	0.004433	0.000471	2.5
0.000471	2.5	0.000471	5	0.000471
0.000471	5	0.000796	7	0.000796
0.000796	7	0.000886	8	0.000886
0.000886	8	0.001269	10	0.001269
0.001269	10	0.001336	13.5	0.002102
0.001336	13.5	0.001697	14	0.002148
0.001697	14	0.001751	18	0.002493
0.001751	18	0.002007	20	0.002652
0.002007	20	0.002282	22.5	0.002839
0.002282	22.5	0.002411	25	0.003017
0.002411	25	0.00269	30.5	0.00338
0.00269	30.5	0.002803	31	0.003411
0.002803	31	0.003017	39.5	0.00391
0.003017	39.5	0.003153	39.5	0.00391
0.003153	39.5	0.003219	44.5	0.004179
0.003219	44.5	0.003504	46	0.004256
0.003504	46	0.003653	50	0.004458
0.003653	50	0.003965	49.5	0.004433
0.003965	49.5	0.004019	0.00026	2.5
0.004019	2.5	0.00026	5	0.00026
0.00026	5	0.000367	7	0.000367
0.000367	7	0.000519	8	0.000519
0.000519	8	0.000551	9	0.000551
0.000551	9	0.000609	10	0.000609
0.000609	10	0.000699	13.5	0.000699
0.000699	13.5	0.000723	14	0.000723
0.000723	14	0.000811	18	0.000811
0.000811	18	0.000871	20	0.000871
0.000871	20	0.000927	22.5	0.000927
0.000927	22.5	0.000954	25	0.000954
0.000954	25	0.001086	30.5	0.001086
0.001086	30.5	0.001124	31	0.001124
0.001124	31	0.001285	39.5	0.001285
0.001285	39.5	0.001292	39.5	0.001292
0.001292	39.5	0.001392	44.5	0.001392
0.001392	44.5	0.001416	46	0.001416
0.001416	46	0.00148	50	0.00148
0.00148	50	0.001509	49.5	0.001509

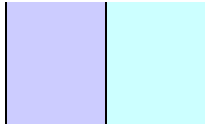
0.00148	50	1
0.00039		2
0.000734		3
0.000881		3.5
0.000927		6
0.001218		6.5
0.00133		9.5
0.001693		10
0.001737		12.5
0.001995		15.5
0.002253		17
0.002391		20.5
0.002714		22
0.002739		25
0.003059		27
0.003108		28
0.003328		32.5
0.003467		35
0.003693		40.5
0.003932		41.5
0.00405		44
0.004116		49
0.004361		50.5
0.004524		

Fig 4



		0.0277		just fbd		1585.8		606324	
				fbd+sks				33570	
						Flow Rates			
						Just Floorboard		Skirting	
Flow Rate	Pressure C	Flow Rate	Pressure C	Flow Rate	Pressure C	Flow Rate	Pressure C	Flow Rate	Pressure C
1.294409	0.001928524	-0.7121	0.002702	0.048692	0.000774	0.0015	1.5	0.000738	0.001578
1.294409	0.001928524	-0.7121	0.002702	0.048692	0.000774	0.0015	1.5	0.000738	0.001578
1.700074	0.001474885	-0.92889	0.002067	0.473293	0.000592	0.0017	1.0	0.000525	0.001071
0.882453	0.002703683	-0.48928	0.003788	-0.02061	0.001085	0.0032	2.5	0.001108	0.002544
0.532174	0.003883947	-0.29444	0.005588	-0.06567	0.0016	0.0043	4.5	0.001714	0.004317
0.4818	0.00427619	-0.26582	0.005992	-0.07151	0.001716	0.0051	6.0	0.001848	0.004733
0.370864	0.005086501	-0.2022	0.007127	-0.07995	0.002041	0.0059	6.5	0.002218	0.005928
0.296554	0.005835283	-0.15919	0.008176	-0.08299	0.002341	0.0073	8.0	0.002553	0.007054
0.243197	0.006537694	-0.12816	0.009161	-0.08324	0.002623	0.0083	9.5	0.002861	0.00812
0.154425	0.008248234	-0.07674	0.011557	-0.07793	0.003009	0.0104	13.5	0.003589	0.010734
0.146652	0.00849039	-0.07228	0.011839	-0.07695	0.00339	0.0110	14.0	0.003672	0.011041
0.132576	0.008843516	-0.06424	0.012391	-0.0749	0.003548	0.0120	15.0	0.003835	0.011644
0.086563	0.010519306	-0.03847	0.01474	-0.0647	0.00422	0.0145	19.5	0.004512	0.014193
0.072251	0.011221037	-0.03074	0.015723	-0.05998	0.004502	0.0149	21.5	0.004789	0.015254
0.069088	0.01139296	-0.02906	0.015964	-0.05879	0.004571	0.0156	22.0	0.004856	0.015513
0.050563	0.012561569	-0.01947	0.017601	-0.05056	0.00504	0.0171	25.5	0.005308	0.017265
0.038551	0.013520495	-0.0136	0.018945	-0.04365	0.005424	0.0187	28.5	0.005672	0.01869
0.033544	0.013987053	-0.01127	0.019599	-0.04027	0.005611	0.0193	30.0	0.005847	0.019398
0.029081	0.014445774	-0.00927	0.020241	-0.03694	0.005795	0.0195	31.5	0.006018	0.020055
0.011213	0.016918455	-0.00237	0.023706	-0.01903	0.006787	0.0236	40.0	0.006919	0.02365
0.009723	0.01719703	-0.00192	0.024096	-0.01703	0.006899	0.0239	41.0	0.007019	0.02405
0.004674	0.018289127	-0.00065	0.025627	-0.00526	0.007337	0.0258	45.0	0.007406	0.02561
0.001683	0.019086714	-0.00015	0.026744	-0.00364	0.007657	0.0269	48.0	0.007685	0.02674
0.0004	0.019479154	-2.8E-05	0.027294	-0.0009	0.007815	0.0270	49.5	0.007822	0.027293
0	0.019609069	0	0.027476	0	0.007867	0.0277	50.0	0.007867	0.027476

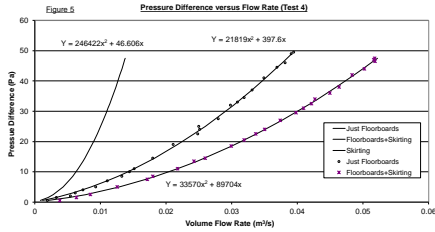
Flow Rate	Pressure C	Just Floorboard	Skirting	Just Floorboard+Skirting
0.001578	1.5	1.5		
0.001578	1.5		1.5	
0.001071	1.0		1.0	
0.002544	2.5		2.5	
0.004317	4.5		4.5	
0.004733	5.0		5.0	
0.005928	6.5		6.5	
0.007054	8.0		8.0	
0.00812	9.5		9.5	
0.010734	13.5		13.5	
0.011041	14.0		14.0	
0.011644	15.0		15.0	
0.014193	19.5		19.5	
0.015254	21.5		21.5	
0.015513	22.0		22.0	
0.017265	25.5		25.5	
0.01869	28.5		28.5	
0.019398	30.0		30.0	
0.020055	31.5		31.5	
0.02365	40.0		40.0	
0.02405	41.0		41.0	
0.02561	45.0		45.0	
0.02674	48.0		48.0	
0.027293	49.5		49.5	
0.027476	50.0		50.0	
0.000841	1.5			1.5
0.000841	1.5			1.5
0.000546	1.0			1.0
0.001436	2.5			2.5
0.002603	4.5			4.5
0.002866	5.0			5.0
0.00371	6.5			6.5
0.004501	8.0			8.0
0.005259	9.5			9.5
0.007145	13.5			13.5
0.007368	14.0			14.0
0.007808	15.0			15.0
0.008681	19.5			19.5
0.010465	21.5			21.5
0.010657	22.0			22.0
0.011957	25.5			25.5
0.013019	28.5			28.5
0.013533	30.0			30.0
0.014038	31.5			31.5
0.016731	40.0			40.0
0.017031	41.0			41.0
0.018204	45.0			45.0
0.019055	48.0			48.0
0.019471	49.5			49.5
0.019609	50.0			50.0
0.000344	1			1
0.000757	1.5			1.5
0.001086	2			2
0.001392	3			3
0.001606	4			4
0.001904	5			5
0.002173	6.5			6.5
0.002531	8			8
0.00277	9			9
0.002989	10			10
0.003649	14			14
0.003981	16			16
0.004287	18.5			18.5
0.004681	20.5			20.5
0.004944	23			23
0.005338	26			26
0.005864	30			30
0.006116	32.5			32.5
0.006492	35			35
0.006569	36.5			36.5
0.007052	41.5			41.5
0.007379	44.5			44.5
0.007714	48.5			48.5
0.007844	50			50
0.007962	51			51
0.001466	1.5			1.5
0.001693	1			1
0.003168	2.5			2.5
0.004317	4.5			4.5
0.005079	5			5
0.005926	6.5			6.5
0.007331	8			8
0.008338	9.5			9.5
0.010368	13.5			13.5
0.011038	14			14
0.011972	15			15
0.01454	19.5			19.5
0.014925	21.5			21.5
0.01561	22			22



