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**Heavy Falling Weight
Deflectometer versus
Static Plate Load Testing**

Final Report

Report Prepared by

The Technical Evaluation Engineering Division
Aerodrome Safety Branch (AARM)
Civil Aviation Directorate
Transport Canada
Ottawa, Ontario, Canada
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Heavy Falling Weight Deflectometer versus Static Plate Load Testing

1.0 Introduction

The operating authority for every certified airport in Canada is required to determine the bearing strength of all airside pavement operational surfaces at the airport. The resulting strength information must be made available (reported) to the aviation community so as to enable determination of the structural suitability of the pavements to support intended aircraft operations. Strength data is also needed for the structural design of restoration measures or new pavement facilities at an airport. In order to determine pavement strength, some type of in-place strength testing is normally required.

As the owner and operator of most of the major airports in Canada, Transport Canada used custom-fabricated equipment to perform static plate load tests on the airfield pavements under its management from 1945 to 1994. When Transport Canada withdrew from operation of Canadian airports in the mid-1990's, the plate load testing services, program and equipment were also withdrawn as the responsibility for strength testing shifted to the new airport owners/operators. As a result, alternative test equipment and methods were needed for the measurement and evaluation of pavement strengths at Canadian airfields.

The Falling Weight Deflectometer (FWD) is a commercially available device for measuring pavement bearing strength that was first marketed during the early 1980's. The FWD has advantages over conventional plate load testing equipment in terms of mobility and test productivity. However, early Transport Canada trials with the device in 1985 indicated that FWD test results did not correlate very well with traditional plate load test measurements (Reference 4) and hence were not compatible with the airfield pavement design and evaluation methods used by Transport Canada.

A heavier version of the FWD intended primarily for the testing of airfield pavements (i.e. the Dynatest 8081 High Capacity Falling Weight Deflectometer - termed "HWD") was first marketed in Canada in 1986. In subsequent years, variations of the HWD were developed by other equipment manufacturers and HWD test devices came into wide-spread use at airports throughout the world. Following the discontinuation of Transport Canada's plate load test program after the 1994 test season, the HWD has become (by default) the predominant equipment for pavement strength testing at Canadian airfields.

Transport Canada began studies in the early 1990's to assess the HWD as an alternative to plate load testing. Transport Canada undertook a parallel test program on eight (8) runways in central Canada during 1990 using the HWD and conventional plate load testing methods (Reference 5). A second parallel test program was undertaken in 1992 which involved parallel testing on an additional 19 runways. The measurements from these two programs are summarized and compared in this report with a view to determining whether the HWD can be used as a substitute for conventional plate load testing.

2.0 Test Methods and Programs

2.1 Conventional Plate Load Testing

Plate load testing on airfield pavements in Canada commenced in 1945 and the original method of test is referred to as the repetitive static plate load test (Reference 1). The standard measure of pavement bearing strength "Ps" resulting from this test is defined as the load that produces a deflection of 12.5 mm after 10 repetitions of load when the load is applied to the pavement surface through a 750 mm diameter circular steel plate. This standard measure of bearing strength is the basis of the Transport Canada (and Public Works Government Services Canada - PWGSC) structural design and evaluation procedures for asphalt pavements (Reference 6). An extensive data base of plate load test measurements covering the period 1945 to 1994 exists for Canadian airports and can be made available to interested parties upon request.

The repetitive static plate load test provides excellent information on the complex load-deflection characteristics of flexible pavement structures, but a test takes approximately six to eight hours to complete and is therefore costly. In order to shorten the test time, Transport Canada's plate load test equipment was upgraded in 1982 with the capability to perform a constant rate of loading (CROL) test which takes only 10 to 15 minutes to complete. Correlations were developed that permit the standard measure of bearing strength "Ps" to be satisfactorily estimated from CROL test results (References 2, 3). Subsequently, Transport Canada used the CROL test procedure exclusively from 1987 to 1994.

The CROL test procedure consists of applying load continuously to a circular, rigid bearing plate (300, 450, 600 or 750 mm in diameter) at a constant loading rate of 1 kN/sec, and recording pavement deflection at one minute intervals as the load increases. Load application is continued until either the full reaction load of 450 kN is applied or a pavement deflection in the order of 7-8 mm has been reached - whichever occurs first. The result is a load-deflection curve as illustrated in Figure 1. The procedure for estimating the standard measure of bearing strength "Ps" from CROL test results is outlined in Appendix A.

2.2 Falling Weight Deflectometer Testing

The falling weight deflectometer a fully automated, computerized, trailer device which measures the deflection bowl of a pavement surface under a series of weights dropped onto a circular steel plate placed on the pavement surface. The original falling weight deflectometer (FWD) is relatively light-weight, being capable of applying short duration impact loads up to 125 kN. The heavier weight 8081 model (HWD) is capable of impact loads of up to 250 kN, which is approximately equal to the load on each wheel of a large modern aircraft operating at maximum weight. In comparison, the 450 kN load used in CROL testing is more representative of the equivalent single wheel load of the multi-wheeled gears on such aircraft. Technical literature describing the Dynatest 8081 High Capacity Falling Weight Deflectometer is given in Appendix C.

Load-deflection relationships resulting from an HWD test are illustrated in Figure 2. The deflection of the plate under a 250 kN impact load is used as the HWD measure of pavement bearing strength for comparison with plate load test results. However, the HWD equipment had a major limitation

in that the deflection sensors could not accurately measure deflections in excess of 2.5 mm, and the deflection of weak pavement structures at a load level of 250 kN exceeds this value. For such pavement structures, extrapolation was necessary to estimate the deflection under a 250 kN load.

In addition to plate deflection, HWD equipment also records the deflection bowl by measuring deflections of the pavement surface at various offsets from the plate. Previous analysis of the 1990 data (Reference 5) indicated that an index of HWD deflection bowl volume did not correlate with CROL test results any better than the HWD plate deflection. Based on this finding, only HWD plate deflection measurements are considered in this report.

2.3 Parallel Testing Programs

The 1990 and 1992 parallel testing programs incorporated a total of 588 test locations on the twenty seven runways listed in Table 1. Under contract, the 1990 CROL plate load testing program was carried out by the engineering firm of TES Limited (Ottawa) and the 1992 testing program was carried out by the engineering firm of ADI Limited (Ottawa), using Transport Canada's plate load test equipment. The HWD testing program in both years was carried out by Dynatest Limited (Downsview, Ontario). Testing by the two methods was not conducted simultaneously, but was separated by a variable period of time of up to two months, as indicated in Table 1.

One CROL test and three HWD tests were performed at each test location, in the testing pattern illustrated in Figure 3, and the three HWD test results were averaged for comparison with the CROL test result. A summary of the test data is given in Appendix A. All tests in the 1990 program, both CROL and HWD, were performed using a 450 mm diameter plate in order to eliminate correlation variability that might arise from differences in plate size. The 1992 CROL testing program included some testing with a 750 mm diameter plate, and a few tests with a 600 mm diameter plate.

2.4 Temperature Correction of HWD Deflections

While the HWD and plate tests were completed at the same locations on each runway, the test sets were in most cases performed several weeks to several months apart. Temperature is a very significant factor affecting the stiffness of asphalt based materials and is considered to be especially critical when performing dynamic type load tests. HWD pavement surface deflection data should therefore be normalized (corrected) to represent the equivalent deflection that would have been obtained at a standard test temperature of 21°C. Temperature correction factors for HWD deflections are given in Table 2 and plotted in Figure 4.

In the data tables of Appendix A, each test temperature is listed but the HWD deflection data has not been corrected for temperature. However, at the bottom of each data table, average HWD deflection temperature correction factors for the runway test data are listed and the resulting corrected average HWD deflection is listed. Plate and HWD test data is summarized in Table 3 for each runway where the average HWD deflections (both uncorrected and temperature corrected) are listed along with the corresponding average standard plate load values.

3.0 CROL vs HWD RELATIONSHIPS

3.1 Theoretical Plate Relationships

As a first approximation, a pavement structure can be represented as a uniform, single-layered elastic system. The following equation relates deflection to load, when load is applied through a rigid, circular plate to the surface of an infinite uniform half-space of isotropic elastic material:

$$D = (\pi/2)(1-\mu^2)(aq/E)$$

where: D = deflection of the plate
a = radius of the plate
q = contact pressure of the plate
 μ = Poisson's ratio of the material
E = elastic modulus of the material

Assuming a Poisson's ratio of 0.5 (incompressible material) produces the familiar equation:

$$D = 1.18 (aq/E) = 0.375 (P/aE)$$

where: P = plate load = $(\pi a^2)q = (\pi a)(aq)$

Using a "c" subscript to denote a CROL test and an "f" subscript to denote a falling weight deflectometer HWD test:

$$P_c / (a_c \cdot D_c \cdot E_c) = P_f / (a_f \cdot D_f \cdot E_f)$$

$$\text{or } P_c / D_c = (E_c / E_f) \cdot (a_c / a_f) \cdot P_f / D_f$$

A pavement structure exhibits viscoelastic characteristics, and E_c will therefore not be the same as E_f due to the major difference in loading times between the CROL and HWD tests. The central question in whether HWD test results can be related to CROL test results is whether there is any consistent relationship between these two modulus values for different pavement structures and subgrades.

If testing is conducted using the same size of plates so that $a_c = a_f$ and if deflections are measured at the same level of load so that $P_c = P_f$, then:

$$E_c/E_f = D_f/D_c$$

3.2 CROL vs HWD Deflection

Figure 5 gives a comparison of CROL and HWD deflections when the deflections are measured under a load of 250 kN on a 450 mm diameter bearing plate in both test procedures. In other words, the only difference in the measurement of the two deflections is that the load is applied in a relatively

static manner in the CROL test and is applied dynamically in the HWD test.

The comparison exhibits a fair degree of scatter, some of which is undoubtedly due to the period of time that in some cases separated the CROL and HWD testing. A higher degree of correlation would likely have resulted if the two testing programs had been conducted simultaneously, under identical conditions of asphalt temperature and other pavement characteristics.

It is most interesting to note from Figure 5 that on the average, the deflection occurring under the statically applied CROL load is approximately double the deflection that occurs under the dynamically applied HWD load, with the ratio increasing toward 3 on very weak pavements. From the theoretical considerations above, this result would imply that elastic modulus values calculated from HWD tests would be in the order of 2 to 3 times higher on the average than the values calculated from CROL tests. This difference in the elastic modulus developed under static and dynamic loadings would have to be recognized in the application of layered elastic system models for pavement design and evaluation.

3.3 CROL Derived Ps vs HWD Deflection

Figure 6 gives a comparison of CROL derived pavement surface "Ps" values and corresponding HWD deflections at 250 kN load. Although a general trend is apparent, the degree of scatter exhibited by the data would indicate that any attempt to predict Ps values from HWD deflections would be subject to very large errors. The theoretical plate relationships given in section 3.1 suggest that "Ps" should vary with the inverse of HWD deflection and the curves

$$P_s = 1800 / D_{\text{HWD}}$$

and

$$P_s = 300 / D_{\text{HWD}}$$

have been plotted with the data in Figure 6 to delineate the approximate high and low boundaries for the relationship.

The increase in the scatter of data from Figure 5 to Figure 6 arises from two main sources. Figure 5 is a comparison of deflections measured when a load level of 250 kN is used in both CROL and HWD testing, which gives the most favourable comparison possible. The "Ps" values plotted in Figure 6 are estimated from CROL test results usually obtained at the significantly higher load level of 450 kN, and the non-linearity of load-deflection relationships introduces some variability between measurements made at the different load levels.

Figure 6 also contains data from CROL testing with a 750 mm plate, and the plotted data would seem to suggest a major difference exists in the Ps versus HWD deflection relationship depending on whether a 450 mm or 750 mm plate is used in the CROL testing. The reason for this difference is not readily apparent. Two possible explanations are offered below.

- a) The standard measure of bearing strength "Ps" being estimated from the 750 mm plate test results is not consistent with the estimates being obtained from 450 mm plate test results. This explanation would imply that some unknown change occurred in CROL test procedures since the Ps vs CROL correlation program was carried out in the early 1980's.
- b) The pavements on which 750 mm plate CROL tests were conducted are relatively thin structures constructed on saturated or wet plastic clay subgrades. These types of subgrades tend to exhibit much less deformation under dynamic loads than under static loads, and hence HWD testing would indicate a stronger pavement than CROL testing.

The data plotted in Figure 6 was condensed by calculating an average HWD deflection and corresponding "Ps" plate load value for each of the 26 runways tested. The runway averages are plotted in Figure 7 along with the regression equation of $P_s = 1029/D_{HWD}$ (correlation coefficient $R^2 = 0.708$). For practical use, the equation can be simplified to $P_s = 1000/D_{HWD}$ which falls mid-way between the data boundaries shown in Figure 6 which also serves to illustrate the high degree of associated data scatter.

The proportionality constant "C" in the equation $P_s = C/D_{HWD}$ was calculated separately for each site and CROL test plate size. The results are plotted in Figure 8 against the nominal thickness of asphalt surfacing recorded in the runway's construction history. It can be seen that the proportionality constant is significantly affected by asphalt thickness, which is undoubtedly due to the difference in stiffness exhibited by the asphalt layer under static and dynamic loads.

4.0 Summary

Airfield pavement bearing strengths were measured using both the heavy falling weight deflectometer (HWD) and conventional CROL plate load testing methods during 1990 and 1992 at selected airports. The data obtained from these programs indicated that the Transport Canada/PWGSC airport standard measure of pavement bearing strength obtained through static plate load testing cannot be directly estimated with any degree of accuracy from deflections measured under dynamic HWD loadings. The difficulty in establishing a relationship arises from certain types of materials (asphaltic concrete and saturated clay subgrades) which react in a much stiffer manner under dynamic HWD loads than under static plate loads. Comparison of the two measures therefore depends on whether these materials are present in the pavement structure and in what thickness.

The general relationship given in Section 3.3 of $P_s = 1000/D_{HWD}$ may be used to estimate the standard plate load "Ps" from HWD plate deflections provided that the very limited accuracy of the relationship is recognized.

A relationship may eventually be derived between the two measures if an analysis is carried out using a layered elastic model in which different modulus values are assigned to material types depending on whether the applied loading is dynamic or static in nature. The measurements for such an analysis should be obtained in more detail and under more controlled conditions than utilized in collecting the currently available data.

5.0 References

1. "Airport Pavement Evaluation - Bearing Strength" (AK-68-31-000), Transport Canada Airports, Safety and Technical Services, AKPEC, Ottawa, September 1987.
2. "Pavement Plate Load Testing By Constant Rate of Loading" (AK-67-09-304), Transport Canada Airports, Safety and Technical Services, AKPEC, Ottawa, May 1986.
3. "CROL vs Repetitive Plate Load Testing", Transport Canada Airports, Safety and Technical Services, AKPEC, Ottawa, April 1994.
4. "Falling Weight Deflectometer Trials At Canadian Airfields" (AK-67-09-372), Transport Canada Airports, Safety and Technical Services, AKPEC, Ottawa, December 1988.
5. "1990 Trials - Falling Weight Deflectometer: Summary Report", Transport Canada Airports, Safety and Technical Services, AKPEC, Ottawa, March 1992.
6. "Manual of Pavement Structural Design" (ASG-19), Public Works Canada, Architectural and Engineering Services, Air Transportation, Ottawa (Hull), Canada, July 1992.

Table 1: HWD/CROL Parallel Testing Programs

Airport	Runway	Number of Test Locations	Date of Testing	
			HWD	CROL
1990 Test Program				
Brandon	08-26	17	July 26	July 21
Dauphin	14-32	27	July 25	July 23
Flin Flon	18-36	15	July 27	August 27
Regina	12-30	32	July 24	August 1
Swift Current	12-30	24	July 23	August 5
The Pas	12-30	18	July 27	August 26
Thompson	05-23	32	July 28	August 28/29
Yorkton	03-21	13	July 25	July 25
1992 Test Program				
Oshawa	04-22 12-30	16 20	October 1 October 1	July 6 July 5
Ottawa Int'l	07-25 14-32	24 26	September 21 September 24	June 26/27 June 25/26
Pembroke	17-35	29	September 28	July 3
Rouyn	08-26	18	September 29	July 16
St. Catharines	06-24	30	September 14	July 12/13
St. Hubert	06L-24R 06R-24L 10-28 18-36	21 12 17 22	September 21 September 21 September 21 September 21	July 20 July 21 July 20 July 23
St. Jean	11-29	24	September 22	July 26
Sherbrooke	14-32	32	September 23	July 27
Toronto Island	06-24 08-26 15-33	16 24 18	September 15 September 15 September 15	July 9/10 July 6/7 July 8
Toronto Pearson	06L-24R	16 (Not Used)	September 16	July 10/11
Val D'Or	18-36	16	September 29	July 18/19
Warton	05-23	29	September 17	July 14
20 Airports	27 Runways	588	-----	-----

Number of plate load tests performed using: a) a 450 mm plate - 354 tests
b) a 600 mm plate - 14 tests
c) a 750 mm plate - 220 tests

Table 2: Temperature Correction Factors for HWD Deflections

Asphalt Test Temperature °C	Deflection Correction Factor	Asphalt Test Temperature °C	Deflection Correction Factor
0	1.600	20	1.008
1	1.535	21	1.000
2	1.479	22	0.992
3	1.426	23	0.984
4	1.377	24	0.977
5	1.332	25	0.970
6	1.292	26	0.964
7	1.256	27	0.960
8	1.223	28	0.956
9	1.193	29	0.952
10	1.166	30	0.950
11	1.142	31	0.948
12	1.121	32	0.946
13	1.102	33	0.944
14	1.085	34	0.942
15	1.070	35	0.940
16	1.056	36	0.939
17	1.043	37	0.938
18	1.030	38	0.937
19	1.018	39	0.936

Note: To correct an HWD deflection to the standard test temperature of 21°C, multiply the measured deflection by the factor that corresponds to the temperature of the asphalt at the time of testing.

Table 3: HWD and Plate Load Test Data Summary

Airport	Runway	Standard Plate Load - Ps (kN)	HWD Deflection (mm) at 250 kN Load	
			Uncorrected	Temp. Corrected
1990 Test Program				
Brandon	08-26	483	2.70	2.64
Dauphin	14-32	225	5.14	4.83
Flin Flon	18-36	876	1.44	1.35
Regina	12-30	570	1.36	1.29
Swift Current	12-30	462	2.96	3.21
The Pas	12-30	971	1.22	1.18
Thompson	05-23	706	1.90	1.80
Yorkton	03-21	183	5.65	5.38
1992 Test Program				
Oshawa	04-22	375	2.01	2.31
	12-30	246	2.70	2.92
Ottawa Int'l	07-25	1061	1.13	1.34
	14-32	1008	1.05	1.11
Pembroke	17-35	842	2.22	2.31
Rouyn	08-26	1073	0.98	1.44
St. Catharines	06-24	251	3.14	3.09
St. Hubert	06L-24R	239	1.45	1.47
	06R-24L	323	2.16	2.14
	10-28	180	1.80	1.80
	18-36	148	4.23	4.26
St. Jean	11-29	166	5.51	6.49
Sherbrooke	14-32	352	1.85	2.20
Toronto Island	06-24	347	3.98	3.87
	08-26	710	1.71	1.71
	15-33	531	3.07	2.98
Toronto Pearson	06L-24R	Data not used in analyses due to an underlying PCC layer.		
Val D'Or	18-36	1349	0.86	1.22
Warton	05-23	272	2.75	2.74

Table 4: Effect of Asphalt Thickness on CROL vs HWD Relationship

Airport	Runway	Number of Tests	Asphalt Layer Thickness (mm)	Factor "a" in the Equation $P_s = a / D_{HWD}$ For CROL Plate Test Size of		
				450 mm	600 mm	750 mm
Brandon	08-26	17	100	1304	----	----
Dauphin	14-32	27	90	1157	----	----
Flin Flon	18-36	15	150	1261	----	----
Oshawa	04-22	6	65	----	1028	----
	04-22	10	75	----	----	611
	12-30	20	115	----	----	664
Ottawa Int'l	07-25	24	193	1199	----	----
	14-32	26	219	1058	----	----
Pembroke	17-35	27	65	1900	----	----
	17-35	2	65	----	1252	----
Regina	12-30	32	349	775	----	----
Rouyn	08-26	18	162	1052	----	----
St. Catharines	06-24	30	130	----	----	788
St. Hubert	06L-24R	21	232	----	----	347
	06R-24L	12	130	----	----	698
	10-28	17	190	----	----	324
	18-36	22	90	----	----	626
St. Jean	11-29	24	65	----	----	915
Sherbrooke	14-32	32	180	----	----	651
Swift Current	12-30	24	90	1368	----	----
The Pas	12-30	18	105	1185	----	----
Thompson	05-23	32	230	1341	----	----
Toronto Island	06-24	16	65	1381	----	----
	08-26	15	90	1366	----	----
	08-26	6	98	----	1032	----
	08-26	3	75	----	----	856
	15-33	18	65	1630	----	----
Val D'Or	18-36	16	165	1160	----	----
Warton	05-23	29	115	----	----	748
Yorkton	03-21	13	90	1034	----	----