0.017141
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0.013304
0.019489
0.023643
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0.025516
0.026304
0.027037
0.027691

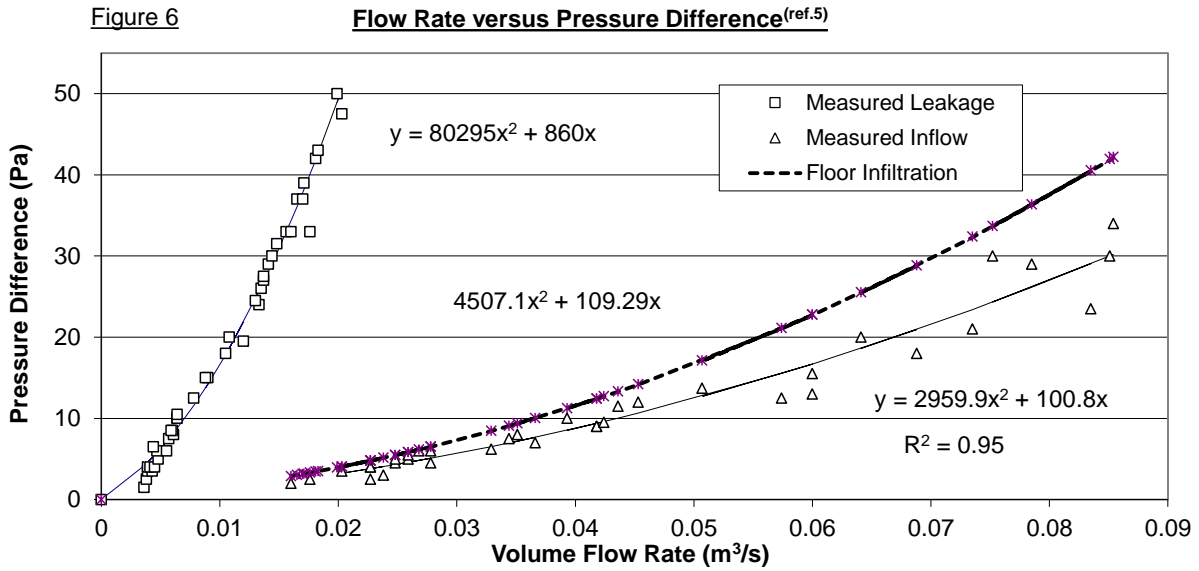
25.5
28.5
30
31.5
40
41
45
48
49.5
50

Fig 5



Ratio calculation		Ratio calculation		Ratio calculation		Ratio calculation		Ratio calculation		Ratio calculation		Ratio calculation		Ratio calculation	
Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate	Flow Rate
-0.2008	0.000877	-0.226	0.00568	0.00771	0.00186	0.0038	0.5	0.001181	0.002028	0.000847	0.218435	0.600218	0.002028	0.5	0.5
-0.201	0.00184	-0.0212	0.00521	0.01171	0.00308	0.00325	1.5	0.002028	0.002028	0.000847	0.218435	0.600218	0.002028	1.5	1.5
-0.2011	0.001963	-0.04225	0.00744	0.01031	0.00548	0.00486	2.5	0.004046	0.007756	0.002811	0.218435	0.600218	0.007756	2.5	2.5
-0.2012	0.002078	-0.06377	0.01177	0.00881	0.00725	0.00595	3.5	0.006064	0.012287	0.004299	0.218435	0.600218	0.012287	3.5	3.5
-0.2013	0.002194	-0.08571	0.01506	-0.01011	0.01133	0.01741	4.5	0.011547	0.016813	0.005356	0.218435	0.600218	0.016813	4.5	4.5
-0.2014	0.00231	-0.10805	0.01874	-0.0244	0.01230	0.01758	5.5	0.013528	0.021364	0.006424	0.218435	0.600218	0.021364	5.5	5.5
-0.2015	0.002428	-0.13079	0.02381	-0.0414	0.01460	0.02174	6.5	0.016517	0.025914	0.007492	0.218435	0.600218	0.025914	6.5	6.5
-0.2016	0.002545	-0.15394	0.02974	-0.0612	0.01720	0.02442	7.5	0.019506	0.030464	0.008560	0.218435	0.600218	0.030464	7.5	7.5
-0.2017	0.002662	-0.17749	0.03651	-0.0828	0.02007	0.02693	8.5	0.022495	0.035014	0.009628	0.218435	0.600218	0.035014	8.5	8.5
-0.2018	0.002779	-0.20154	0.04414	-0.1062	0.02313	0.02924	9.5	0.025484	0.039564	0.010696	0.218435	0.600218	0.039564	9.5	9.5
-0.2019	0.002896	-0.22609	0.05261	-0.1315	0.02644	0.03135	10.5	0.028473	0.044114	0.011764	0.218435	0.600218	0.044114	10.5	10.5
-0.2020	0.003013	-0.25114	0.06194	-0.1588	0.03000	0.03326	11.5	0.031462	0.048664	0.012832	0.218435	0.600218	0.048664	11.5	11.5
-0.2021	0.003130	-0.27669	0.07211	-0.1881	0.03391	0.03497	12.5	0.034451	0.053214	0.013900	0.218435	0.600218	0.053214	12.5	12.5
-0.2022	0.003247	-0.30274	0.08314	-0.2194	0.03806	0.03648	13.5	0.037440	0.057764	0.014968	0.218435	0.600218	0.057764	13.5	13.5
-0.2023	0.003364	-0.32929	0.09491	-0.2527	0.04247	0.03779	14.5	0.040429	0.062314	0.016036	0.218435	0.600218	0.062314	14.5	14.5
-0.2024	0.003481	-0.35634	0.10744	-0.2880	0.04714	0.03890	15.5	0.043418	0.066864	0.017104	0.218435	0.600218	0.066864	15.5	15.5
-0.2025	0.003598	-0.38389	0.12171	-0.3253	0.05215	0.04001	16.5	0.046407	0.071414	0.018172	0.218435	0.600218	0.071414	16.5	16.5
-0.2026	0.003715	-0.41194	0.13684	-0.3646	0.05740	0.04112	17.5	0.049396	0.075964	0.019240	0.218435	0.600218	0.075964	17.5	17.5
-0.2027	0.003832	-0.44049	0.15281	-0.4059	0.06289	0.04223	18.5	0.052385	0.080514	0.020308	0.218435	0.600218	0.080514	18.5	18.5
-0.2028	0.003949	-0.46954	0.16964	-0.4492	0.06852	0.04334	19.5	0.055374	0.085064	0.021376	0.218435	0.600218	0.085064	19.5	19.5
-0.2029	0.004066	-0.49909	0.18731	-0.4945	0.07439	0.04445	20.5	0.058363	0.089614	0.022444	0.218435	0.600218	0.089614	20.5	20.5
-0.2030	0.004183	-0.52914	0.20584	-0.5418	0.08048	0.04556	21.5	0.061352	0.094164	0.023512	0.218435	0.600218	0.094164	21.5	21.5
-0.2031	0.004300	-0.55969	0.22521	-0.5911	0.08681	0.04667	22.5	0.064341	0.098714	0.024580	0.218435	0.600218	0.098714	22.5	22.5
-0.2032	0.004417	-0.59074	0.24544	-0.6424	0.09338	0.04778	23.5	0.067330	0.103264	0.025648	0.218435	0.600218	0.103264	23.5	23.5
-0.2033	0.004534	-0.62229	0.26651	-0.6957	0.10019	0.04889	24.5	0.070319	0.107814	0.026716	0.218435	0.600218	0.107814	24.5	24.5
-0.2034	0.004651	-0.65434	0.28844	-0.7510	0.10724	0.04999	25.5	0.073308	0.112364	0.027784	0.218435	0.600218	0.112364	25.5	25.5
-0.2035	0.004768	-0.68689	0.31211	-0.8083	0.11453	0.05110	26.5	0.076297	0.116914	0.028852	0.218435	0.600218	0.116914	26.5	26.5
-0.2036	0.004885	-0.72094	0.33754	-0.8676	0.12206	0.05221	27.5	0.079286	0.121464	0.029920	0.218435	0.600218	0.121464	27.5	27.5
-0.2037	0.005002	-0.75599	0.36471	-0.9289	0.13087	0.05332	28.5	0.082275	0.126014	0.030988	0.218435	0.600218	0.126014	28.5	28.5
-0.2038	0.005119	-0.79104	0.39364	-0.9922	0.14008	0.05443	29.5	0.085264	0.130564	0.032056	0.218435	0.600218	0.130564	29.5	29.5
-0.2039	0.005236	-0.82609	0.42431	-1.0575	0.14969	0.05554	30.5	0.088253	0.135114	0.033124	0.218435	0.600218	0.135114	30.5	30.5
-0.2040	0.005353	-0.86114	0.45674	-1.1248	0.15960	0.05665	31.5	0.091242	0.139664	0.034192	0.218435	0.600218	0.139664	31.5	31.5
-0.2041	0.005470	-0.89619	0.49091	-1.1941	0.17081	0.05776	32.5	0.094231	0.144214	0.035260	0.218435	0.600218	0.144214	32.5	32.5
-0.2042	0.005587	-0.93124	0.52684	-1.2654	0.18242	0.05887	33.5	0.097220	0.148764	0.036328	0.218435	0.600218	0.148764	33.5	33.5
-0.2043	0.005704	-0.96629	0.56451	-1.3387	0.19443	0.05998	34.5	0.100209	0.153314	0.037396	0.218435	0.600218	0.153314	34.5	34.5
-0.2044	0.005821	-1.00134	0.60384	-1.4140	0.20684	0.06109	35.5	0.103198	0.157864	0.038464	0.218435	0.600218	0.157864	35.5	35.5
-0.2045	0.005938	-1.03639	0.64491	-1.4913	0.21965	0.06220	36.5	0.106187	0.162414	0.039532	0.218435	0.600218	0.162414	36.5	36.5
-0.2046	0.006055	-1.07144	0.68774	-1.5706	0.23286	0.06331	37.5	0.109176	0.166964	0.040600	0.218435	0.600218	0.166964	37.5	37.5
-0.2047	0.006172	-1.10649	0.73231	-1.6519	0.24647	0.06442	38.5	0.112165	0.171514	0.041668	0.218435	0.600218	0.171514	38.5	38.5
-0.2048	0.006289	-1.14154	0.78864	-1.7352	0.26048	0.06553	39.5	0.115154	0.176064	0.042736	0.218435	0.600218	0.176064	39.5	39.5
-0.2049	0.006406	-1.17659	0.84681	-1.8205	0.27489	0.06664	40.5	0.118143	0.180614	0.043804	0.218435	0.600218	0.180614	40.5	40.5
-0.2050	0.006523	-1.21164	0.90694	-1.9078	0.28970	0.06775	41.5	0.121132	0.185164	0.044872	0.218435	0.600218	0.185164	41.5	41.5
-0.2051	0.006640	-1.24669	0.96891	-1.9971	0.30491	0.06886	42.5	0.124121	0.189714	0.045940	0.218435	0.600218	0.189714	42.5	42.5
-0.2052	0.006757	-1.28174	0.10374	-2.0884	0.32052	0.06997	43.5	0.127110	0.194264	0.047008	0.218435	0.600218	0.194264	43.5	43.5
-0.2053	0.006874	-1.31679	0.11001	-2.1817	0.33653	0.07108	44.5	0.130099	0.198814	0.048076	0.218435	0.600218	0.198814	44.5	44.5
-0.2054	0.006991	-1.35184	0.11678	-2.2770	0.35294	0.07219	45.5	0.133088	0.203364	0.049144	0.218435	0.600218	0.203364	45.5	45.5
-0.2055	0.007108	-1.38689	0.12405	-2.3743	0.36975	0.07330	46.5	0.136077	0.207914	0.050212	0.218435	0.600218	0.207914	46.5	46.5
-0.2056	0.007225	-1.42194	0.13182	-2.4736	0.38696	0.07441	47.5	0.139066	0.212464	0.051280	0.218435	0.600218	0.212464	47.5	47.5
-0.2057	0.007342	-1.45699	0.14009	-2.5749	0.40457	0.07552	48.5	0.142055	0.217014	0.052348	0.218435	0.600218	0.217014	48.5	48.5
-0.2058	0.007459	-1.49204	0.14886	-2.6782	0.42258	0.07663	49.5	0.145044	0.221564	0.053416	0.218435	0.600218	0.221564	49.5	49.5
-0.2059	0.007576	-1.52709	0.15813	-2.7835	0.44099	0.07774	50.5	0.148033	0.226114	0.054484	0.218435	0.600218	0.226114	50.5	50.5
-0.2060	0.007693	-1.56214	0.16790	-2.8908	0.45980	0.07885	51.5	0.151022	0.230664	0.055552	0.218435	0.600218	0.230664	51.5	51.5
-0.2061	0.007810	-1.59719	0.17817	-2.9991	0.47901	0.07996	52.5	0.154011	0.235214	0.056620	0.218435	0.600218	0.235214	52.5	52.5
-0.2062	0.007927	-1.63224	0.18894	-3.1084	0.49862	0.08107	53.5	0.157000	0.239764	0.057688	0.218435	0.600218	0.239764	53.5	53.5
-0.2063	0.008044	-1.66729	0.20021	-3.2197	0.51863	0.08218	54.5	0.160089	0.244314	0.058756	0.218435	0.600218	0.244314	54.5	54.5
-0.2064	0.008161	-1.70234	0.21208	-3.3330	0.53904	0.08329	55.5	0.163178	0.248864	0.059824	0.218435	0.600218	0.248864	55.5	55.5
-0.2065	0.008278	-1.73739	0.22455	-3.4483	0.559										