Figure 1: CROL Static Plate Load Test

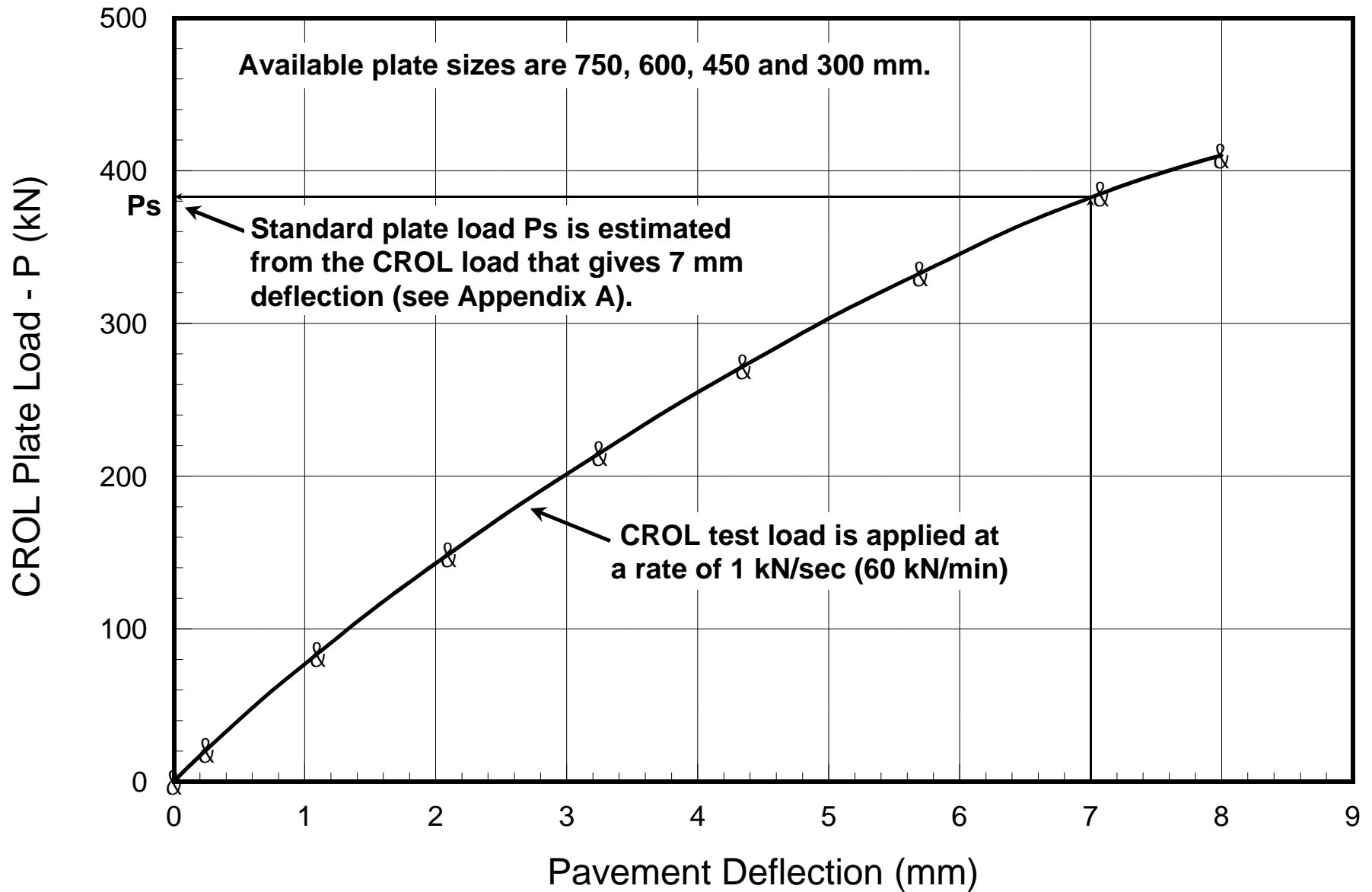


Figure 2: HWD Impact Plate Load Test

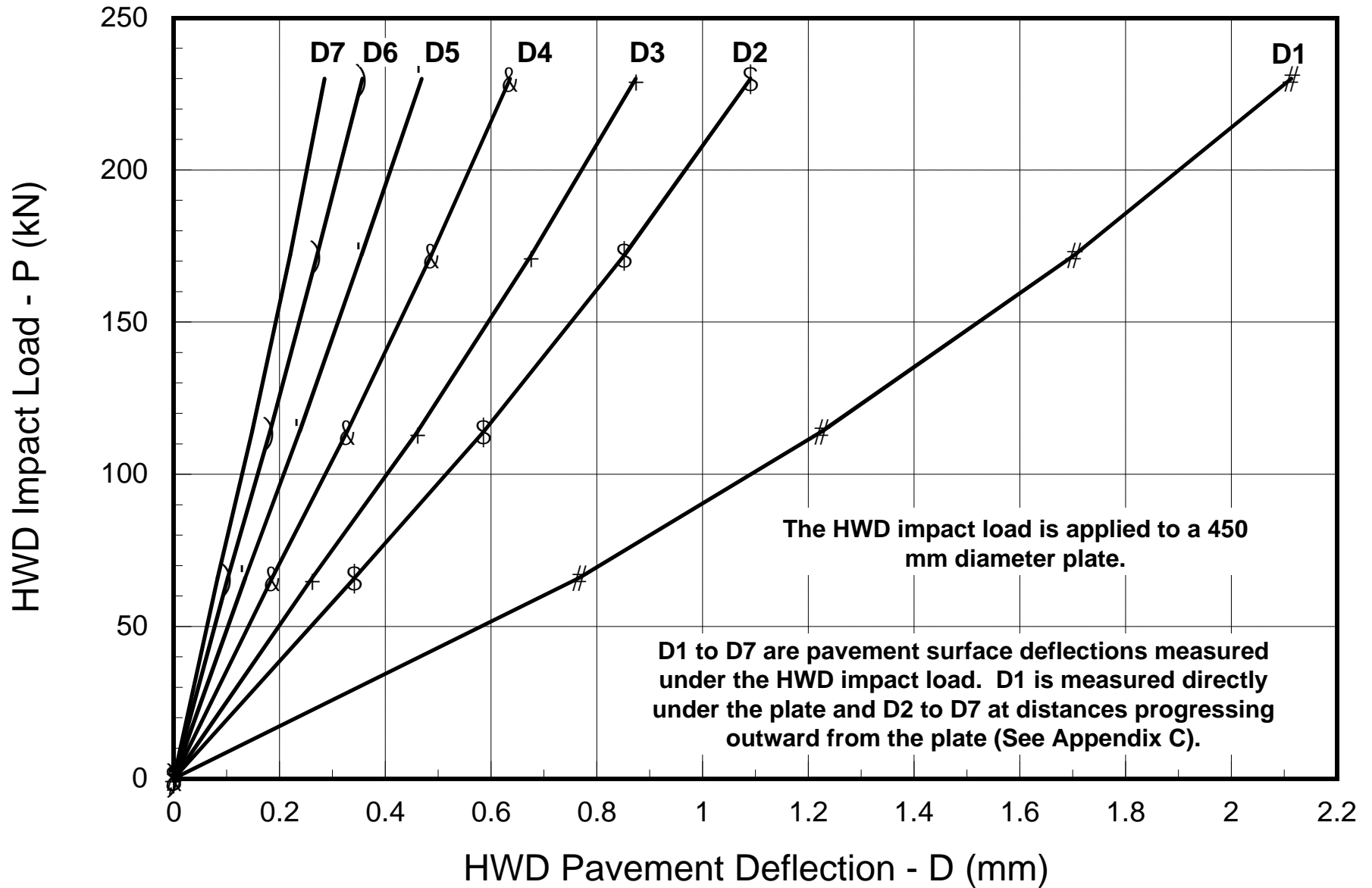


Figure 3: HWD/CROL Plate Load Test Layout

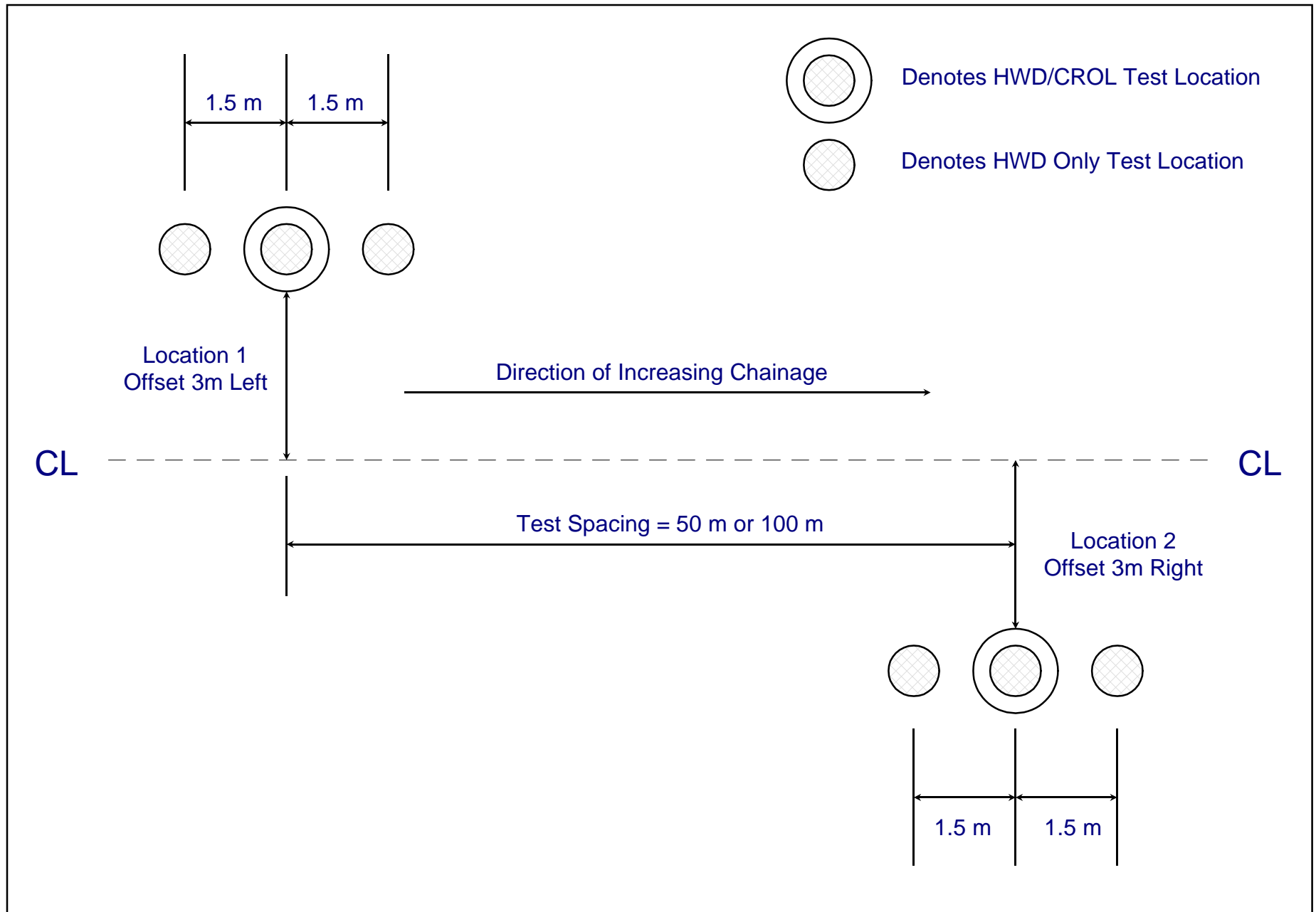


Figure 4: Temperature Correction Factors for HWD Deflections

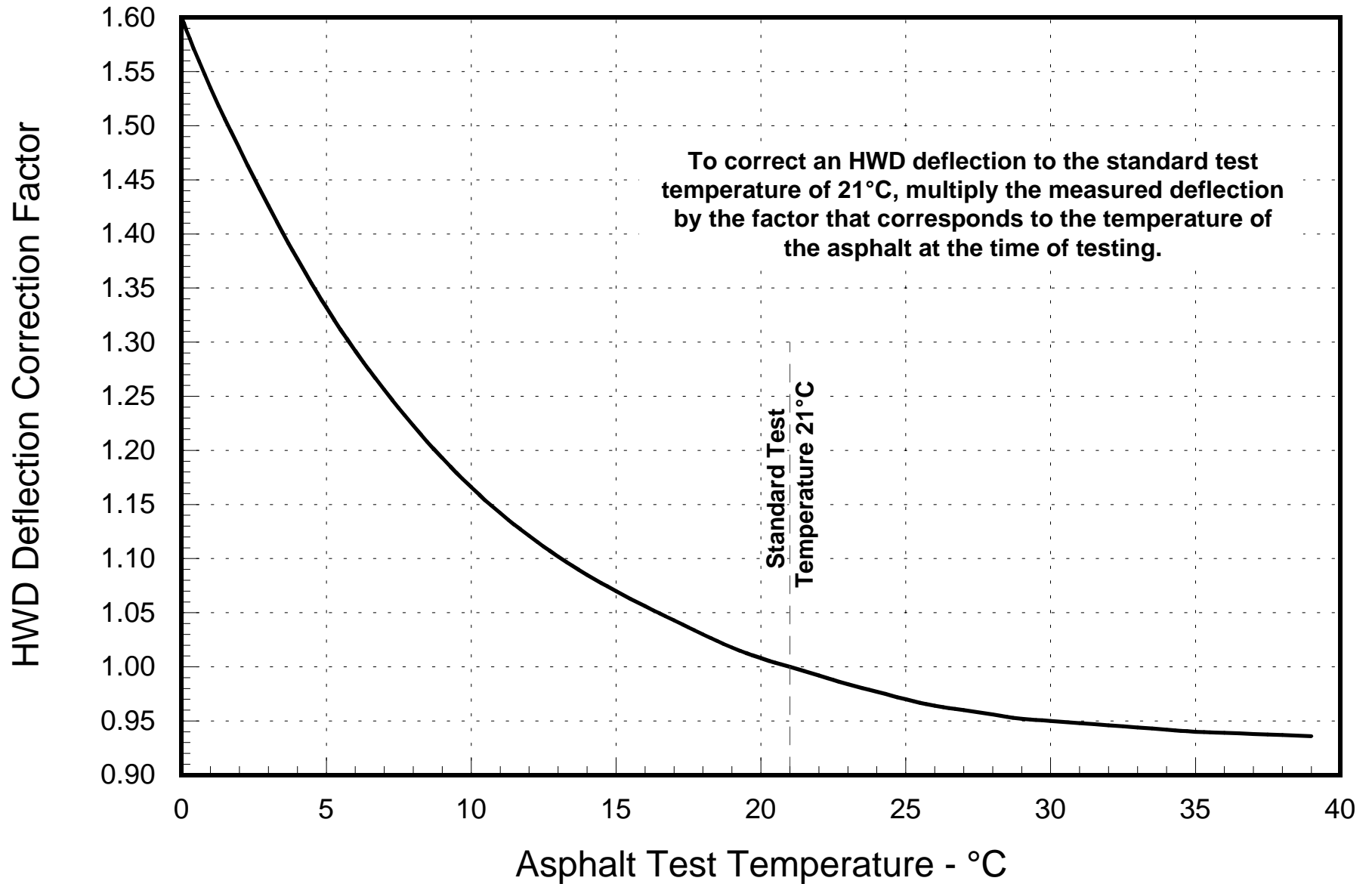


Figure 5: CROL vs HWD Deflection at 250 kN Load

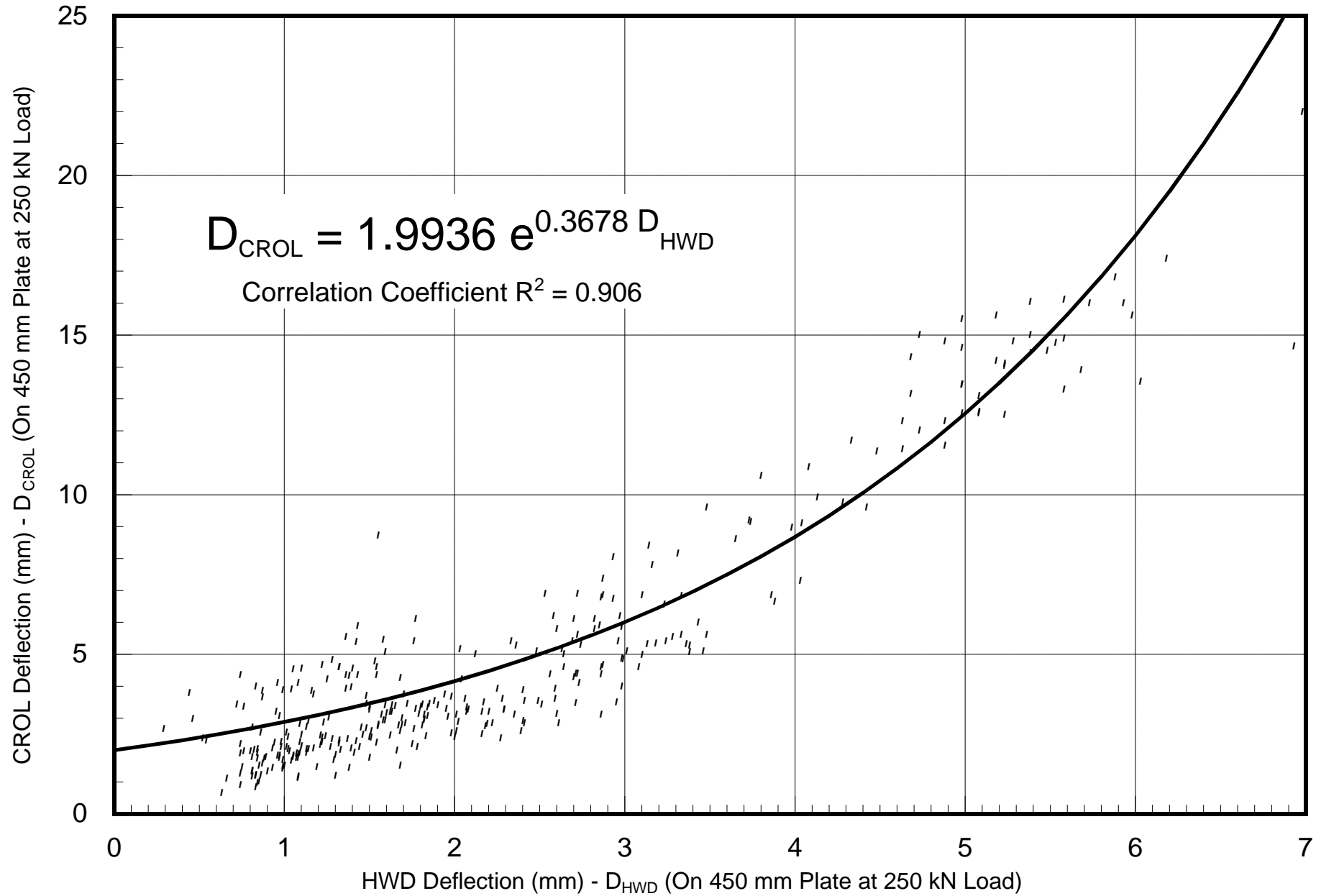


Figure 6: Standard Plate Load "Ps" vs HWD Deflection (All Data)

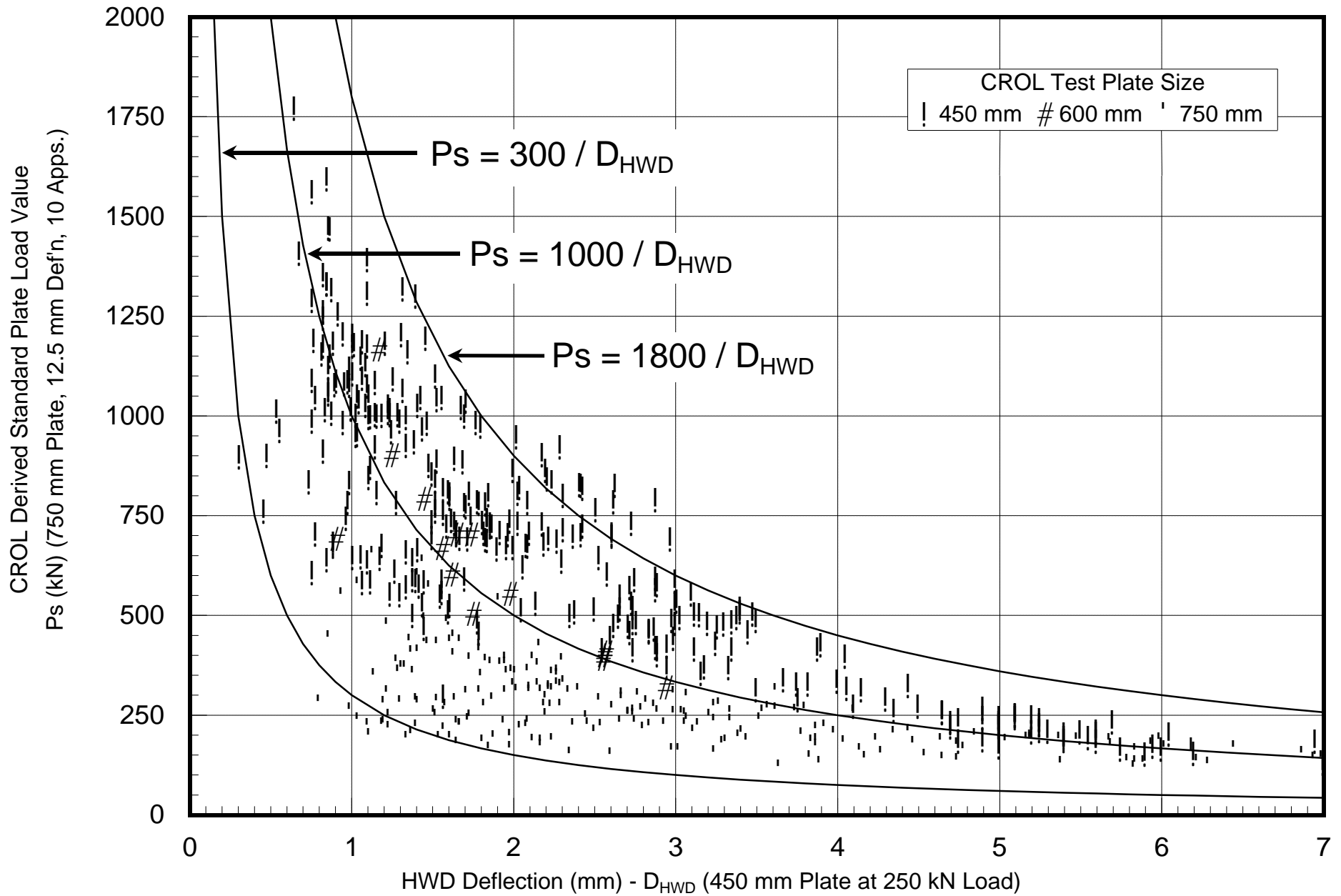


Figure 7: Plate Bearing Strength "Ps" vs HWD Deflection (Runway Averages)

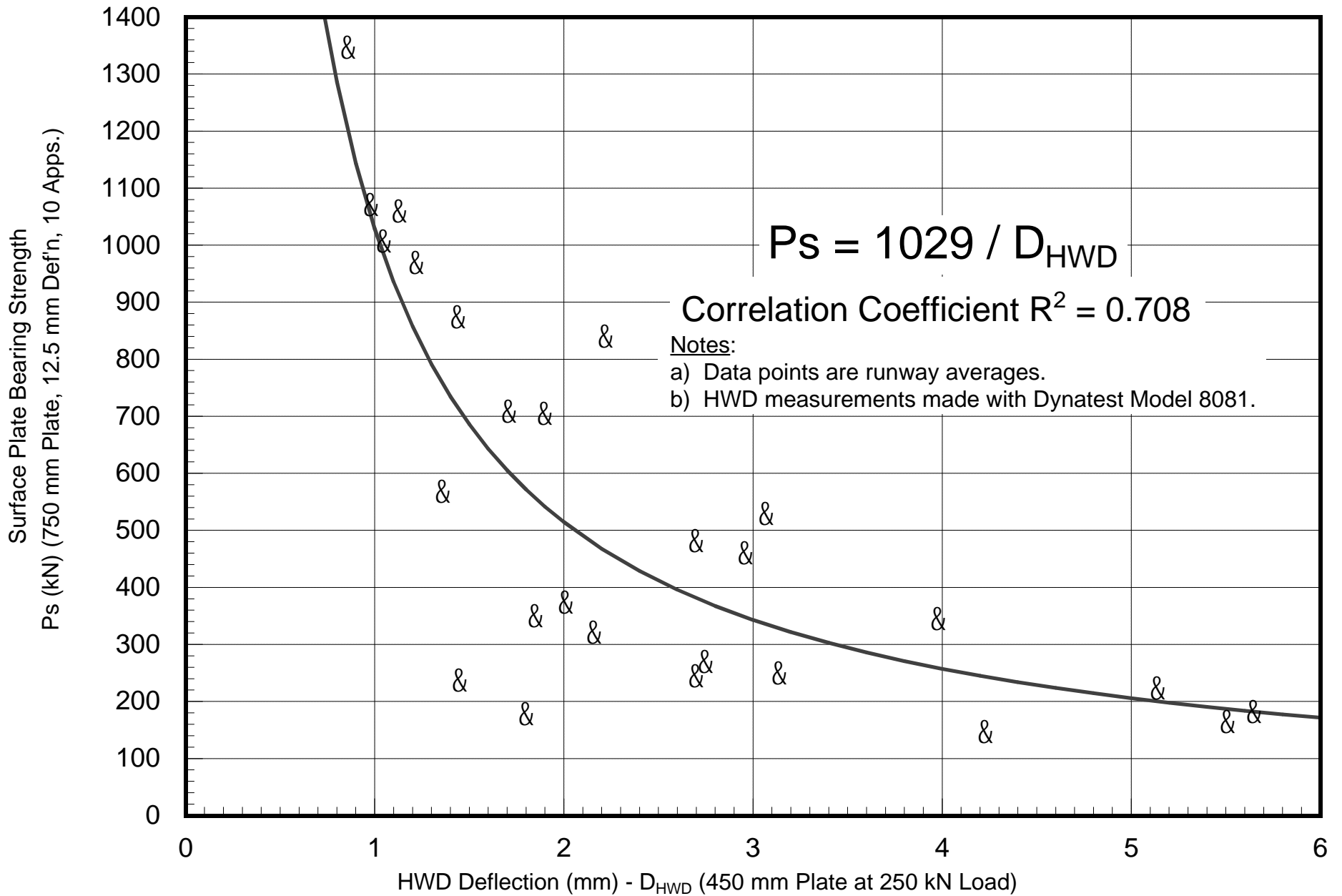
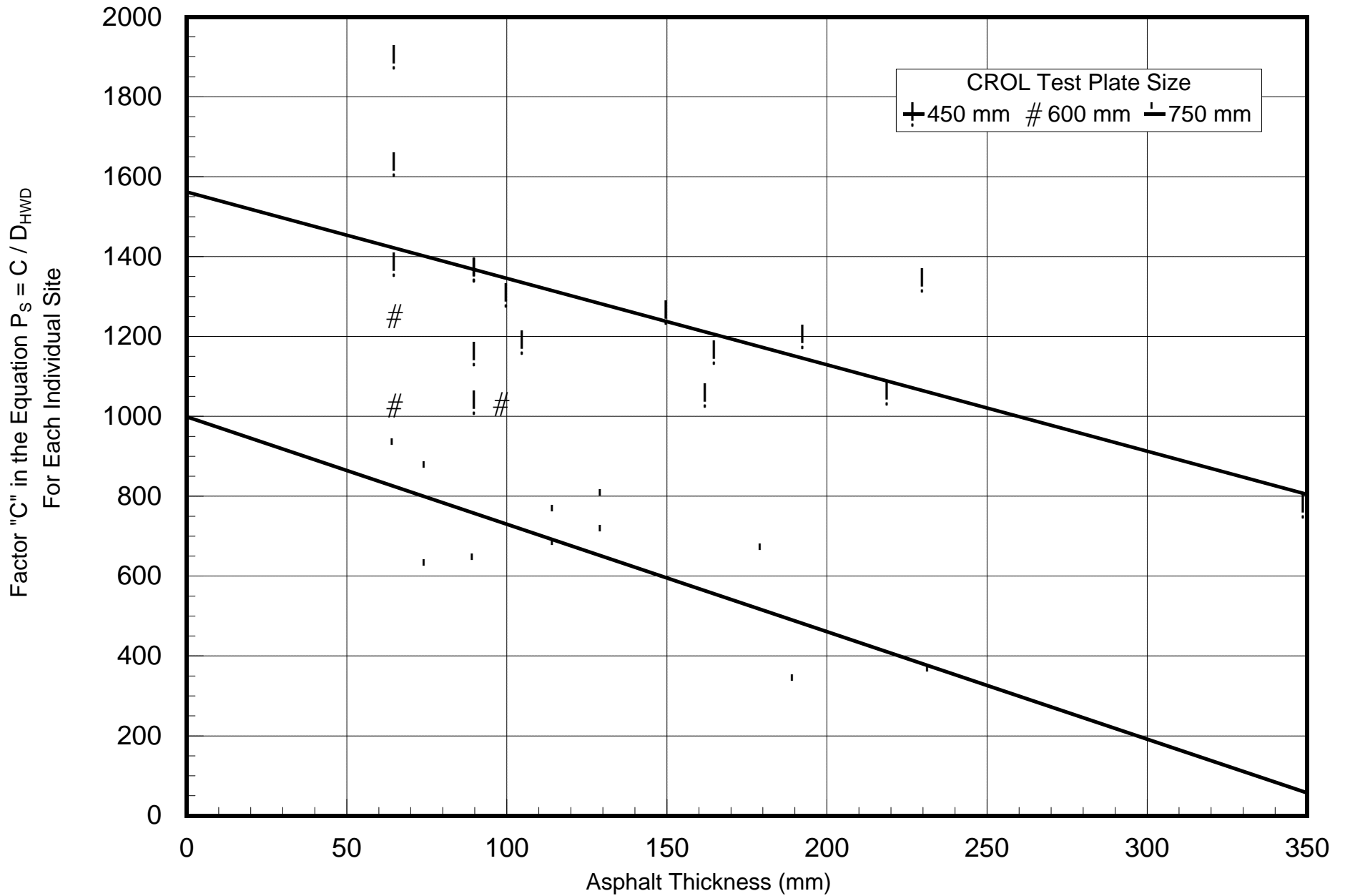