Fig 6



Marta data

Rawdata below on lines 101

Marta data

Table of results for the Quadratic curves (fig.4)					Floor Infiltration	
Pressure Diff V's Flow Rate						
Flow Rate	leakage		inflow		Infiltration	
	Measured Press dif	Quadratic PressDiff	Measured Press dif	Predict PressDiff	PressDiff Predict	PressDiff Predict
	Measured	Quadratic Leakage	Measured	Predict	Floor Infiltr	Floor Infiltration
0	0		0		0	0
0.0036	1.5	4.1387832				
0.0038	2.5	4.4297398				
0.0039	3.5	4.57762695				
0.0043	3.5	5.18523455				
0.0039	4	4.57762695				
0.0041	4	4.87821895				
0.0045	4	5.49867375				
0.0048	5	5.9808768				
0.0047	6	5.81853655				
0.0055	6	7.16222375				
0.0044	6.5	5.3411512				
0.0057	7.5	7.51420455				
0.0061	8	8.23743695				
0.006	8.5	8.05422				
0.0059	8.5	7.87260895				
0.0064	10	8.7967232				
0.0064	10	8.7967232				
0.0064	10.5	8.7967232				
0.0078	12.5	11.5978278				
0.009	15	14.249295				
0.0088	15	13.7913248				
0.0105	18	17.88882375				
0.012	19.5	21.88968				
0.0108	20	18.6600888				
0.0133	24	25.64936255				
0.013	24.5	24.757655				

0.0135	26	26.25186375							
0.0137	27	26.86078855							
0.0137	27.5	26.86078855							
0.0141	29	28.09790895							
0.0144	30	29.0426112							
0.0148	31.5	30.3246968							
0.0156	33	32.9659512							
0.016	33	34.32512	2	2.371494	2.902406	2.89426			
0.0165	37	36.06021375			3.030289	3.021789			
0.017	37	37.835455			3.160426	3.151566			
0.0171	39	38.19532095			3.186724	3.177791			
0.0176	33	40.0187392	2.5	2.691995	3.319565	3.310264			
0.0181	42	41.88230495			3.45466	3.444985			
0.0183	43	42.63897255			3.509329	3.499503			
0.0203	47.5	50.55894655			4.075849	4.064459			
0.0199	50	48.92356295			3.95966	3.948591			
0.0227			2.5	3.814729	4.803267	4.789872			
0.0238			3	4.077074	5.154019	5.139659			
0.0203			3.5	3.267203	4.075849	4.064459			
0.0227			4	3.814729	4.803267	4.789872			
0.0227			4	3.814729	4.803267	4.789872			
0.0248			4.5	4.321785	5.48235	5.467087			
0.0278			4.5	5.091437	6.521426	6.503309			
0.0248			5	4.321785	5.48235	5.467087			
0.0259			5	4.597805	5.853924	5.837641			
0.0259			5.5	4.597805	5.853924	5.837641			
0.0268			6	4.828967	6.166053	6.148912			
0.0278			6	5.091437	6.521426	6.503309			
0.0329			6.2	6.522119	8.474041	8.450575			
0.0366			7	7.65644	10.03739	10.00965			
0.0344			7.5	6.972211	9.09296	9.067801			
0.0351			8	7.186812	9.38873	9.362762			
0.0418			9	9.387604	12.44313	12.40882			
0.0418			9	9.387604	12.44313	12.40882			
0.0424			9.5	9.597654	12.7364	12.70129			
0.0393			10	8.535334	11.2561	11.22503			
0.0436			11.5	10.02415	13.33267	13.29594			
0.0453			12	10.64294	14.19961	14.16051			
0.0574			12.5	15.54152	21.12277	21.06485			
0.06			13	16.70724	22.78265	22.72022			
0.0507			13.7	12.722	17.12622	17.07916			
0.06			15.5	16.70724	22.78265	22.72022			
0.0688			18	20.94968	28.85286	28.77396			
0.0641			20	18.62679	25.52397	25.4541			
0.0735			21	23.40333	32.38088	32.29241			
0.0835			23.5	29.05897	40.54983	40.43925			
0.0785			29	26.15715	36.35268	36.25346			
0.0752			30	24.32302	33.70601	33.61395			
0.0851			30	30.01881	41.94052	41.82617			
0.0854			34	30.20047	42.20384	42.08878			

		just fbds	109.2	4507.1							
		just fbds	137	4507.1			pred Q				
		A=137	A=109			% Flow Rate		from ratio			
		Flow Rate	Flow Rate	A=137	A=109	Equation	% Diff				
0.016	2.89426	0.014351	0.015973	10.15809	10.31	0.2	0.0142	11.53	2.89426		
0.0165	3.021789	0.014826	0.016473	9.99768	10.15	0.2	0.0146	11.34	3.021789		
0.017	3.151566	0.015301	0.016972	9.842138	9.99	0.2	0.0151	11.16	3.151566		
0.0171	3.177791	0.015397	0.017072	9.811594	9.96	0.2	0.0152	11.13	3.177791		
0.0176	3.310264	0.015873	0.017571	9.66161	9.81	0.2	0.0157	10.95	3.310264		
0.0181	3.444985	0.016351	0.018070	9.516039	9.66	0.2	0.0161	10.79	3.444985		
0.0183	3.499503	0.016542	0.018270	9.459004	9.61	0.2	0.0163	10.72	3.499503		
0.0203	4.064459	0.018459	0.020267	8.923418	9.07	0.2	0.0182	10.10	4.064459		
0.0199	3.948591	0.018074	0.019868	9.025728	9.17	0.2	0.0179	10.22	3.948591		
0.0227	4.789872	0.020770	0.022664	8.354367	8.50	0.2	0.0206	9.44	4.789872		
0.0238	5.139659	0.021833	0.023762	8.116731	8.26	0.2	0.0216	9.17	5.139659		
0.0203	4.064459	0.018459	0.020267	8.923418	9.07	0.2	0.0182	10.10	4.064459		
0.0227	4.789872	0.020770	0.022664	8.354367	8.50	0.2	0.0206	9.44	4.789872		
0.0227	4.789872	0.020770	0.022664	8.354367	8.50	0.2	0.0206	9.44	4.789872		
0.0248	5.467087	0.022802	0.024761	7.911956	8.06	0.2	0.0226	8.93	5.467087		