Figure 8: Effect of Asphalt Thickness on CROL vs HWD Relationship



APPENDIX A

TEST DATA SUMMARY

Appendix A - Test Data Summary

Notes on Test Data

- 1) HWD data represents the average of 3 tests at each location.
- 2) Standard plate load test values (Ps) were determined from CROL test data using the following procedure.
 - a) If a deflection of 7 mm was not reached during the CROL test, then the load at 7 mm deflection was estimated using the average plate load ratios given below.

Plate Size (mm)	Average Load Ratio $P_{\text{def'n}} / P_{7\text{mm}}$ at a Deflection of				
	<u>3 mm</u>	<u>4 mm</u>	<u>5 mm</u>	<u>6 mm</u>	<u>7 mm</u>
300	0.533	0.668	0.789	0.899	1.000
450	0.504	0.641	0.769	0.889	1.000
600	0.488	0.627	0.757	0.883	1.000
750	0.504	0.641	0.767	0.890	1.000

- b) Ps was estimated from CROL test results using the equation:

$$P_s = C_0 + C_1 * P + C_2 * P^2 + C_3 * P^3$$

where: Ps = the standard plate load value (i.e. load on a 750 mm plate that gives 12.5 mm deflection after 10 applications of load)

P = the CROL plate load that gives 7 mm deflection

Plate Size (mm)	Regression Equation Coefficients			
	<u>C₀</u>	<u>C₁</u>	<u>C₂</u>	<u>C₃</u>
300	-1086E-1	3711E-3	-2749E-6	6703E-10
450	-6152E-2	2179E-3	-9596E-7	2319E-10
600	-3306E-3	1417E-3	-2708E-7	-8700E-12
750	-2670E-2	1301E-3	-4283E-7	7840E-11

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: BRANDON

Runway: 08-26

Year of Testing: 1990

Location			HWD Test Data July 26					Plate Load Test Data July 21											
No	Station	Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN) @ 200	Load (kN) @ 250	Plate (mm)	Load (kN) @ 1	Load (kN) @ 2	Load (kN) @ 3	Load (kN) @ 4	Load (kN) @ 5	Load (kN) @ 6	Load (kN) @ 7	Defl'n (mm) of	Ps (kN)	Def @ 250 kN
3	5+100 4mR	24	1.27	1.83	2.28	2.60			450	36	75	116	157	195	230	260		444	6.60
4	5+200 4mL	24	1.37	2.01	2.58	3.25			450	41	80	117	153	186	219	251		429	6.95
5	5+300 4mR	24	1.21	1.76	2.24	2.66			450	51	104	156	206	251	290	321		547	5.00
6	5+400 4mL	24	1.58	2.35	2.98	3.33			450	34	70	106	140	171	197	216		367	8.55
7	5+500 4mR	24	1.24	1.86	2.38	2.72			450	39	79	118	157	195	232	266		455	6.50
8	5+600 4mL	24	1.25	1.90	2.32	2.66			450	43	91	140	188	232	271	301		514	5.40
9	5+700 4mR	24	1.19	1.72	2.17	2.50			450	43	89	137	184	228	268	---		515	5.50
10	5+800 4mL	24	1.38	1.96	2.44	2.87			450	40	83	126	167	206	241	---		464	6.30
11	5+900 4mR	24	1.01	1.47	1.82	1.96			450	62	123	184	243	299	351	398		668	4.15
12	6+000 4mL	24	1.23	1.75	2.13	2.35			450	44	87	129	171	215	259	---		498	5.80
13	6+100 4mR	24	1.55	2.19	2.69	3.12			450	40	78	115	150	182	213	243		414	7.25
14	6+200 4mL	24	1.32	1.87	2.30	2.62			450	40	82	124	165	205	242	277		473	6.20
15	6+300 4mR	24	1.35	1.89	2.35	2.88			450	36	73	110	147	182	215	245		418	7.18
16	6+400 4mL	24	1.40	2.00	2.49	2.95			450	34	71	109	147	184	217	246		421	7.13
17	6+500 4mR	24	1.33	1.91	2.39	2.74			450	42	81	119	154	186	216	242		413	7.30
18	6+600 4mL	24	0.94	1.32	1.61	1.82			450	67	136	203	267	325	---	---		705	3.75
19	6+700 4mR	24	1.51	2.03	2.43	2.84			450	37	74	112	151	190	230	270		461	6.50

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+091 - 6+737 100 AC + 230 B + 600 SB

Subgrade: Predominately clayey silt (CL) with some pockets of sandy silt (ML)

Data Analysis:

n = 17
 Average Plate Ps = 483 kN
 Average HWD Deflection at 250 kN = 2.70 mm
 Average HWD Test Temperature = 24.0 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.977
 Temperature Corrected HWD Deflection at 250 kN = 2.64 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: DAUPHIN

Runway: 14-32

Year of Testing: 1990

Location			HWD Test Data July 25					Plate Load Test Data July 23									
No	Station	Test Temp	Def. (mm) @ 100	150	@ 200	Load (kN) 250	Plate (mm)	Load (kN) 1	2	3	4	5	6	7	Ps (kN)	Def @ 250 kN	
1	5+100 3mL	34	2.26	3.34	4.25*	4.90*	450	24	47	70	92	112	132	149	243	12.70*	
2	5+150 3mR	34	1.87	1.83	3.70*	4.35*	450	31	59	82	104	123	141	159	261	12.10*	
3	5+200 3mL	34	2.31	3.50*	4.50*	5.25*	450	28	52	73	93	111	128	146	237	12.90*	
4	5+250 3mR	34	2.31	3.50*	4.50*	5.25*	450	29	54	75	93	109	125	139	224	14.45*	
5	5+300 3mL	34	2.40	3.55*	4.50*	5.25*	450	24	45	65	83	100	116	132	210	14.50*	
6	5+350 3mR	34	2.20	3.30*	4.30*	5.10*	450	29	55	78	99	118	136	152	248	13.00*	
7	5+400 3mL	34	2.20	3.30*	4.40*	5.20*	450	32	60	85	106	124	139	150	244	16.00*	
8	5+450 3mR	34	2.34	3.40*	4.30*	5.00*	450	27	51	74	95	114	132	149	243	12.95*	
9	5+500 3mL	34	2.30	3.40*	4.40*	5.10*	450	30	56	79	100	119	136	152	249	12.95*	
10	5+550 3mR	34	2.27	3.30*	4.20*	5.00*	450	25	47	69	88	107	124	140	225	13.85*	
11	5+600 3mL	34	2.36	3.40*	4.50*	5.30*	450	26	48	68	85	101	116	131	208	15.20*	
12	5+650 3mR	34	2.50	3.60*	4.60*	5.40*	450	24	45	64	80	96	112	127	201	14.85*	
13	5+700 3mL	34	2.39	3.40*	4.40*	5.10*	450	26	51	74	96	115	133	148	242	13.50*	
14	5+750 3mR	34	2.20	3.30*	4.30*	5.00*	450	25	49	72	93	112	129	142	230	15.00*	
15	5+800 3mL	34	2.60	3.90*	4.80*	5.60*	450	22	41	58	73	88	103	119	184	15.30*	
16	5+850 3mR	34	2.00	3.05	4.00*	4.70*	450	23	44	65	84	102	120	137	220	13.55*	
17	5+900 3mL	34	1.85	2.85	3.75*	4.50*	450	29	57	82	105	126	146	164	271	11.75*	
18	5+950 3mR	34	2.00	3.00	3.95*	4.65*	450	27	52	77	100	121	140	156	256	12.70*	
19	6+000 3mL	34	2.50	3.80*	4.85*	5.70*	450	36	62	82	97	112	127	---	232	14.30*	
20	6+050 3mR	34	2.00	3.10*	4.00*	4.75*	450	24	46	68	88	108	127	146	237	12.40*	
21	6+100 3mL	37	2.30	3.50*	4.60*	5.40*	450	21	42	63	81	98	112	123	192	15.40*	
22	6+150 3mR	38	2.05	3.10*	4.10*	5.00*	450	22	43	64	84	103	120	137	220	13.85*	
23	6+200 3mL	38	2.40	3.60*	4.70*	5.50*	450	24	45	65	83	99	115	130	206	14.90*	
24	6+250 3mR	38	2.20	3.40*	4.40*	5.20*	450	22	43	62	81	98	114	130	206	14.60*	
25	6+300 3mL	38	2.40	3.60*	4.70*	5.60*	450	22	44	64	84	101	116	129	204	16.50*	
26	6+350 3mR	38	2.45	3.70*	4.75*	5.55*	450	18	37	55	74	91	108	124	193	15.15*	
27	6+400 3mL	38	2.40	3.60*	4.65*	5.40*	450	21	40	58	75	90	105	119	185	16.45*	

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+090 - 6+432 90 AC + 225 B + 300 SB

Subgrade: Silty clay (ML to CL), silt (ML) to sandy silt (SM)
 (soft bluish grey clay over soft medium brown silty clay
 underlain by loose medium brown silty sand - often saturated)

Data Analysis:

n = 27
 Average Plate Ps = 225 kN
 Average HWD Deflection at 250 kN = 5.14 mm
 Average HWD Test Temperature = 35.0 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.940
 Temperature Corrected HWD Deflection at 250 kN = 4.83 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: FLIN FLON

Runway: 18-36

Year of Testing: 1990

Location			HWD Test Data July 27					Plate Load Test Data Aug 27											
No	Station		Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN)	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Defl'n (mm) of	Ps (kN)	Def @ 250 kN
1	5+100	3mL	37	0.67	0.95	1.23	1.52		450	57	124	197	271	343	407	460		761	3.75
2	5+200	3mR	37	0.69	0.98	1.26	1.53		450	83	167	252	335	415	489	---		886	3.00
3	5+300	3mL	37	0.40	0.57	0.73	0.89		450	62	121	179	235	291	348	406		680	4.25
4	5+400	3mR	37	0.63	0.89	1.15	1.39		450	91	183	273	361	444	522	---		934	2.75
5	5+500	3mL	37	0.45	0.63	0.82	1.00		450	104	203	300	398	502	---	---		1016	2.50
6	5+600	3mR	37	0.51	0.70	0.90	1.09		450	108	216	320	418	508	---	---		1025	2.30
7	5+700	3mL	37	0.59	0.84	1.09	1.34		450	101	199	295	391	488	---	---		995	2.60
8	5+800	3mR	37	0.74	1.10	1.43	1.73		450	73	151	230	306	378	440	491		805	3.25
9	5+900	3mL	38	0.68	1.02	1.36	1.68		450	108	213	314	412	504	---	---		1020	2.38
10	6+000	3mR	38	0.76	1.06	1.36	1.64		450	90	179	265	348	425	494	---		893	2.85
11	6+100	3mL	38	0.55	0.80	1.07	1.34		450	94	189	282	369	448	515	---		924	2.70
12	6+200	3mR	38	0.71	0.99	1.25	1.52		450	72	141	207	272	337	404	473		779	3.68
13	6+300	3mL	38	0.71	1.05	1.37	1.67		450	66	134	200	264	322	373	414		693	3.78
14	6+400	3mR	38	0.70	1.04	1.37	1.69		450	82	162	240	318	395	472	549		883	3.16
15	6+500	3mL	38	0.63	0.92	1.21	1.50		450	81	163	244	322	397	465	526		853	3.08

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 6+524 150 AC + 230 B + 450 SB

Subgrade: Predominately silty sand (SM), pockets of silty clay (ML to CL)

Data Analysis:

n = 15
 Average Plate Ps = 876 kN
 Average HWD Deflection at 250 kN = 1.44 mm
 Average HWD Test Temperature = 37.5 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.938
 Temperature Corrected HWD Deflection at 250 kN = 1.35 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: OSHAWA

Runway: 04-22

Year of Testing: 1992

Location		HWD Test Data					Oct 1		Plate Load Test Data							July 6	
No	Station	Test Temp	Def. (mm) @ 100	150	@ 200	Load (kN) 250	Plate (mm)	Load (kN)	at 1	2	3	4	5	6	7	Ps (kN)	Def @ 250 kN
21	5+050 2mL	9	0.44	0.65	0.88	1.15	750	47	98	149	196	237	---	---	337	5.35	
22	5+100 2mR	9	0.51	0.76	1.02	1.30	750	55	111	165	211	245	---	---	347	4.90	
23	5+150 2mL	9	0.51	0.76	1.01	1.29	750	62	122	175	220	---	---	---	372	4.85	
24	5+200 2mR	10	0.78	1.20	1.66	2.17	750	64	128	189	244	---	---	---	410	4.15	
25	5+250 2mL	11	0.54	0.82	1.11	1.42	750	36	71	105	139	173	208	244	267	7.15	
26	5+300 3mR	11	0.92	1.44	2.07	2.85	750	29	56	83	110	137	164	194	210	8.75	
27	5+350 3mL	11	1.11	1.70	2.35	3.05	750	30	61	92	125	157	190	223	243	7.85	
28	5+400 2mR	11	0.56	0.83	1.12	1.42	750	61	120	179	235	---	---	---	397	4.30	
29	5+450 2mL	12	0.65	0.97	1.32	1.68	750	66	132	195	251	---	---	---	421	4.00	
30	5+500 2mR	11	0.57	0.86	1.19	1.54	750	71	145	208	248	---	---	---	417	4.00	
31	5+550 2mL	11	0.67	1.01	1.38	1.75	600	68	122	176	243	---	---	---	505	4.10	
32	5+600 2mR	11	0.71	1.09	1.51	1.98	600	67	133	199	269	---	---	---	554	3.70	
33	5+650 2mL	11	0.90	1.41	1.97	2.56	600	44	91	139	185	224	---	---	392	5.80	
34	5+700 2mR	11	1.06	1.65	2.28	2.94	600	46	88	126	161	191	217	240	320	7.50	
35	5+750 2mL	11	0.85	1.35	1.93	2.57	600	54	105	152	195	233	---	---	407	5.45	
36	5+800 2mR	12	0.88	1.38	1.95	2.56	600	48	101	152	196	229	---	---	400	5.65	

Runway Nominal Construction:

AC - Asphaltic Concrete	B - Crushed Base	SB - Subbase
Thicknesses in millimetres		
Station 5+000 - 5+245	65 AC + 230 B + 100 SB + 150 B + 75 SB	
5+245 - 5+340	115 AC + 150 B + 75 SB	
5+340 - 5+380	65 AC + 230 B + 100 SB + 150 B + 75 SB	
5+380 - 5+420	65 AC + 230 B + 700 SB	
5+420 - 5+814	65 AC + 230 B + 100 SB + 150 B + 75 SB	

Subgrade: Silty sand (SM)

Data Analysis:

n = 16
 Average Plate Ps = 375 kN
 Average HWD Deflection at 250 kN = 2.01 mm
 Average HWD Test Temperature = 10.7 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.149
 Temperature Corrected HWD Deflection at 250 kN = 2.31 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: OSHAWA

Runway: 12-30

Year of Testing: 1992

Location		HWD Test Data						Plate Load Test Data							July 5			
No	Station	Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN) @ 200	Load (kN) @ 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	5+050 2mL	14	0.32	0.49	0.67	0.87			750	69	136	203	---	---	---	---	433	3.67
2	5+100 2mR	14	0.71	1.08	1.49	1.92			750	83	166	251	---	---	---	---	525	2.97
3	5+150 1mL	14	0.59	0.93	1.33	1.82			750	26	50	73	95	116	138	160	171	10.80
4	5+200 2mR	14	0.56	0.87	1.23	1.68			750	31	60	88	114	141	168	196	212	8.80
5	5+250 2mL	14	0.85	1.33	1.83	2.38			750	31	61	89	116	143	169	195	211	9.05
6	5+300 2mR	14	0.95	1.48	2.06	2.62			750	35	69	103	137	169	202	234	255	7.50
7	5+350 2mL	14	1.00	1.54	2.12	2.72			750	32	64	95	126	158	189	221	241	7.85
8	5+400 2mR	14	0.92	1.45	2.08	2.76			750	31	60	88	115	143	172	203	220	8.40
9	5+450 2mL	14	0.73	1.14	1.62	2.13			750	76	132	177	224	---	---	---	378	4.60
10	5+500 2mR	14	0.65	1.00	1.40	1.83			750	34	67	101	134	168	203	239	261	7.30
11	5+550 2mL	15	1.16	1.81	2.67	3.99			750	27	53	78	103	128	153	178	192	9.75
12	5+600 2mR	15	1.04	1.62	2.28	2.99			750	21	42	62	81	101	121	142	149	12.00
13	5+650 2mL	15	0.85	1.34	1.89	2.51			750	27	53	79	104	130	155	182	196	9.50
14	5+700 1mR	16	1.47	2.32	3.18*	4.05*			750	26	51	73	94	115	137	159	169	11.00
15	5+750 2mL	15	1.83	2.73	3.65*	4.75*			750	26	50	72	93	113	133	153	163	11.40
16	5+800 2mR	15	1.17	1.84	2.62	3.63			750	40	78	117	156	194	234	275	300	6.35
17	5+850 2mL	14	0.94	1.48	2.11	2.81			750	30	56	81	106	131	158	188	203	8.95
18	5+900 2mR	14	1.46	2.26	3.05*	3.90*			750	18	34	50	65	81	97	116	118	13.80
19	5+950 2mL	14	0.80	1.24	1.72	2.24			750	35	69	102	136	169	203	238	259	7.30
20	6+000 2mR	14	0.82	1.27	1.77	2.30			750	30	60	90	122	156	195	238	260	7.20

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 5+098 90 AC + 225 B + 405 SB
 5+098 - 5+870 115 AC + 150 B + 75 SB

Subgrade: Silty sand (SM)

Data Analysis:

n = 20
 Average Plate Ps = 246 kN
 Average HWD Deflection at 250 kN = 2.70 mm
 Average HWD Test Temperature = 14.4 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.080
 Temperature Corrected HWD Deflection at 250 kN = 2.92 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: OTTAWA

Runway: 07-25

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data									
No	Station	Test Temp	Sept 21					June 26/27									
			Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN) @ 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	5+100 3mL	10	0.66	0.96	1.19	1.40	450	129	276	458	---	---	---	---	1300	1.84	
2	5+200 3mR	8	0.30	0.47	0.62	0.76	450	110	218	331	457	---	---	---	1088	2.29	
3	5+300 3mL	9	0.30	0.47	0.62	0.76	450	95	192	290	388	483	---	---	986	2.58	
4	5+400 3mR	12	0.33	0.50	0.64	0.78	450	105	209	313	417	520	---	---	1046	2.37	
5	5+500 3mL	10	0.23	0.35	0.46	0.56	450	92	184	277	371	469	---	---	963	2.70	
6	5+600 3mR	8	0.19	0.28	0.38	0.46	450	56	114	175	239	307	381	60	761	4.18	
7	5+700 3mL	11	0.53	0.77	0.97	1.15	450	110	217	323	431	545	---	---	1083	2.32	
8	5+800 3mR	11	0.48	0.70	0.88	1.04	450	104	207	309	414	522	---	---	1048	2.42	
9	5+900 3mL	10	0.66	0.97	1.21	1.43	450	108	215	324	434	---	---	---	1046	2.32	
10	6+000 3mR	10	0.61	0.90	1.12	1.32	450	158	309	467	---	---	---	---	1317	1.60	
11	6+100 3mL	11	0.47	0.71	0.92	1.11	450	79	156	231	307	383	463	---	845	3.23	
12	6+200 3mR	11	0.66	0.98	1.22	1.44	450	94	187	279	374	472	---	---	967	2.68	
13	6+300 3mL	11	0.43	0.67	0.86	1.03	450	85	167	252	347	461	---	---	950	2.95	
14	6+400 3mR	10	0.63	0.92	1.14	1.32	450	115	224	332	443	---	---	---	1063	2.26	
15	6+500 3mL	10	0.39	0.59	0.75	0.89	450	129	256	382	510	---	---	---	1181	1.98	
16	6+600 3mR	8	0.51	0.74	0.92	1.07	450	114	228	355	512	---	---	---	1184	2.19	
17	6+700 3mL	9	0.38	0.57	0.72	0.86	450	101	204	317	444	---	---	---	1065	2.43	
18	6+800 3mR	8	0.74	1.05	1.30	1.52	450	117	234	350	462	---	---	---	1098	2.16	
19	6+900 3mL	9	0.49	0.71	0.89	1.05	450	109	213	317	428	---	---	---	1034	2.37	
20	7+000 3mR	7	0.73	1.07	1.33	1.56	450	93	187	286	395	521	---	---	1046	2.63	
21	7+100 3mL	9	0.46	0.68	0.86	1.03	450	104	203	299	394	492	---	---	1000	2.50	
22	7+200 3mR	8	0.73	1.04	1.26	1.46	450	87	194	332	517	---	---	---	1193	2.50	
23	7+300 3mL	8	0.69	0.96	1.17	1.35	450	91	202	336	497	---	---	---	1160	2.40	
24	7+350 3mR	7	0.87	1.23	1.48	1.71	450	66	140	232	353	515	---	---	1037	3.19	

Runway Nominal Construction:

AC - Asphaltic Concrete	B - Crushed Base	SB - Subbase
Thicknesses in millimetres		
Station 5+000 - 5+125	115 AC + 305 B	
5+125 - 6+463	220 AC + 230 B	
6+463 - 6+753	165 AC + 305 B	
6+753 - 6+829	165 AC + 305 B + 600 SB	
6+829 - 7+350	165 AC + 305 B	

Subgrade: Gravelly sand to fine sand, little silt (SW, SP, SM)

Data Analysis:

n = 24
 Average Plate Ps = 1061 kN
 Average HWD Deflection at 250 kN = 1.13 mm
 Average HWD Test Temperature = 9.4 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.182
 Temperature Corrected HWD Deflection at 250 kN = 1.34 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: OTTAWA

Runway: 14-32

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data										
No	Station		Test Temp	Sept 24			Load (kN)	Plate (mm)	June 25/26							Ps (kN)	Def @ 250 kN	
				Def. (mm) 100	Def. (mm) 150	Def. (mm) @ 200			Load (kN) 250	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6			Load (kN) 7
25	5+200	3mL	13	0.36	0.55	0.70	0.86	450	111	219	327	439	---	---	---	---	1054	2.32
26	5+300	3mR	14	0.30	0.47	0.62	0.77	450	138	271	405	---	---	---	---	1189	1.86	
27	5+400	3mL	14	0.35	0.52	0.68	0.83	450	114	232	360	506	---	---	---	1175	2.19	
28	5+500	3mR	14	0.60	0.88	1.10	1.31	450	120	242	373	522	---	---	---	1202	2.08	
29	5+600	3mL	14	0.46	0.69	0.88	1.06	450	117	243	384	---	---	---	---	1143	2.07	
30	5+700	3mR	13	0.46	0.71	0.92	1.11	450	109	218	327	436	---	---	---	1049	2.32	
31	5+800	3mL	13	0.49	0.74	0.95	1.15	450	72	152	242	340	445	---	---	922	3.12	
32	5+900	3mR	14	0.42	0.62	0.80	0.96	450	92	187	291	407	543	---	---	1080	2.63	
33	6+000	3mL	15	0.59	0.84	1.04	1.24	450	89	184	290	410	---	---	---	1001	2.66	
34	6+100	3mR	15	0.41	0.62	0.81	0.99	450	77	147	216	287	365	454	---	832	3.47	
35	6+200	3mL	15	0.38	0.57	0.73	0.88	450	79	162	255	364	496	---	---	1006	2.95	
36	6+300	3mR	16	0.50	0.74	0.93	1.10	450	105	213	341	505	---	---	---	1173	2.28	
37	6+400	3mL	15	0.37	0.54	0.69	0.82	450	98	206	334	495	---	---	---	1155	2.36	
38	6+500	3mR	16	0.54	0.82	1.04	1.25	450	75	147	228	331	467	---	---	960	3.26	
39	6+600	3mL	15	0.56	0.87	1.12	1.34	450	44	89	138	191	249	316	390	657	5.00	
40	6+700	3mR	15	0.57	0.84	1.06	1.26	450	83	167	265	388	551	---	---	1092	2.84	
41	6+800	3mL	16	0.34	0.52	0.68	0.83	450	74	153	239	333	438	---	---	911	3.11	
42	6+900	3mR	18	0.18	0.28	0.38	0.48	450	66	136	213	298	392	499	---	900	3.38	
43	7+000	3mL	18	0.20	0.32	0.43	0.54	450	85	177	275	382	498	---	---	1011	2.76	
44	7+100	3mR	17	0.31	0.47	0.61	0.74	450	60	122	188	264	351	455	---	834	3.83	
45	7+200	3mL	18	0.44	0.65	0.82	0.98	450	48	98	153	214	287	372	475	782	4.50	
46	7+300	3mR	17	0.70	1.00	1.25	1.47	450	75	151	238	345	479	---	---	980	3.11	
47	7+400	3mL	18	0.56	0.83	1.04	1.24	450	77	166	277	417	---	---	---	1015	2.79	
48	7+500	3mR	19	0.62	0.94	1.19	1.41	450	103	205	306	407	508	---	---	1026	2.45	
49	7+600	3mL	19	0.71	1.03	1.30	1.53	450	85	174	273	385	517	---	---	1040	2.79	
50	7+700	3mR	18	0.50	0.77	1.01	1.23	450	101	198	293	391	496	---	---	1008	2.56	

Runway Nominal Construction:

AC - Asphaltic Concrete	B - Crushed Base	SB - Subbase
Thicknesses in millimetres		
Station 5+183 - 7+484	230 AC + 230 B	
7+484 - 7+697	115 AC + 300 B	
7+697 - 7+865	175 AC + 305 B	

Subgrade: Gravelly sand to fine sand, little silt (SW, SP, SM)

Data Analysis:

n = 26
 Average Plate Ps = 1008 kN
 Average HWD Deflection at 250 kN = 1.05 mm
 Average HWD Test Temperature = 15.7 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.060
 Temperature Corrected HWD Deflection at 250 kN = 1.11 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: PEMBROKE

Runway: 17-35

Year of Testing: 1992

Location			HWD Test Data Sept 28					Plate Load Test Data July 3								
No	Station	Test Temp	Def. (mm) 100	Def. (mm) 150	@ Load (kN) 200	Load (kN) 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	5+050 2mL	15	0.56	0.81	1.05	1.25	600	110	227	348	469	---	---	---	902	----
2	5+100 2mR	15	0.50	0.72	0.94	1.17	600	180	359	507	---	---	---	---	1167	----
3	5+150 2mL	16	0.52	0.75	0.98	1.21	450	135	268	401	---	---	---	---	1182	1.86
4	5+200 2mR	16	0.71	1.05	1.38	1.70	450	104	208	309	404	491	---	---	999	1.92
5	5+250 2mL	15	0.84	1.23	1.61	2.00	450	83	169	256	338	412	474	---	862	2.92
6	5+300 2mR	15	1.26	1.86	2.42	2.97	450	63	128	193	256	315	368	413	691	3.90
7	5+350 2mL	15	1.13	1.65	2.16	2.73	450	64	129	194	259	322	382	439	729	3.87
8	5+400 2mR	15	0.90	1.29	1.66	2.04	450	74	152	230	306	379	446	---	819	3.29
9	5+450 1mL	16	0.89	1.32	1.76	2.20	450	80	159	238	317	396	475	---	863	3.15
10	5+500 1mR	18	1.19	1.78	2.35	2.89	450	48	97	148	198	248	295	339	576	5.07
11	5+550 1mL	16	1.19	1.77	2.34	2.88	450	71	142	213	285	356	426	---	789	3.50
12	5+600 1mR	16	0.99	1.46	1.95	2.43	450	76	155	233	309	380	444	---	817	3.24
13	5+650 1mL	17	0.99	1.47	1.94	2.41	450	82	168	251	329	397	451	---	827	3.00
14	5+700 1mR	18	1.14	1.65	2.14	2.63	450	75	153	232	310	383	449	---	825	3.24
15	5+750 3mL	18	1.08	1.59	2.10	2.62	450	69	141	213	284	353	418	477	784	3.53
16	5+800 3mR	18	0.93	1.32	1.74	2.29	450	90	180	270	358	444	---	---	922	2.76
17	5+850 3mL	18	0.88	1.26	1.64	2.02	450	88	177	266	355	443	530	---	946	2.82
18	5+900 1mR	19	0.94	1.37	1.79	2.21	450	79	157	233	308	383	459	---	840	3.21
19	5+950 3mL	19	0.96	1.39	1.81	2.24	450	77	154	230	307	382	455	---	834	3.24
20	6+000 2mR	19	0.99	1.43	1.86	2.31	450	69	138	206	275	344	415	488	800	3.67
21	6+050 1mL	18	0.99	1.47	1.94	2.42	450	77	152	227	301	375	450	---	825	3.30
22	6+100 4mR	18	1.04	1.53	2.02	2.51	450	66	131	194	258	323	391	463	764	3.93
23	6+150 2mL	18	0.94	1.38	1.83	2.27	450	60	117	173	230	287	346	409	685	4.33
24	6+200 2mR	18	0.92	1.32	1.71	2.10	450	68	135	202	271	---	---	---	705	3.68
25	6+250 2mL	18	1.06	1.54	2.05	2.61	450	60	118	175	233	291	353	417	697	4.32
26*	6+300 1mR	18	1.01	1.45	1.88	2.33	450	---	---	---	---	---	---	---	---	----
27	6+350 1mL	18	1.03	1.50	1.97	2.42	450	59	117	176	235	295	356	419	700	4.27
28	6+400 2mR	19	0.96	1.38	1.78	2.18	450	87	175	261	347	432	---	---	901	2.90
29	6+450 2mL	20	0.79	1.13	1.47	1.80	450	101	201	299	397	---	---	---	974	2.50
30	6+500 2mR	19	0.74	1.09	1.43	1.77	450	96	192	289	386	481	---	---	983	2.58

* Data not used in the analysis.