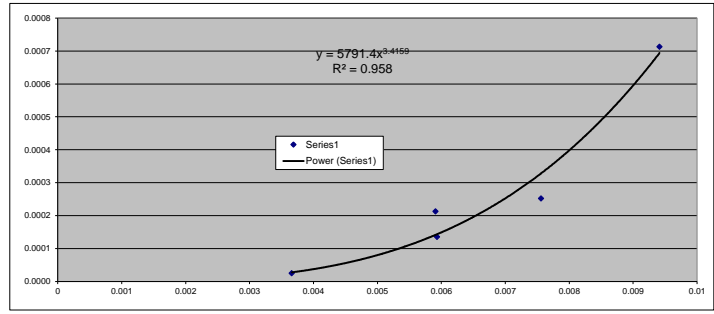
0.0278	6.503309	0.025715	0.027756	7.354492	7.50	0.2	0.0255	8.28	6.503309
0.0248	5.467087	0.022802	0.024761	7.911956	8.06	0.2	0.0226	8.93	5.467087
0.0259	5.837641	0.023868	0.025859	7.698145	7.84	0.2	0.0237	8.68	5.837641
0.0259	5.837641	0.023868	0.025859	7.698145	7.84	0.2	0.0237	8.68	5.837641
0.0268	6.148912	0.024742	0.026758	7.5315	7.68	0.2	0.0245	8.49	6.148912
0.0278	6.503309	0.025715	0.027756	7.354492	7.50	0.2	0.0255	8.28	6.503309
0.0329	8.450575	0.030692	0.032849	6.566095	6.71	0.2	0.0305	7.37	8.450575
0.0366	10.00965	0.034318	0.036544	6.091394	6.24	0.2	0.0341	6.81	10.00965
0.0344	9.067801	0.032161	0.034347	6.36509	6.51	0.2	0.0319	7.13	
0.0351	9.362762	0.032847	0.035046	6.2754	6.42	0.2	0.0326	7.03	
0.0418	12.40882	0.039429	0.041737	5.528784	5.67	0.2	0.0392	6.16	
0.0418	12.40882	0.039429	0.041737	5.528784	5.67	0.2	0.0392	6.16	
0.0424	12.70129	0.040020	0.042336	5.470437	5.61	0.2	0.0398	6.09	
0.0393	11.22503	0.036970	0.039240	5.785805	5.93	0.2	0.0368	6.46	
0.0436	13.29594	0.041202	0.043534	5.357336	5.50	0.2	0.0410	5.95	
0.0453	14.16051	0.042878	0.045232	5.204836	5.35	0.2	0.0427	5.78	
0.0574	21.06485	0.054835	0.057315	4.327025	4.47	0.1	0.0547	4.75	
0.06	22.72022	0.057410	0.059912	4.175546	4.32	0.1	0.0573	4.57	
0.0507	17.07916	0.048208	0.050624	4.772952	4.91	0.1	0.0480	5.27	
0.06	22.72022	0.057410	0.059912	4.175546	4.32	0.1	0.0573	4.57	
0.0688	28.77396	0.066135	0.068700	3.732974	3.87	0.1	0.0660	4.05	
0.0641	25.4541	0.061473	0.064006	3.95702	4.10	0.1	0.0613	4.31	
0.0735	32.29241	0.070800	0.073393	3.532869	3.67	0.1	0.0707	3.81	
0.0835	40.43925	0.080736	0.083380	3.171037	3.31	0.1	0.0807	3.39	
0.0785	36.25346	0.075767	0.078387	3.342214	3.48	0.1	0.0757	3.59	
0.0752	33.61395	0.072489	0.075091	3.465659	3.61	0.1	0.0724	3.73	
0.0851	41.82617	0.082326	0.084978	3.119895	3.26	0.1	0.0823	3.33	
0.0854	42.08878	0.082625	0.085277	3.110489	3.25	0.1	0.0826	3.32	

Equation = 0.7423 0.2577 0.05
 0.7423 0.2577 0.05

pressure Difference	Crack Width	Edge Coef	Laminar coef
50	0.000251877	4507	137.22
Lam width =	0.006958998		
Flow Rate at 50 Pa	0.0912		
Predicted Flow Rate=	0.0126		

x= -0.4858
0.1387

Lam.Coeff	Edge Coef	Lam.Coeff	Edge=f(Lam)	% diff
0.003661	0.0000247	0.003660965	2.55401E-05	-3.515937171
0.005909	0.00021	0.005909333	0.000140784	33.84110348
0.005934	0.00014	0.005934084	0.000142897	-5.659363511
0.009414	0.00071	0.009413836	0.000740471	-3.86221847
0.007561	0.00025	0.00756062	0.000338908	-34.5530993



Gap size	Edge effect calculation	crack width	Laminar coef	crack width	Lam.Coeff = F(Edge)		
0 (test 2)	18218186	6.08738E-10	0.0000246726	6750	4.90667E-08	0.003660965	6933.88
1.25(test 1)	244911	4.52822E-08	0.0002127961	1605	2.06355E-07	0.005909333	1131.505
(2 fits)	606324	1.82907E-08	0.0001352432	1585	2.08959E-07	0.005934084	1656.84
random	21819	5.08278E-07	0.0007129358	397	8.34257E-07	0.009413836	409.1277
1.75(Martin)	4507	6.34418E-08	0.0002518765	107	4.32188E-07	0.00756062	137.0922

Lam.Coeff	Edge Coef	Lam.Coeff	Edge Coef	% diff		
0.003661	0.0000247	0.003660965	2.76E-05	2.75594E-05	-11.70	
0.005909	0.00021	0.005909333	0.00021	0.000141	0.000141443	33.53
0.005934	0.00014	0.005934084	0.00014	0.000143	0.000143477	-6.09
0.009414	0.00071	0.009413836	0.00071	0.000694	0.000694021	2.65
0.007561	0.00025	0.00756062	0.000328	0.000328207		-30.30

Figure 1 Laminar Coefficient Width versus Edge Effect Coefficient Width

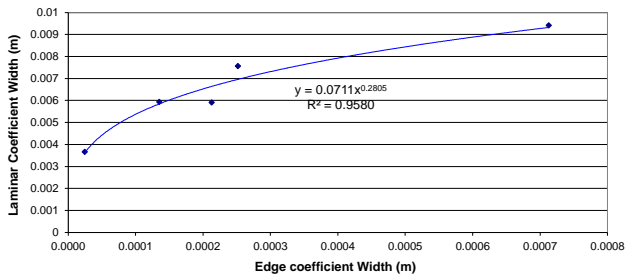
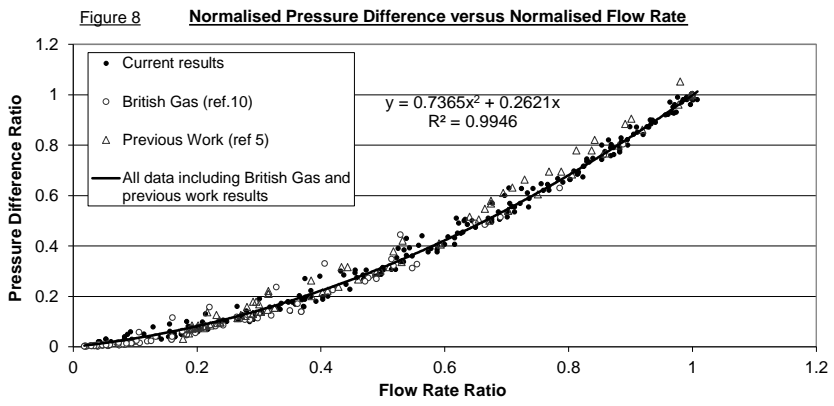
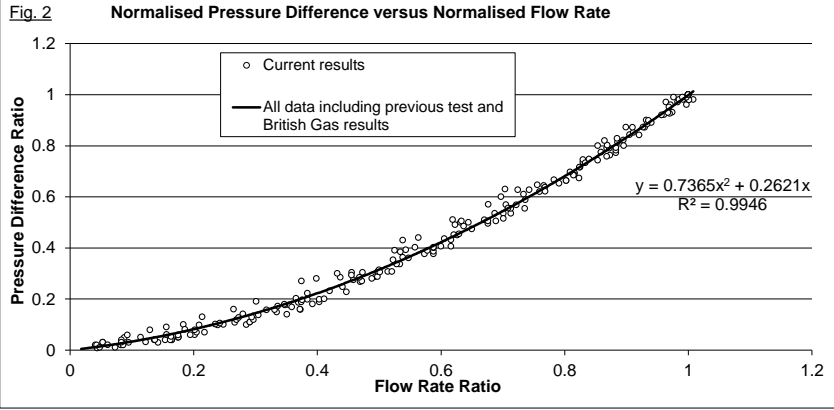