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 6+524 65 AC + 230 B

Subgrade: (no information)

Data Analysis:

n = 29
 Average Plate Ps = 842 kN
 Average HWD Deflection at 250 kN = 2.22 mm
 Average HWD Test Temperature = 17.2 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.040
 Temperature Corrected HWD Deflection at 250 kN = 2.31 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: REGINA

Runway: 12-30

Year of Testing: 1990

Location		HWD Test Data July 24					Plate Load Test Data Aug 1									
No	Station	Test Temp	Def. (mm) 100	Def. (mm) 150	Def. (mm) @ 200	Load (kN) 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1*	5+450 3mL	23	0.44	0.62	0.80	0.95	450	69	141	213	281	343	396	---	739	3.55
2	5+500 3mR	23	0.46	0.66	0.86	1.07	450	53	106	157	206	254	299	342	581	4.92
3	5+550 3mL	23	0.56	0.80	1.06	1.27	450	55	110	165	218	269	317	360	609	4.62
4	5+600 3mR	23	0.52	0.75	0.99	1.24	450	54	107	157	204	248	289	325	553	5.06
5	5+650 3mL	23	0.67	0.97	1.23	1.45	450	42	84	126	166	205	241	273	467	6.28
6	5+700 3mR	23	0.68	0.97	1.22	1.45	450	54	108	162	213	261	304	---	582	4.75
7	5+750 3mL	23	0.73	1.04	1.31	1.60	450	37	79	123	169	214	257	297	507	5.85
8	5+800 3mR	23	0.50	0.73	0.95	1.12	450	52	104	156	206	254	300	343	583	4.94
9	5+850 3mL	23	0.46	0.66	0.86	1.01	450	59	120	179	237	291	339	382	643	4.28
10	5+900 3mR	23	0.54	0.78	1.00	1.18	450	60	120	179	235	288	337	380	641	4.26
11	5+950 3mL	23	0.41	0.58	0.76	0.89	450	56	119	183	247	307	359	401	673	4.06
12	6+000 3mR	30	0.60	0.86	1.10	1.30	450	49	98	145	193	240	287	---	550	5.23
13	6+050 3mL	30	0.45	0.63	0.82	0.97	450	70	141	211	279	341	398	---	742	3.60
14	6+100 3mR	30	0.50	0.72	0.93	1.10	450	50	105	163	221	277	329	375	633	4.50
15	6+150 3mL	30	0.67	0.98	1.28	1.56	450	52	104	155	203	248	290	326	555	5.00
16	6+200 3mR	38	0.75	1.07	1.36	1.61	450	42	88	136	184	229	271	307	524	5.48
17	6+250 3mL	38	0.63	0.91	1.17	1.38	450	55	110	162	213	262	308	---	588	4.75
18	6+300 3mR	38	0.62	0.90	1.16	1.34	450	51	103	153	202	249	294	335	570	5.00
19	6+350 3mL	38	0.64	0.94	1.20	1.42	450	53	105	156	206	253	297	337	572	4.94
20	6+400 3mR	38	0.66	0.96	1.22	1.44	450	46	89	132	174	216	261	308	525	5.78
21	6+450 3mL	38	0.69	1.00	1.29	1.56	450	51	105	159	212	262	306	---	584	4.75
22	6+500 3mR	38	0.75	1.06	1.33	1.57	450	23	44	66	89	115	144	177	296	9.11
23	6+550 3mL	38	0.64	0.92	1.16	1.38	450	42	85	127	169	211	252	292	498	5.94
24	6+600 3mR	38	0.41	0.57	0.73	0.85	450	59	116	172	227	282	336	---	638	4.40
25*	6+650 3mL	38	0.38	0.53	0.66	0.78	450	49	98	146	194	243	292	---	559	5.15
26	6+700 3mR	38	0.52	0.72	0.90	1.06	450	59	116	173	229	285	341	---	646	4.30
27	6+750 3mL	39	0.81	1.18	1.51	1.78	450	45	92	138	182	222	256	282	482	5.80
28	6+800 3mR	39	0.95	1.37	1.74	2.05	450	45	92	138	183	226	266	301	513	5.56
29	6+850 3mL	39	0.81	1.18	1.50	1.79	450	39	80	120	160	199	234	265	453	6.50
30	6+900 3mR	39	0.78	1.12	1.42	1.70	450	56	111	165	217	266	310	348	591	4.67
31	6+950 3mL	39	0.63	0.91	1.17	1.40	450	55	109	162	213	261	307	---	586	4.72
32	7+000 3mR	39	0.63	0.90	1.15	1.38	450	58	117	176	233	287	336	378	638	4.33
33	7+050 3mL	39	0.72	1.02	1.30	1.55	450	48	98	147	196	242	286	---	547	5.18
34	7+100 3mR	39	0.57	0.79	1.00	1.19	450	64	125	184	242	299	357	---	674	4.15

* Data not used in the analysis

Runway Nominal Construction:

Station	AC-asphaltic concrete	B-crushed base	SB-subbase	PCC-Portland cement concrete
5+305 - 5+457	215 AC	+ 250 PCC	+ 560 SB	
5+457 - 6+554	340 AC	+ 200 B	+ 500 SB	
6+554 - 6+615	375 AC	+ 200 B	+ 500 SB	
6+615 - 6+667	260 AC	+ 250 PCC	+ 75 SB	
6+677 - 6+798	375 AC	+ 200 B	+ 500 SB	
6+798 - 7+164	365 AC	+ 200 B	+ 500 SB	

Subgrade: High plasticity clay (CH) (very expansive)

Data Analysis:

n = 32

Average Plate Ps = 570 kN

Average HWD Deflection at 250 kN = 1.36 mm

Average HWD Test Temperature = 32.6 Deg Celsius

Average HWD Deflection Temperature Correction Factor = 0.945

Temperature Corrected HWD Deflection at 250 kN = 1.29 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: ROUYN

Runway: 08-26

Year of Testing: 1992

Location			HWD Test Data Sept 29					Plate Load Test Data July 16								
No	Station	Test Temp	Def. (mm) 100	Def. (mm) 150	@ Load (kN) 200	Load (kN) 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	5+100 3mL	2	0.47	0.66	0.85	1.02	450	129	262	390	507	---	---	---	1177	1.92
2	5+200 3mR	2	0.32	0.44	0.55	0.65	450	234	478	721	---	---	---	---	1771	1.07
3*	5+300 3mL	2	0.21	0.30	0.39	0.48	450	122	250	369	467	---	---	---	1107	2.00
4	5+400 3mR	1	0.42	0.60	0.76	0.91	450	113	232	349	457	---	---	---	1087	2.18
5	5+500 3mL	2	0.42	0.60	0.76	0.90	450	115	234	349	451	---	---	---	1077	2.14
6	5+600 3mR	2	0.46	0.64	0.80	0.95	450	139	274	412	---	---	---	---	1205	1.84
7	5+700 2mL	2	0.51	0.75	0.97	1.19	450	99	203	306	404	492	---	---	1000	2.45
8	5+800 3mR	2	0.44	0.65	0.84	1.01	450	139	274	410	---	---	---	---	1200	1.82
9	5+900 3mL	2	0.42	0.61	0.79	0.95	450	98	203	306	401	481	---	---	983	2.45
10	6+000 2mR	2	0.54	0.80	1.05	1.28	450	70	143	217	290	359	421	475	782	3.43
11	6+100 3mL	3	0.47	0.70	0.91	1.12	450	83	173	262	346	420	479	---	870	2.89
12	6+200 4mR	2	0.59	0.87	1.14	1.41	450	50	106	166	227	288	344	395	663	4.36
13	6+300 2mL	2	0.44	0.64	0.82	0.99	450	113	231	346	450	---	---	---	1076	2.16
14	6+400 2mR	3	0.12	0.19	0.25	0.31	450	80	162	247	331	414	496	---	896	3.06
15	6+500 3mL	3	0.43	0.64	0.83	1.01	450	131	265	393	506	---	---	---	1175	1.88
16	6+600 3mR	3	0.41	0.59	0.76	0.92	450	148	293	436	---	---	---	---	1255	1.72
17	6+700 2mL	3	0.36	0.52	0.69	0.84	450	102	209	315	414	500	---	---	1014	2.40
18	6+800 3mR	2	0.48	0.69	0.90	1.10	450	114	233	348	448	---	---	---	1073	2.16
19	6+900 2mL	2	0.51	0.74	0.95	1.15	450	101	206	310	408	493	---	---	1002	2.42

* Data not used in the analysis

Runway Nominal Nonstruction:

AC - Asphaltic Concrete	B - Crushed Base	SB - Subbase	PCC - Portland Cement Concrete
Thicknesses in millimetres			
Station 5+000 - 5+275	90 AC + 305 B + 125 SB		
5+275 - 5+366	245 AC + 230 PCC + 915 SB		
5+366 - 6+311	165 AC + 230 B + 305 SB + 230 B + 915 SB		
6+311 - 6+433	265 AC + 230 B + 305 SB + 230 B + 915 SB		
6+433 - 6+905	165 AC + 230 B + 305 SB + 230 B + 915 SB		

Subgrade: Low to high plasticity clay (CL,CH)

Data Analysis:

n = 18
 Average Plate Ps = 1073 kN
 Average HWD Deflection at 250 kN = 0.98 mm
 Average HWD Test Temperature = 2.2 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.468
 Temperature Corrected HWD Deflection at 250 kN = 1.44 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: ST. CATHARINES

Runway: 06-24

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data										
No	Station		Test Temp	Def. (mm)		@ Load (kN)			Plate (mm)	Load (kN) at Defl'n (mm) of							Ps (kN)	Def @ 250 kN
				100	150	200	250	1		2	3	4	5	6	7			
1	5+050	3mL	21	1.10	1.68	2.24	2.80*	750	31	64	97	131	164	197	228	249	----	
2	5+100	3mR	21	1.46	2.24	3.09*	3.88*	750	28	56	83	111	137	163	189	204	----	
3	5+150	3mL	21	1.16	1.76	2.38	3.00*	750	33	66	99	131	163	193	223	242	----	
4	5+200	3mR	21	1.14	1.79	2.43	3.08*	750	31	61	92	122	152	180	208	226	----	
5	5+250	3mL	21	1.14	1.80	2.44	3.12*	750	24	49	75	102	128	155	181	196	----	
6	5+300	3mR	21	1.17	1.85	2.54	3.22*	750	32	63	93	124	154	185	216	235	----	
7	5+350	3mL	22	1.12	1.76	2.41	3.07*	750	30	62	94	126	158	190	220	239	----	
8	5+400	3mR	21	1.25	2.00	2.76*	3.53*	750	30	60	90	120	150	180	209	227	----	
9	5+450	3mL	22	1.35	2.16	2.98*	3.79*	750	23	47	71	97	123	149	175	189	----	
10	5+500	3mR	22	1.19	1.90	2.63*	3.35*	750	29	58	87	117	146	176	205	222	----	
11	5+550	3mL	22	1.15	1.84	2.55	3.25*	750	29	58	87	116	146	175	204	222	----	
12	5+600	3mR	22	0.90	1.43	1.99	2.54*	750	35	71	108	145	181	217	251	274	----	
13	5+650	3mL	23	0.96	1.53	2.14	2.75*	750	36	70	102	132	162	190	218	237	----	
14	5+700	3mR	23	1.02	1.63	2.27	2.90*	750	30	60	92	125	158	191	223	244	----	
15	5+750	3mL	23	1.06	1.67	2.28	2.88*	750	34	69	103	137	171	204	237	259	----	
16	5+800	3mR	24	0.81	1.29	1.78	2.28*	750	41	82	124	165	207	247	287	314	----	
17	5+850	3mL	24	0.99	1.55	2.17	2.78*	750	41	81	121	159	196	231	264	288	----	
18	5+900	3mR	24	1.00	1.58	2.16	2.75*	750	31	63	96	129	162	195	226	246	----	
19	5+950	3mL	24	1.06	1.68	2.34	3.00*	750	39	79	118	157	195	232	267	292	----	
20	6+000	3mR	24	1.00	1.60	2.21	2.83*	750	34	70	106	143	179	214	247	270	----	
21	6+050	3mL	24	0.92	1.49	2.08	2.68*	750	38	76	114	150	186	220	254	278	----	
22	6+100	3mR	25	0.83	1.33	1.82	2.32*	750	46	92	136	178	219	257	293	320	----	
23	6+150	3mL	25	1.12	1.80	2.50*	3.25*	750	35	70	105	140	174	207	239	261	----	
24	6+200	3mR	25	1.07	1.71	2.38*	3.08*	750	39	77	116	154	191	226	261	285	----	
25	6+250	3mL	25	1.29	2.08	2.90*	3.75*	750	32	66	100	134	167	198	227	248	----	
26	6+300	3mR	25	1.26	2.01	2.79*	3.55*	750	32	65	98	130	162	194	226	246	----	
27	6+350	3mL	24	1.45	2.31	3.20*	4.11*	750	35	70	104	137	168	198	226	246	----	
28	6+400	3mR	25	1.29	2.04	2.83*	3.58*	750	35	70	104	137	171	203	234	255	----	
29	6+450	3mL	26	1.38	2.20	3.00*	3.81*	750	37	73	109	143	175	205	233	254	----	
30	6+500	3mR	26	1.18	1.87	2.57*	3.28*	750	37	74	110	145	180	212	242	264	----	

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 6+524 130 AC + 230 B + 305 SB

Subgrade: Silty clay, little sand (CL)

Data Analysis:

n = 30
 Average Plate Ps = 251 kN
 Average HWD Deflection at 250 kN = 3.14 mm
 Average HWD Test Temperature = 23.2 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.983
 Temperature Corrected HWD Deflection at 250 kN = 3.09 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: ST. HUBERT

Runway: 06L-24R

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data									
No	Station	Test Temp	Sept 21					July 20									
			Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN) @ 250	Plate (mm)	Load (kN) @ 1	Load (kN) @ 2	Load (kN) @ 3	Load (kN) @ 4	Load (kN) @ 5	Load (kN) @ 6	Load (kN) @ 7	Ps (kN)	Def @ 250 kN
1	5+200 4mL	18	0.56	0.90	1.26	1.65	750	41	79	116	151	185	218	251	274	----	
2	5+300 2mR	18	0.57	0.91	1.27	1.66	750	31	61	90	119	147	174	201	218	----	
3	5+400 3mL	19	0.55	0.87	1.19	1.53	750	34	68	100	131	161	190	217	236	----	
4	5+500 3mR	18	0.49	0.78	1.09	1.41	750	40	78	115	151	186	219	252	275	----	
5	5+600 4mL	18	0.54	0.87	1.23	1.59	750	37	72	106	140	173	206	238	260	----	
6	5+700 3mR	19	0.76	1.19	1.65	2.10	750	32	63	92	121	148	175	202	219	----	
7	5+800 2mL	18	0.56	0.87	1.19	1.52	750	36	70	104	137	168	197	225	245	----	
8	5+900 3mR	19	0.48	0.73	0.98	1.24	750	32	65	99	131	162	191	217	236	----	
9	6+000 2mL	19	0.40	0.61	0.83	1.05	750	30	60	91	121	151	180	208	226	----	
10	6+100 3mR	19	0.31	0.48	0.64	0.81	750	36	73	110	146	181	216	248	271	----	
11	6+200 3mL	19	0.46	0.68	0.91	1.12	750	27	54	79	104	128	152	175	188	----	
12	6+300 3mR	20	0.51	0.76	1.01	1.24	750	30	60	88	115	141	166	190	205	----	
13	6+400 4mL	20	0.40	0.61	0.82	1.00	750	35	70	105	138	170	201	231	252	----	
14	6+500 3mR	20	0.50	0.76	1.01	1.23	750	40	81	121	161	200	236	270	294	----	
15	6+600 3mL	20	0.78	1.19	1.59	1.95	750	30	61	91	121	150	176	201	218	----	
16	6+700 2mR	20	0.64	0.97	1.28	1.58	750	33	64	91	117	141	164	186	201	----	
17	6+800 3mL	19	0.54	0.82	1.07	1.31	750	38	76	113	150	185	218	247	270	----	
18	6+900 3mR	20	0.69	1.06	1.40	1.74	750	38	74	107	138	166	192	215	234	----	
19	7+000 3mL	19	0.51	0.75	0.98	1.21	750	41	80	117	153	187	217	246	268	----	
20	7+100 3mR	19	0.48	0.70	0.91	1.11	750	30	60	90	119	146	172	194	211	----	
21	7+200 3mL	19	1.01	1.53	2.02	2.47	750	30	60	90	119	147	173	196	213	----	

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+122 - 6+097 218 AC + 305 B
 6+097 - 7+288 243 AC + 380 B

Subgrade: Silty clay to clayey silt (CL,ML,CH,MH)

Data Analysis:

n = 21
 Average Plate Ps = 239 kN
 Average HWD Deflection at 250 kN = 1.45 mm
 Average HWD Test Temperature = 19.1 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.017
 Temperature Corrected HWD Deflection at 250 kN = 1.47 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: ST. HUBERT

Runway: 06R-24L

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data									
No	Station	Test Temp	Sept 21				Plate (mm)	July 21							Ps (kN)	Def @ 250 kN	
			Def. (mm) @ 100	150	200	250		Load (kN) at 1	2	3	4	5	6	7			
61	5+100 2mL	22	0.94	1.45	1.96	2.41	750	42	83	124	164	203	241	276	301	----	
62	5+200 2mR	22	0.93	1.42	1.90	2.35	750	42	82	123	162	200	236	270	295	----	
63	5+300 2mL	22	0.81	1.23	1.64	2.02	750	49	98	146	192	236	277	315	343	----	
64	5+400 2mR	22	0.88	1.34	1.80	2.23	750	41	82	123	163	202	240	276	302	----	
65	5+500 2mL	22	0.87	1.32	1.77	2.16	750	53	105	155	204	250	293	334	363	----	
66	5+600 2mR	22	0.86	1.31	1.76	2.16	750	48	93	136	177	216	252	286	313	----	
67	5+700 2mL	22	0.86	1.29	1.73	2.10	750	53	104	151	197	240	281	320	348	----	
68	5+800 2mR	22	0.79	1.20	1.61	1.96	750	48	97	147	198	247	293	337	366	----	
69	5+900 2mL	22	0.95	1.40	1.85	2.30	750	39	80	123	165	207	247	284	310	----	
70	6+000 2mR	22	0.89	1.35	1.81	2.25	750	46	89	130	169	207	242	275	301	----	
71	6+100 2mL	22	0.73	1.10	1.49	1.81	750	41	86	132	179	225	268	307	335	----	
72	6+200 2mR	21	0.81	1.22	1.67	2.11	750	40	80	121	161	200	237	272	297	----	

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase WBM - Water Bound McAdam
 Thicknesses in millimetres
 Station 5+000 - 6+219 130 AC + 580 WBM + 100 SB

Subgrade: Silty clay to clayey silt (CL,ML,CH,MH)

Data Analysis:

n = 12
 Average Plate Ps = 323 kN
 Average HWD Deflection at 250 kN = 2.16 mm
 Average HWD Test Temperature = 21.9 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.993
 Temperature Corrected HWD Deflection at 250 kN = 2.14 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: ST. HUBERT

Runway: 10-28

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data											
No	Station		Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN)	Plate (mm)	Load (kN)	at 1	Defl'n (mm) of 2	3	4	5	6	7	Ps (kN)	Def @ 250 kN
44	5+050	3mL	21	0.46	0.74	1.04	1.35	750	26	51	76	100	123	145	167	179	----		
45	5+100	3mR	20	0.55	0.90	1.28	1.66	750	28	53	76	97	117	136	155	165	----		
46	5+150	3mL	21	0.86	1.40	1.99	2.61	750	25	47	67	84	100	116	132	138	----		
47	5+200	3mR	21	0.77	1.26	1.79	2.36	750	26	48	68	86	103	119	135	141	----		
48	5+250	3mL	21	0.60	0.99	1.41	1.86	750	24	47	68	89	108	127	145	153	----		
49	5+300	3mR	21	0.69	1.10	1.53	1.99	750	25	49	71	92	111	129	146	154	----		
50	5+350	2mL	21	0.55	0.90	1.26	1.62	750	27	53	77	101	124	146	168	180	----		
51	5+400	2mR	21	0.55	0.88	1.22	1.55	750	34	64	89	111	130	149	167	179	----		
52	5+450	2mL	21	0.68	1.07	1.48	1.89	750	33	62	88	111	131	151	170	182	----		
53	5+500	2mR	21	0.51	0.81	1.11	1.41	750	37	70	99	126	150	172	193	209	----		
54	5+550	2mL	22	0.45	0.70	0.96	1.21	750	37	70	101	128	154	178	201	218	----		
55	5+600	4mR	22	0.76	1.19	1.66	2.13	750	32	60	84	106	125	144	162	173	----		
56	5+650	3mL	22	0.53	0.81	1.10	1.38	750	30	59	85	110	133	156	177	191	----		
57	5+700	3mR	22	0.74	1.15	1.57	1.99	750	31	59	85	108	131	152	172	185	----		
58	5+750	3mL	21	0.65	1.01	1.37	1.73	750	38	73	104	133	159	184	207	225	----		
59	5+800	3mR	22	0.64	1.00	1.35	1.68	750	33	64	94	122	148	172	196	212	----		
60	5+850	3mL	22	0.82	1.26	1.72	2.18	750	27	52	76	99	120	140	159	170	----		

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 5+850 190 AC + 305 B

Subgrade: Silty clay to clayey silt (CL,ML,CH,MH)

Data Analysis:

n = 17
 Average Plate Ps = 180 kN
 Average HWD Deflection at 250 kN = 1.80 mm
 Average HWD Test Temperature = 21.3 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.998
 Temperature Corrected HWD Deflection at 250 kN = 1.80 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: ST. HUBERT

Runway: 18-36

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data										
			Sept 21					July 23										
No	Station		Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN)	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Defl'n (mm) 4	Defl'n (mm) 5	Defl'n (mm) 6	Defl'n (mm) 7	Ps (kN)	Def @ 250 kN
22	5+050	2mL	20	1.24	1.93*	2.60*	3.30*		750	26	51	74	96	117	138	157	167	----
23	5+100	3mR	20	1.77	2.69*	3.63*	4.55*		750	22	43	62	80	98	114	131	136	----
24	5+150	3mL	20	1.59	2.45*	3.30*	4.15*		750	22	44	64	85	104	123	141	149	----
25	5+200	3mR	20	1.81	2.78*	3.76*	4.75*		750	18	35	53	70	87	104	121	124	----
26	5+250	3mL	20	1.80	2.80*	3.78*	4.79*		750	20	41	63	84	105	125	145	153	----
27	5+300	3mR	20	0.73	1.11*	1.50*	1.88*		750	39	77	115	151	186	221	254	277	----
28	5+350	3mL	20	0.79	1.23*	1.64*	2.05*		750	32	61	89	115	140	164	189	205	----
29	5+400	3mR	20	0.83	1.28*	1.73*	2.18*		750	26	50	73	95	115	134	152	161	----
30	5+450	3mL	21	0.48	0.73*	0.96*	1.20*		750	33	64	93	121	148	173	198	214	----
31	5+500	2mR	20	1.48	2.28*	3.06*	3.84*		750	23	44	63	80	97	112	127	132	----
32	5+550	3mL	20	2.07	3.15*	4.26*	5.39*		750	19	36	53	70	85	100	115	117	----
33	5+600	3mR	20	2.18	3.38*	4.58*	5.80*		750	21	40	57	74	89	104	119	122	----
34	5+650	3mL	20	2.27	3.45*	4.65*	5.85*		750	19	38	55	71	87	103	118	120	----
35	5+700	3mR	21	2.42	3.70*	5.00*	6.23*		750	18	36	54	71	88	104	120	123	----
36	5+750	3mL	20	2.28	3.50*	4.75*	5.90*		750	18	36	54	71	87	103	117	120	----
37	5+800	3mR	20	1.64	2.50*	3.38*	4.25*		750	27	53	77	100	121	142	163	174	----
38	5+850	3mL	20	2.25	3.44*	4.65*	5.84*		750	18	35	51	65	79	93	106	107	----
39	5+900	3mR	20	0.87	1.35*	1.78*	2.25*		750	29	55	79	102	123	144	163	175	----
40	5+950	3mL	20	1.58	2.45*	3.32*	4.18*		750	22	42	61	78	94	110	126	130	----
41	6+000	3mR	21	1.46	2.20*	2.91*	3.65*		750	21	39	54	69	82	94	107	108	----
42	6+050	3mL	20	2.39	3.70*	5.00*	6.30*		750	22	42	59	75	89	102	113	115	----
43	6+100	3mR	21	1.83	2.78*	3.72*	4.66*		750	23	44	62	79	94	109	123	128	----

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 6+143 90 AC + 200 B + 100 SB

Subgrade: Silty clay to clayey silt (CL,ML,CH,MH)

Data Analysis:

n = 22
 Average Plate Ps = 148 kN
 Average HWD Deflection at 250 kN = 4.23 mm
 Average HWD Test Temperature = 20.2 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.006
 Temperature Corrected HWD Deflection at 250 kN = 4.26 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: ST. JEAN

Runway: 11-29

Year of Testing: 1992

Location			HWD Test Data Sept 22				Plate Load Test Data July 26									
No	Station	Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	5+050 2mL	9	2.35*	3.53*	4.75*	5.69*	750	31	59	83	105	125	145	164	175	----
2	5+100 3mR	9	2.83*	4.20*	5.58*	7.00*	750	21	41	60	78	95	111	127	132	----
3	5+150 3mL	9	2.31*	3.54*	4.75*	5.95*	750	25	50	73	95	116	136	154	164	----
4	5+200 2mR	9	2.82*	4.20*	5.56*	6.95*	750	18	36	54	72	90	107	124	128	----
5	5+250 2mL	8	2.09*	3.11*	4.18*	5.20*	750	26	51	76	101	124	146	166	178	----
6	5+300 1mR	9	2.38*	3.58*	4.78*	6.03*	750	27	51	73	93	112	130	147	156	----
7	5+350 3mL	9	2.23*	3.30*	4.40*	5.49*	750	22	46	71	96	121	145	165	177	----
8	5+400 3mR	9	2.10*	3.13*	4.18*	5.20*	750	31	59	85	109	131	151	170	183	----
9	5+450 2mL	9	1.90*	2.88*	3.88*	4.86*	750	28	54	80	105	129	152	174	187	----
10	5+500 2mR	9	2.13*	3.20*	4.30*	5.38*	750	28	54	79	102	125	146	166	178	----
11	5+550 1mL	9	2.05*	3.08*	4.15*	5.18*	750	29	55	80	103	125	146	166	178	----
12	5+600 2mR	9	2.00*	3.00*	4.00*	5.05*	750	28	54	78	101	122	142	162	173	----
13	5+650 2mL	10	1.85*	2.78*	3.70*	4.65*	750	28	55	79	102	123	143	163	174	----
14	5+700 3mR	10	1.78*	2.65*	3.55*	4.45*	750	32	62	89	115	139	161	182	197	----
15	5+750 2mL	10	2.41	3.65*	4.65*	6.00*	750	27	53	78	101	123	145	165	177	----
16	5+800 2mR	10	2.28*	3.40*	4.55*	5.70*	750	27	52	74	95	115	134	152	162	----
17	5+850 2mL	10	2.40	3.70*	4.95*	6.20*	750	27	53	76	98	118	137	154	164	----
18	5+900 2mR	10	2.40	3.68*	4.95*	6.20*	750	25	48	69	89	107	124	140	148	----
19	5+950 2mL	11	2.64	4.10*	5.50*	6.88*	750	23	45	65	85	103	120	136	142	----
20	6+000 3mR	11	2.54	3.85*	5.20*	6.46*	750	26	51	73	94	113	131	148	157	----
21	6+050 2mL	11	1.15	1.79*	2.39*	3.03*	750	26	49	70	89	107	125	142	150	----
22	6+100 1mR	10	1.62	2.50*	3.38*	4.36*	750	31	61	88	114	138	159	179	193	----
23	6+150 2mL	11	2.24	3.45*	4.66*	5.85*	750	26	50	71	91	109	126	142	150	----
24	6+200 2mR	10	1.69	2.63*	3.55*	4.48*	750	24	48	71	94	116	137	158	168	----

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 5+305 65 AC + 305 B
 5+305 - 6+067 65 AC + 150 B + 25 AC + 125 B
 6+067 - 6+219 65 AC + 305 B

Subgrade: CL,CH

Data Analysis:

n = 24
 Average Plate Ps = 166 kN
 Average HWD Deflection at 250 kN = 5.51 mm
 Average HWD Test Temperature = 9.6 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.177
 Temperature Corrected HWD Deflection at 250 kN = 6.49 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: SHERBROOKE

Runway: 14-32

Year of Testing: 1992

Location			HWD Test Data Sept 23				Plate Load Test Data July 27										
No	Station		Test Temp	Def. (mm) 100	Def. (mm) 150	@ Load (kN) 200	Load (kN) 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	5+150	3mL	5	0.72	1.07	1.44	1.84	750	47	95	145	196	246	296	344	373	----
2	5+200	3mR	5	0.85	1.27	1.77	2.11	750	36	75	116	157	199	239	277	303	----
3	5+250	3mL	5	0.57	0.86	1.18	1.54	750	26	57	92	130	170	210	250	273	----
4	5+300	3mR	5	0.53	0.80	1.08	1.39	750	47	92	137	182	226	270	315	343	----
5	5+350	3mL	6	0.51	0.76	1.03	1.32	750	49	96	142	187	232	279	328	357	----
6	5+400	3mR	5	0.52	0.78	1.05	1.34	750	46	93	139	186	233	280	328	357	----
7	5+450	3mL	6	0.73	1.08	1.47	1.87	750	47	95	143	192	240	289	337	366	----
8	5+500	3mR	9	0.71	1.07	1.48	1.96	750	38	76	115	153	192	231	270	295	----
9	5+550	2mL	7	0.67	1.01	1.38	1.80	750	54	107	159	211	264	316	369	399	----
10	5+600	3mR	7	0.53	0.80	1.07	1.38	750	49	99	151	204	258	311	364	394	----
11	5+650	3mL	7	0.56	0.84	1.14	1.46	750	62	126	191	256	321	385	447	477	----
12	5+700	3mR	8	0.65	0.99	1.38	1.80	750	51	103	157	212	268	325	381	411	----
13	5+750	3mL	9	0.62	0.93	1.26	1.60	750	64	127	191	254	317	380	442	472	----
14	5+800	3mR	8	0.75	1.12	1.53	1.97	750	42	86	130	176	222	269	315	343	----
15	5+850	3mL	8	0.63	0.95	1.28	1.62	750	58	115	171	226	280	335	391	421	----
16	5+900	3mR	10	0.81	1.22	1.68	2.20	750	33	65	98	131	165	200	238	260	----
17	5+950	3mL	9	0.90	1.35	1.81	2.28	750	42	85	129	174	219	265	310	338	----
18	6+000	3mR	10	0.67	1.01	1.37	1.74	750	52	103	152	201	249	298	347	377	----
19	6+050	2mL	10	0.82	1.24	1.70	2.21	750	34	69	106	143	181	219	256	280	----
20	6+100	3mR	9	0.65	0.99	1.34	1.72	750	42	82	121	158	194	231	267	292	----
21	6+150	3mL	10	0.89	1.34	1.81	2.28	750	47	94	139	184	229	274	319	347	----
22	6+200	3mR	11	0.60	0.92	1.27	1.64	750	55	108	160	211	261	310	357	387	----
23	6+250	3mL	11	0.74	1.15	1.58	2.03	750	35	73	112	153	193	234	273	298	----
24	6+300	3mR	10	0.66	1.02	1.41	1.80	750	35	72	109	148	188	228	269	294	----
25	6+350	3mL	13	0.76	1.16	1.58	2.00	750	47	93	138	182	227	272	318	347	----
26	6+400	3mR	13	0.85	1.30	1.76	2.23	750	42	84	124	163	202	242	281	307	----
27	6+450	3mL	12	0.63	0.96	1.30	1.64	750	58	116	173	231	288	346	405	435	----
28	6+500	3mR	12	0.75	1.15	1.55	1.96	750	50	100	150	199	248	298	348	378	----
29	6+550	3mL	12	0.73	1.13	1.53	1.93	750	50	98	146	192	239	286	335	364	----
30	6+600	3mR	12	0.93	1.39	1.86	2.31	750	50	99	148	197	246	296	346	376	----
31	6+650	3mL	13	0.81	1.27	1.73	2.18	750	41	80	118	156	193	232	271	296	----
32	6+700	3mR	13	0.73	1.14	1.56	2.01	750	42	84	124	165	205	245	286	313	----

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+092 - 6+737 180 AC + 230 B + 610 SB

Subgrade: Silty sand (SM)

Data Analysis:

n = 32
 Average Plate Ps = 352 kN
 Average HWD Deflection at 250 kN = 1.85 mm
 Average HWD Test Temperature = 9.1 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.190
 Temperature Corrected HWD Deflection at 250 kN = 2.20 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: SWIFT CURRENT