Fig 8

Ratio flow rate	Current res	British Gas Previous Work (ref 5)
0.009804	0.043911	0.009804
0.04902	0.087823	0.04902
0.098039	0.209083	0.098039
0.176471	0.354518	0.176471
0.303922	0.455687	0.303922
0.392157	0.543214	0.392157
0.490196	0.622879	0.490196
0.627451	0.742908	0.627451
0.735294	0.829774	0.735294
0.843137	0.905357	0.843137
0.980392	1.008163	0.980392
0.007353	0.043911	0.007353
0.039216	0.083316	0.039216
0.078431	0.129272	0.078431
0.107843	0.26653	0.107843
0.137255	0.304789	0.137255
0.186275	0.369611	0.186275
0.303922	0.473333	0.303922
0.401961	0.5581	0.401961
0.568627	0.705172	0.568627
0.745098	0.829774	0.745098
0.921569	0.960988	0.921569
0.960784	0.997264	0.960784
0.019608	0.040879	0.019608
0.058824	0.092805	0.058824
0.284314	0.437329	0.284314
0.352941	0.522708	0.352941
0.5	0.631591	0.5
0.627451	0.724286	0.627451
0.77451	0.858898	0.77451
0.872549	0.899301	0.872549
1	1	1
0.019802	0.082339	0.019802
0.029703	0.142615	0.029703
0.039604	0.154042	0.039604
0.039604	0.164677	0.039604
0.039604	0.164677	0.039604
0.049505	0.174667	0.049505
0.059406	0.201688	0.059406
0.069307	0.217848	0.069307
0.09901	0.28523	0.09901
0.108911	0.291111	0.108911
0.108911	0.291111	0.108911
0.118812	0.296876	0.118812
0.148515	0.334461	0.148515
0.168317	0.358906	0.168317
0.158416	0.372804	0.158416
0.188119	0.403376	0.188119
0.19802	0.403376	0.19802
0.227723	0.447214	0.227723
0.267327	0.469403	0.267327
0.287129	0.494032	0.287129
0.287129	0.497451	0.287129
0.306931	0.514205	0.306931
0.306931	0.520756	0.306931
0.336634	0.533616	0.336634
0.376238	0.573423	0.376238
0.376238	0.588016	0.376238
0.386139	0.588016	0.386139
0.405941	0.616166	0.405941
0.50495	0.688895	0.50495
0.534653	0.701089	0.534653
0.514851	0.701089	0.514851
0.534653	0.713074	0.534653
0.554455	0.713074	0.554455
0.663366	0.802538	0.663366
0.663366	0.802538	0.663366
0.673267	0.823387	0.673267
0.732673	0.833616	0.732673
0.742574	0.853706	0.742574
0.762376	0.873334	0.762376
0.772277	0.882984	0.772277
0.782178	0.882984	0.782178
0.792079	0.882984	0.792079
0.851485	0.911322	0.851485
0.841584	0.920575	0.841584
0.871287	0.929735	0.871287
0.930693	0.974245	0.930693
0.970297	0.982905	0.970297
0.980198	0.991489	0.980198
0.980198	1	0.980198
1	1	1
0.05	0.175412	0.05
0.05	0.175412	0.05
0.1	0.248069	0.1
0.14	0.350823	0.14
0.16	0.372104	0.16
0.18	0.392232	0.18
0.2	0.411377	0.2
0.27	0.47231	0.27
0.28	0.488325	0.28
0.36	0.547723	0.36
0.4	0.588348	0.4
0.45	0.626345	0.45
0.5	0.644503	0.5
0.61	0.733799	0.61
0.62	0.759555	0.62
0.79	0.868243	0.79
0.79	0.872662	0.79



0.89	0.94054	0.89
0.92	0.956757	0.92
1	1	1
0.019802	0.086102	0.019802
0.039604	0.162355	0.039604
0.059406	0.194657	0.059406
0.069307	0.204963	0.069307
0.118812	0.269235	0.118812
0.128713	0.294093	0.128713
0.188119	0.37421	0.188119
0.19802	0.383988	0.19802
0.247525	0.440907	0.247525
0.306931	0.497936	0.306931
0.336634	0.528434	0.336634
0.405941	0.599973	0.405941
0.435644	0.605439	0.435644
0.49505	0.676141	0.49505
0.534653	0.687018	0.534653
0.554455	0.735654	0.554455
0.643564	0.766365	0.643564
0.693069	0.816328	0.693069
0.80198	0.869111	0.80198
0.821782	0.895256	0.821782
0.871287	0.909858	0.871287
0.970297	0.963929	0.970297
1	1	1
0.03	0.05295	0.03
0.03	0.05295	0.03
0.02	0.061142	0.02
0.05	0.114386	0.05
0.09	0.155882	0.09
0.1	0.183425	0.1
0.13	0.213996	0.13
0.16	0.264752	0.16
0.19	0.301088	0.19
0.27	0.374415	0.27
0.28	0.398596	0.28
0.3	0.432338	0.3
0.39	0.525072	0.39
0.43	0.538256	0.43
0.44	0.563699	0.44
0.51	0.619013	0.51
0.57	0.676716	0.57
0.6	0.697124	0.6
0.63	0.703795	0.63
0.8	0.853799	0.8
0.82	0.864675	0.82
0.9	0.932287	0.9
0.96	0.971558	0.96
0.99	0.976356	0.99
1	1	1
0.019608	0.043147	0.019608
0.029412	0.095092	0.029412
0.039216	0.136444	0.039216
0.058824	0.174886	0.058824
0.078431	0.201721	0.078431
0.098039	0.239125	0.098039
0.127451	0.272888	0.127451
0.156863	0.317905	0.156863
0.176471	0.347866	0.176471
0.196078	0.375443	0.196078
0.27451	0.458374	0.27451
0.313725	0.5	0.313725
0.362745	0.538418	0.362745
0.401961	0.588001	0.401961
0.45098	0.620998	0.45098
0.509804	0.670424	0.509804
0.588235	0.736582	0.588235
0.637255	0.768392	0.637255
0.686275	0.81541	0.686275
0.715686	0.825137	0.715686
0.813725	0.885762	0.813725
0.872549	0.926845	0.872549
0.95098	0.968932	0.95098
0.980392	0.985264	0.980392
1	1	1
0.010526	0.073127	0.010526
0.031579	0.122365	0.031579
0.052632	0.163517	0.052632
0.105263	0.242536	0.105263
0.157895	0.331098	0.157895
0.178947	0.346873	0.178947
0.231579	0.420084	0.231579
0.284211	0.468243	0.284211
0.305263	0.501335	0.305263
0.389474	0.578122	0.389474
0.431579	0.616181	0.431579
0.473684	0.649969	0.473684
0.505263	0.67618	0.505263
0.568421	0.722074	0.568421
0.621053	0.768706	0.621053
0.652632	0.790992	0.652632
0.684211	0.814311	0.684211
0.715789	0.824102	0.715789
0.757895	0.868338	0.757895
0.8	0.895622	0.8
0.884211	0.933626	0.884211
0.926316	0.970143	0.926316
0.978947	1.001336	0.978947
0.989474	0.997323	0.989474
1	1	1
0.010101	0.048002	0.010101
0.030303	0.083141	0.030303
0.040404	0.137455	0.040404
0.060606	0.156282	0.060606

Test 2
Test 3

test 3
test 4

0.080808	0.185909	0.080808
0.10101	0.235159	0.10101
0.141414	0.279895	0.141414
0.171717	0.336011	0.171717
0.20202	0.365569	0.20202
0.222222	0.384012	0.222222
0.292929	0.455383	0.292929
0.383838	0.534522	0.383838
0.454545	0.629534	0.454545
0.484848	0.636812	0.484848
0.505051	0.633184	0.505051
0.555556	0.708734	0.555556
0.646465	0.755929	0.646465
0.666667	0.782881	0.666667
0.69697	0.808936	0.69697
0.747475	0.839684	0.747475
0.828283	0.885105	0.828283
0.89899	0.935722	0.89899
0.929293	0.967204	0.929293
0.989899	0.990741	0.989899

1	1	1
0.001302	0.019326	0.001302
0.003128	0.030644	0.003128
0.004878	0.041651	0.004878
0.007713	0.056842	0.007713
0.011223	0.077099	0.011223
0.020646	0.101361	0.020646
0.082098	0.230073	0.082098
0.170892	0.362365	0.170892
0.321654	0.517664	0.321654
0.514004	0.690219	0.514004
1	1	1
0.057406	0.106557	0.057406
0.115313	0.160494	0.115313
0.156938	0.220339	0.156938
0.236843	0.328283	0.236843
0.330078	0.40625	0.330078
0.444876	0.528455	0.444876
1	1	1
0.003409	0.019461	0.003409
0.004954	0.028509	0.004954
0.007898	0.041139	0.007898
0.011513	0.056034	0.011513
0.017953	0.079268	0.017953
0.022625	0.095588	0.022625
0.06861	0.193452	0.06861
0.118355	0.264228	0.118355
0.225266	0.419355	0.225266
0.490905	0.65	0.490905
1	1	1
0.00934	0.04138	0.00934
0.01455	0.07059	0.01455
0.02389	0.10000	0.02389
0.03973	0.13333	0.03973
0.06145	0.17647	0.06145
0.08617	0.22222	0.08617
0.12926	0.30000	0.12926
0.28143	0.48000	0.28143
0.48919	0.66667	0.48919
1.00000	1.00000	1.00000
0.001654	0.039773	0.001654
0.00338	0.056452	0.00338
0.006386	0.074468	0.006386
0.008628	0.083333	0.008628
0.02857	0.159091	0.02857
0.138819	0.368421	0.138819
1	1	1
0.001654	0.039773	0.001654
0.00338	0.056452	0.00338
0.006386	0.074468	0.006386
0.008628	0.083333	0.008628
0.02857	0.159091	0.02857
0.138819	0.368421	0.138819
1	1	1
0.001383	0.022	0.001383
0.0031	0.035484	0.0031
0.004512	0.047667	0.004512
0.010511	0.080337	0.010511
0.015414	0.107519	0.015414
0.045935	0.183333	0.045935
0.11369	0.297917	0.11369
0.272653	0.476667	0.272653
0.484511	0.665116	0.484511
1	1	1
0.002381	0.020502	0.002381
0.003925	0.032111	0.003925
0.006155	0.047172	0.006155
0.011138	0.073019	0.011138
0.015714	0.090346	0.015714
0.054854	0.197422	0.054854
0.108317	0.28658	0.108317
0.327472	0.555249	0.327472
0.803397	0.888399	0.803397
1	1	1
0.00603	0.03467	0.00603
0.01138	0.05627	0.01138
0.01636	0.07367	0.01636
0.02471	0.10250	0.02471
0.06582	0.18860	0.06582
0.10736	0.27736	0.10736
0.25973	0.47151	0.25973
0.62946	0.78585	0.62946
1.00000	1.00000	1.00000
0.003866	0.038055	0.003866
0.006692	0.059406	0.006692

Test 4
Etheridge

0.01329	0.094737
0.048009	0.183673
0.107378	0.285714
0.347906	0.514286
0.760126	0.857143
1	1
0.001383	0.01791
0.002882	0.033803
0.007904	0.059259
0.013946	0.094118
0.021705	0.12
0.040303	0.16
0.124492	0.32
0.269276	0.489796
1	1
0.003087	0.029302
0.006926	0.05339
0.013076	0.086301
0.023056	0.126
0.085266	0.242308
0.14349	0.35
0.311916	0.547826
1	1
0.068771	0.187354
0.071801	0.193208
0.074885	0.199063
0.075508	0.200234
0.078656	0.206089
0.081857	0.211944
0.083152	0.214286
0.093822	0.233021
0.096575	0.237705
0.096575	0.237705
0.113811	0.265808
0.113811	0.265808
0.113811	0.265808
0.122122	0.278689
0.129902	0.290398
0.129902	0.290398
0.138706	0.303279
0.138706	0.303279
0.146102	0.313817
0.154522	0.325527
0.154522	0.325527
0.200788	0.385246
0.215453	0.40281
0.222462	0.411007
0.237831	0.428571
0.266708	0.460187
0.294834	0.489461
0.301783	0.496487
0.315911	0.510539
0.336453	0.530445
0.405798	0.593677
0.500494	0.672131
0.539824	0.702576
0.539824	0.702576
0.604778	0.750585
0.683655	0.805621
0.76725	0.860656
0.798648	0.880562
0.86136	0.919204
0.960809	0.977752
0.993761	0.996487
1	1
0.031579	0.17734
0.052632	0.187192
0.073684	0.192118
0.084211	0.192118
0.084211	0.20197
0.073684	0.211823
0.136842	0.216749
0.084211	0.221675
0.126316	0.231527
0.105263	0.236453
0.126316	0.270936
0.157895	0.280788
0.178947	0.29064
0.178947	0.295567
0.168421	0.300493
0.210526	0.315271
0.210526	0.315271
0.221053	0.315271
0.263158	0.384236
0.315789	0.433498
0.315789	0.44335
0.378947	0.517241
0.421053	0.53202
0.410526	0.591133
0.515789	0.640394
0.505263	0.655172
0.547368	0.665025
0.568421	0.674877
0.578947	0.674877
0.610526	0.694581
0.631579	0.70936
0.663158	0.729064
0.694737	0.768473
0.694737	0.788177
0.778947	0.812808
0.778947	0.837438
0.821053	0.842365
0.884211	0.891626
0.905263	0.901478
1.052632	0.980296

0.01329	
0.048009	
0.107378	
0.347906	
0.760126	
1	
0.001383	
0.002882	
0.007904	
0.013946	
0.021705	
0.040303	
0.124492	
0.269276	
1	
0.003087	
0.006926	
0.013076	
0.023056	
0.085266	
0.14349	
0.311916	
1	
0.068771	
0.071801	
0.074885	
0.075508	
0.078656	
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0.083152	
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0.096575	
0.113811	
0.113811	
0.113811	
0.122122	
0.129902	
0.129902	
0.138706	
0.138706	
0.146102	
0.154522	
0.154522	
0.200788	
0.215453	
0.222462	
0.237831	
0.266708	
0.294834	
0.301783	
0.315911	
0.336453	
0.405798	
0.500494	
0.539824	
0.539824	
0.604778	
0.683655	
0.76725	
0.798648	
0.86136	
0.960809	
0.993761	
1	
0.031579	
0.052632	
0.073684	
0.084211	
0.084211	
0.073684	
0.136842	
0.084211	
0.126316	
0.105263	
0.126316	
0.157895	
0.178947	
0.178947	
0.168421	
0.210526	
0.210526	
0.221053	
0.263158	
0.315789	
0.315789	
0.378947	
0.421053	
0.410526	
0.515789	
0.505263	
0.547368	
0.568421	
0.578947	
0.610526	
0.631579	
0.663158	
0.694737	
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0.778947	
0.778947	
0.821053	
0.884211	
0.905263	
1.052632	

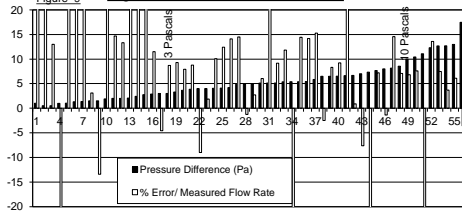
0.068771	Etheridge
0.071801	Marta floor
0.074885	
0.075508	
0.078656	
0.081857	
0.083152	
0.093822	
0.096575	
0.096575	
0.113811	
0.113811	
0.113811	
0.122122	
0.129902	
0.129902	
0.138706	
0.138706	
0.146102	
0.154522	
0.154522	
0.200788	
0.215453	
0.222462	
0.237831	
0.266708	
0.294834	
0.301783	
0.315911	
0.336453	
0.405798	
0.500494	
0.539824	
0.539824	
0.604778	
0.683655	
0.76725	
0.798648	
0.86136	
0.960809	
0.993761	
1	Marta floor
0.031579	Marta Total
0.052632	
0.073684	
0.084211	
0.084211	
0.073684	
0.136842	
0.084211	
0.126316	
0.105263	
0.126316	
0.157895	
0.178947	
0.178947	
0.168421	
0.210526	
0.210526	
0.221053	
0.263158	
0.315789	
0.315789	
0.378947	
0.421053	
0.410526	
0.515789	
0.505263	
0.547368	
0.568421	
0.578947	
0.610526	
0.631579	
0.663158	
0.694737	
0.694737	
0.778947	
0.778947	
0.821053	
0.884211	
0.905263	
1.052632	

1 1

1 Marta

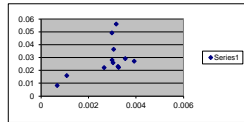
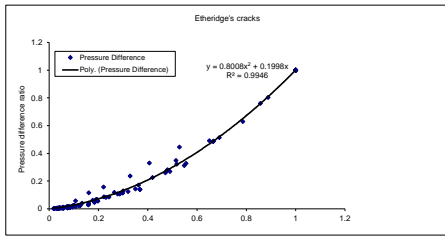
Fig 9

Figure 9 Magnitude of Error With Pressure Difference



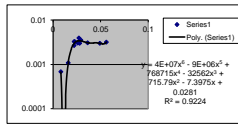
Flow Rate Pressure Difference

0.019326	0.001302
0.030644	0.001328
0.041651	0.001873
0.058842	0.007713
0.077059	0.011223
0.101361	0.026646
0.230073	0.082098
0.362365	0.179992
0.517864	0.321654
0.690219	0.514004
1	1
0.105657	0.057406
0.160484	0.115313
0.220339	0.156938
0.328283	0.236843
0.46025	0.330778
0.528455	0.444876
1	1
0.019461	0.003409
0.028509	0.004954
0.041139	0.007698
0.056634	0.011513
0.079268	0.017353
0.095688	0.022625
0.183452	0.06861
0.294228	0.118355
0.419255	0.225266
0.65	0.490905
1	1
0.04138	0.00934
0.07059	0.01455
0.10060	0.02289
0.13333	0.03973
0.17647	0.06145
0.22222	0.08817
0.30000	0.12926
0.40000	0.28143
0.66667	0.45819
1.00000	1.00000
0.039773	0.001654
0.056452	0.00338
0.074468	0.006386
0.083333	0.008628
0.159091	0.02867
0.368421	0.138819
1	1
0.022	0.001383
0.035484	0.0031
0.047867	0.004512
0.080337	0.010511
0.107519	0.015414
0.183333	0.046935
0.297917	0.11369
0.478667	0.272853
0.666116	0.484511
1	1
0.020562	0.002381
0.032111	0.003925
0.047172	0.006155
0.072619	0.011138
0.090346	0.015714
0.197422	0.054854
0.28658	0.108317
0.555249	0.327472
0.88939	0.803397
1	1
0.030467	0.00603
0.05657	0.01138
0.07367	0.01636
0.10260	0.02471
0.18860	0.06582
0.27736	0.10738
0.47151	0.25973
0.78585	0.62946
1.00000	1.00000
0.038055	0.003866
0.059406	0.006692
0.094737	0.01329
0.183673	0.048009
0.286714	0.107378
0.514286	0.347906
0.857143	0.760126
1	1
0.01791	0.001383
0.033803	0.002882
0.059259	0.007904
0.084118	0.013946
0.12	0.021705
0.16	0.040203
0.32	0.124892
0.489796	0.265270
1	1
0.029502	0.003087
0.05339	0.006926
0.086301	0.013076
0.128	0.023566
0.242308	0.085266
0.35	0.14349
0.547826	0.311916
1	1



Equation = 0.7423 0.2577 0.05

Edge	Lam
crack width	crack width
0.00324	0.002623
0.00346	0.029195
0.002984	0.049164
0.00267	0.022273
0.003624	0.027161
0.003059	0.036388
0.003032	0.025936
0.003167	0.056659
0.001083	0.015984
0.002659	0.022183
0.000682	0.008288
0.002991	0.028023



Flow Rate	PressDiff	Factor	PressFlow	% Diff
0.031576	1.0084	0.662472	0.01911	39.4784
0.069919	4.1972	0.196358	0.06086	14.0922
0.090635	6.5192	0.269022	0.06292	9.20567
0.122358	10.4221	0.363687	0.113085	7.578337
0.033664	3.11491	0.073785	0.01862	41.44
0.063564	4.85019	0.207204	0.054373	14.4874
0.091844	8.162175	0.299107	0.078489	14.54072
0.04037	1.894949	0.116979	0.033711	26.88807
0.080739	5.853287	0.271212	0.076905	15.24812
0.138886	12.66062	0.453227	0.126517	7.466209
0.091853	2.411664	0.134325	0.04522	26.90766
0.096185	5.394016	0.244493	0.082308	14.42731
0.173132	17.47661	0.532688	0.176237	-3.57822
0.054816	3.2910	0.171004	0.049727	9.283749
0.080612	5.3681	0.244467	0.071053	11.88872
0.137041	12.8963	0.442879	0.13872	6.972032
0.071127	2.7427	0.148951	0.053664	24.55206
0.103249	5.4158	0.240002	0.08963	14.19584
0.056776	2.0718	0.114167	0.034726	37.71611
0.093635	5.1276	0.227061	0.069079	23.78356
0.145017	12.2072	0.411927	0.123231	13.58174
0.062786	1.3629	0.088369	0.034875	44.4532
0.142398	6.6225	0.282404	0.113388	20.63352
0.024376	0.6481	0.162441	0.022438	7.94695
0.030695	5.1159	0.208803	0.028842	6.038515
0.041459	7.6742	0.278379	0.088462	7.20688
0.065775	3.8651	0.176488	0.050111	8.763888
0.08984	6.6674	0.261812	0.089018	9.914301
0.142584	12.6901	0.409869	0.13786	3.694067
0.008185	5.3870	0.2451	0.012499	-52.7019
0.011238	7.3316	0.3036	0.015482	-37.7717
0.016743	11.0545	0.3953	0.020267	-21.6464
0.038637	1.032284	0.0481	0.018351	52.50502
0.087701	4.104893	0.1846	0.062755	28.44424
0.138128	8.544614	0.2660	0.112818	18.32346

Pressure [% Error/ Measured Flow Rate

1.01	39.48
0.50	24.81
0.50	13.00
1.00	-51.53
1.03	33.77
1.31	41.44
1.36	44.45
1.50	3.14
1.50	-13.39
1.89	26.89
2.00	14.70
2.00	13.34
2.07	37.72
2.41	26.87
2.74	24.55
2.82	11.53
3.00	-4.58
3.00	8.70
3.29	9.28
3.65	7.95
3.87	8.76
4.00	-8.99
4.00	1.86
4.084469	10.10
4.10	12.39
4.29	14.09
4.85	14.49
5.00	-1.26
5.00	2.71
5.12	6.04
5.13	23.78
5.19	9.17
5.37	11.86
5.39	-52.70
5.39	14.43
5.42	14.16
5.85	15.25
6.50	-2.51
6.503309	8.28
6.62	20.63
6.67	0.91
7.00	-7.65
7.33	-37.77
7.67	7.21
8.00	-1.41
8.16	14.54
8.54	7.09
10.09985	6.91
10.42	7.58
11.06	-21.65
12.30	13.58
12.66	7.47
12.69	3.66
12.99	6.07
17.48	-3.58