Runway: 12-30

Year of Testing: 1990

Location			HWD Test Data July 23					Plate Load Test Data Aug 5								
No	Station	Test Temp	Def. (mm) 100	Def. (mm) 150	@ Load (kN) 200	Load (kN) 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	at Defl'n (mm) 4	of (mm) 5	of (mm) 6	of (mm) 7	Ps (kN)	Def @ 250 kN
1	6+195 3mR	10	1.67	2.27	2.69	2.99	450	52	99	140	177	208	236	258	441	6.60
2	6+145 3mL	10	1.86	2.50	2.93	3.16	450	35	68	100	130	158	184	208	353	8.80
3	6+095 3mR	10	1.36	2.02	2.68	3.26*	450	54	105	151	192	227	255	275	470	5.80
4	6+045 3mL	12	1.24	1.81	2.35	2.89	450	49	94	134	170	200	225	245	418	7.25
5	5+995 3mR	12	1.22	1.72	2.24	2.74	450	69	129	180	222	257	284	304	519	4.80
6	5+945 3mL	12	1.22	1.73	2.17	2.55	450	46	88	125	158	188	216	242	412	7.30
7	5+895 3mR	14	1.47	2.02	2.44	2.76	450	54	104	150	192	228	258	281	480	5.70
8	5+845 3mL	14	2.20	2.96*	3.44*	3.82*	450	33	65	96	125	151	174	194	327	11.00
9	5+795 3mR	15	1.89	2.51	2.83	2.95	450	34	67	101	133	163	191	216	367	8.45
10	5+745 3mL	15	1.56	2.08	2.51	2.98	450	52	100	145	186	223	256	284	486	5.81
11	5+695 3mR	15	1.78	2.20	2.65	3.03	450	55	107	155	197	235	265	289	493	5.49
12	5+645 3mL	15	1.54	2.04	2.40	2.74	450	45	90	134	176	215	251	281	481	6.00
13	5+595 3mR	15	1.57	2.02	2.34	2.65	450	51	100	148	191	230	264	291	497	5.56
14	5+545 3mL	15	1.56	1.96	2.24	2.53	450	72	140	203	260	309	350	381	643	3.83
15	5+495 3mR	15	1.33	1.73	2.01	2.30	450	74	140	199	252	298	339	375	634	4.00
16	5+445 3mL	15	1.54	2.05	2.50	3.00	450	72	134	187	234	275	312	345	585	4.40
17	5+395 3mR	15	1.49	2.00	2.39	2.73	450	62	120	173	219	258	288	310	529	4.80
18	5+345 3mL	15	1.74	2.23	2.66	3.12	450	54	106	154	198	237	269	294	502	5.39
19	5+295 3mR	16	1.55	2.14	2.65	3.20	450	54	105	151	192	228	257	280	479	5.75
20	5+245 3mL	16	1.58	2.02	2.36	2.71	450	55	106	152	192	227	255	276	471	5.80
21	5+195 3mR	16	2.33	3.12*	3.48*	3.75*	450	28	58	88	118	146	171	194	327	9.60
22	5+145 3mL	16	2.20	2.90*	3.30*	3.50*	450	30	59	88	116	142	165	186	313	10.00
23	5+095 3mR	16	1.64	2.19	2.57	2.84	450	55	104	148	186	218	246	267	457	6.19
24	5+045 3mL	16	1.81	2.38	2.73	2.89	450	40	80	117	153	184	212	235	401	7.78

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 6+200 90 AC + 225 B + 500 SB

Subgrade: Silty clay (CL). Soft, light brown to gray silty clay to 3.5m.
 At 3.5m, a clayey till may be encountered.

Data Analysis:

n = 24
 Average Plate Ps = 462 kN
 Average HWD Deflection at 250 kN = 2.96 mm
 Average HWD Test Temperature = 14.2 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.083
 Temperature Corrected HWD Deflection at 250 kN = 3.21 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: THE PAS

Runway: 12-30

Year of Testing: 1990

Location			HWD Test Data					Plate Load Test Data									
No	Station		Test Temp	July 27				Plate (mm)	Aug 26							Ps (kN)	Def @ 250 kN
				Def. (mm)	@ 100	@ 150	@ 200		@ 250	Load (kN)	at 1	at 2	at 3	at 4	at 5		
1	5+100	3mL	23	0.64	0.87	1.09	1.30	450	96	186	273	362	455	558	---	985	2.75
2	5+200	3mR	23	0.52	0.68	0.85	1.00	450	94	187	283	387	502	---	---	1016	2.65
3	5+300	3mL	23	0.51	0.69	0.87	1.04	450	91	179	264	350	440	534	---	952	2.80
4	5+400	3mR	23	0.54	0.76	0.92	1.12	450	101	198	293	389	490	---	---	997	2.52
5	5+500	3mL	23	0.57	0.77	0.94	1.11	450	98	191	281	372	465	564	---	994	2.65
6	5+600	3mR	23	0.79	1.07	1.35	1.61	450	77	152	224	295	363	429	---	792	3.33
7	5+700	3mL	23	0.55	0.74	0.91	1.07	450	116	226	332	440	552	---	---	1093	2.22
8	5+800	3mR	23	0.66	0.88	1.09	1.29	450	101	199	297	394	493	---	---	1002	2.50
9	5+900	3mL	24	0.55	0.76	0.97	1.16	450	79	155	228	299	368	437	---	806	3.30
10	6+000	3mR	27	0.52	0.68	0.83	0.98	450	122	230	337	455	---	---	---	1084	2.22
11	6+100	3mL	27	0.52	0.68	0.84	0.99	450	120	226	330	440	569	---	---	1119	2.22
12	6+200	3mR	27	0.53	0.69	0.85	1.01	450	120	239	356	467	---	---	---	1105	2.08
13	6+300	3mL	27	0.73	1.04	1.35	1.65	450	64	130	198	263	324	379	425	709	3.80
14	6+400	3mR	27	0.63	0.84	1.04	1.23	450	107	211	312	411	507	---	---	1024	2.87
15	6+500	3mL	27	0.76	1.05	1.33	1.60	450	75	151	225	299	370	439	---	808	3.33
16	6+600	3mR	27	0.69	0.96	1.23	1.48	450	87	173	257	338	413	482	542	874	2.89
17	6+700	3mL	27	0.55	0.81	0.99	1.09	450	119	233	344	457	574	---	---	1127	2.17
18	6+800	3mR	27	0.58	0.77	0.96	1.16	450	106	207	305	399	490	---	---	998	2.43

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+061 - 6+844 105 AC + 230 B + 230 SB + 75 AC + 150 B + 230 SB

Subgrade: Sandy, silty clay (CL, ML) , bouldary, till-like, limestone bedrock at 2 to 3 metres

Data Analysis:

n = 18
 Average Plate Ps = 971 kN
 Average HWD Deflection at 250 kN = 1.22 mm
 Average HWD Test Temperature = 25.1 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.970
 Temperature Corrected HWD Deflection at 250 kN = 1.18 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: THOMPSON

Runway: 05-23

Year of Testing: 1990

Location			HWD Test Data July 28					Plate Load Test Data Aug 28/29									
No	Station		Test Temp	Def. (mm) 100	Def. (mm) 150	@ Load (kN) 200	Load (kN) 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Defl'n (mm) 6	Defl'n (mm) 7	Ps (kN)	Def @ 250 kN
1	5+050	3mL	27	0.70	1.01	1.32	1.57	450	82	162	238	307	368	418	456	754	3.20
2	5+100	3mR	27	0.69	1.00	1.32	1.65	450	74	145	212	274	330	379	420	702	3.61
3	5+150	3mL	27	0.74	1.05	1.34	1.59	450	74	147	218	284	343	394	434	723	3.50
4	5+200	3mR	27	0.76	1.08	1.38	1.64	450	79	151	216	277	333	387	439	729	3.60
5	5+250	3mL	27	0.90	1.26	1.58	1.87	450	55	120	191	261	328	387	434	722	3.85
6	5+300	3mR	27	0.94	1.27	1.57	1.84	450	77	153	227	295	356	407	445	738	3.35
7	5+350	3mL	27	0.85	1.17	1.47	1.74	450	64	129	194	259	324	386	447	742	3.85
8	5+400	3mR	27	0.69	0.98	1.26	1.50	450	66	131	197	262	327	393	---	734	3.85
9	5+450	3mL	27	0.91	1.24	1.55	1.83	450	64	130	195	258	316	368	412	689	3.83
10	5+500	3mR	27	1.09	1.51	1.88	2.22	450	68	139	209	275	333	381	415	693	3.61
11	5+550	3mL	28	1.07	1.47	1.84	2.19	450	57	122	190	256	318	368	404	677	3.90
12	5+600	3mR	29	0.91	1.31	1.71	2.08	450	57	120	186	252	312	363	402	674	4.00
13	5+650	3mL	29	0.93	1.30	1.65	1.97	450	70	139	207	270	328	378	419	700	3.70
14	5+700	3mR	29	0.36	0.51	0.66	0.78	450	69	138	203	266	324	376	421	703	3.75
15	5+750	3mL	30	0.35	0.55	0.64	0.76	450	55	109	162	213	263	311	358	606	4.75
16	5+800	3mR	31	0.71	1.00	1.28	1.52	450	89	180	269	351	421	477	513	835	2.80
17	5+850	3mL	31	1.10	1.55	1.97	2.38	450	40	84	130	176	221	262	298	508	5.67
18	5+900	3mR	31	0.83	1.18	1.50	1.81	450	72	145	215	281	342	395	440	731	3.53
19	5+950	3mL	31	1.04	1.45	1.83	2.18	450	70	141	210	276	337	391	438	728	3.61
20	6+000	3mR	31	0.92	1.27	1.58	1.86	450	75	148	218	284	343	394	437	727	3.47
21	6+050	3mL	32	0.99	1.34	1.67	1.98	450	75	150	222	290	351	403	443	736	3.45
22	6+100	3mR	34	0.86	1.19	1.48	1.72	450	55	115	178	241	303	361	412	690	4.14
23	6+150	3mL	34	1.10	1.48	1.82	2.14	450	50	97	143	188	233	276	---	530	5.40
24	6+200	3mR	34	0.98	1.33	1.65	1.92	450	62	128	196	263	325	379	423	706	3.80
25	6+250	3mL	34	1.04	1.40	1.73	2.03	450	86	170	251	326	392	448	491	805	3.00
26	6+300	3mR	34	0.82	1.14	1.43	1.70	450	84	169	249	321	379	419	---	777	3.00
27	6+350	3mL	34	0.98	1.35	1.70	2.03	450	71	144	216	284	346	399	439	730	3.50
28	6+400	3mR	34	1.05	1.43	1.78	2.09	450	72	142	211	279	349	422	---	781	3.60
29	6+450	3mL	34	1.20	1.61	1.98	2.31	450	72	142	208	271	328	381	428	713	3.67
30	6+500	3mR	34	1.24	1.74	2.19	2.61	450	72	137	195	250	305	361	421	704	4.00
31	6+550	3mL	34	1.31	1.83	2.29	2.72	450	65	123	175	221	263	300	334	568	4.69
32	6+600	3mR	34	1.09	1.54	1.98	2.43	450	71	136	195	253	310	370	434	722	3.95

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+122 - 6+570 230 AC + 630 B + 430 SB
 6+570 - 6+720 230 AC + 230 B + 740 SB

Subgrade: Low to high plasticity clay (CL, CH). Stiff, grey and red, layered (varved) clay.

Data Analysis:

n = 32
 Average Plate Ps = 706 kN
 Average HWD Deflection at 250 kN = 1.90 mm
 Average HWD Test Temperature = 30.5 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.949
 Temperature Corrected HWD Deflection at 250 kN = 1.80 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: TORONTO ISLAND

Runway: 06-24

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data										July 9/10	
No	Station		Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN)	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN	
25	5+050	3mL	23	1.21	1.94	2.65*	3.35*		450	46	90	133	174	212	249	283	483	6.00	
26	5+100	3mR	23	1.66	2.60	3.53*	4.44*		450	28	59	90	120	148	173	192	323	10.00	
27	5+150	2mR	23	1.88	2.88	3.90*	4.90*		450	25	50	74	97	119	141	161	265	11.94	
28	5+200	2mL	24	1.55	2.38	3.24*	4.15*		450	32	63	91	117	142	165	187	313	10.31	
29	5+250	2mL	24	1.49	2.32	3.18*	4.00*		450	27	56	85	115	144	172	198	334	9.38	
30	5+300	2mR	24	1.43	2.16	2.93*	3.67*		450	33	64	93	121	148	174	200	337	9.00	
31	5+350	2mL	25	1.80	2.73	3.70*	4.65*		450	27	51	74	96	116	136	155	255	11.81	
32	5+400	2mR	24	1.57	2.37	3.26*	4.10*		450	24	48	72	96	120	142	164	271	11.25	
33	5+450	2mL	25	1.47	2.25	3.00*	3.76*		450	22	45	69	94	119	146	173	288	9.56	
34	5+500	2mR	25	1.55	2.39	3.22*	4.06*		450	26	53	80	108	135	162	188	316	9.50	
35	5+550	2mL	25	1.18	1.75	2.38*	3.00*		450	42	82	122	161	200	240	281	479	6.25	
36	5+600	2mR	26	1.26	1.87	2.54*	3.18*		450	31	62	94	126	158	188	217	369	8.19	
37	5+650	3mL	26	1.35	1.98	2.70*	3.35*		450	36	72	109	144	179	212	243	414	7.22	
38	5+700	2mR	26	2.44	3.35*	4.46*	5.60*		450	24	45	64	81	98	114	131	208	13.70	
39	5+750	2mL	26	1.35	1.99	2.70*	3.38*		450	51	99	144	186	225	259	289	493	5.72	
40	5+800	2mR	26	1.60	2.32	3.23*	4.05*		450	34	69	105	140	174	205	233	397	7.69	

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase WBM - Water Bound Macadam
 Thicknesses in millimetres
 Station 5+000 - 5+808 65 AC + 180 WBM
 5+808 - 5+895 90 AC + 230 WBM + 305 SB

Subgrade: Poorly graded gravel to sand (GP,SP)

Data Analysis:

n = 16
 Average Plate Ps = 347 kN
 Average HWD Deflection at 250 kN = 3.98 mm
 Average HWD Test Temperature = 24.7 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.972
 Temperature Corrected HWD Deflection at 250 kN = 3.87 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: TORONTO ISLAND

Runway: 08-26

Year of Testing: 1992

Location			HWD Test Data				Sept 15		Plate Load Test Data							July 6/7	
No	Station		Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Load (kN) @ 250	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	5+050	3mL	20	0.62	0.90	1.17	1.45	750	104	207	306	---	---	---	---	623	----
2	5+100	3mR	20	0.61	0.88	1.15	1.42	750	92	187	279	364	---	---	---	588	----
3	5+150	3mL	19	0.64	0.93	1.20	1.49	750	84	172	260	340	409	---	---	557	----
4	5+200	3mR	20	0.67	0.98	1.27	1.56	600	85	170	253	331	---	---	---	668	----
5	5+250	3mL	20	0.37	0.56	0.74	0.91	600	83	171	259	344	---	---	---	692	----
6	5+300	3mR	20	0.64	0.95	1.29	1.62	600	78	154	225	293	356	---	---	602	----
7	5+350	3mL	20	0.64	0.92	1.19	1.45	600	106	210	314	---	---	---	---	793	----
8	5+400	3mR	21	0.72	1.04	1.38	1.74	600	87	178	267	351	---	---	---	703	----
9	5+450	3mL	20	0.66	0.97	1.30	1.65	600	84	175	266	351	---	---	---	703	----
10	5+500	3mR	20	0.65	0.94	1.26	1.61	450	79	159	238	314	---	---	---	804	3.81
11	5+550	3mL	20	0.75	1.10	1.47	1.85	450	87	178	262	332	376	---	---	802	2.83
12	5+600	3mR	20	0.98	1.43	1.90	2.37	450	69	143	217	283	337	371	---	697	3.50
13	5+650	3mL	21	0.74	1.07	1.42	1.79	450	79	156	230	300	364	---	---	779	3.70
14	5+700	3mR	21	0.74	1.08	1.44	1.84	450	68	142	217	283	335	365	---	687	3.50
15	5+750	3mL	21	0.81	1.20	1.63	2.09	450	66	135	203	265	318	357	---	673	3.73
16	5+800	3mR	21	0.74	1.07	1.42	1.78	450	80	166	247	317	366	---	---	784	3.06
17	5+850	3mL	21	0.76	1.11	1.48	1.86	450	65	137	210	277	333	---	---	721	3.73
18	5+900	3mR	22	0.74	1.08	1.45	1.83	450	78	161	241	311	363	---	---	778	3.17
19	5+950	3mL	22	0.76	1.12	1.51	1.90	450	61	126	191	254	308	352	---	665	3.95
20	6+000	3mR	22	0.78	1.16	1.57	2.00	450	64	126	187	246	302	354	---	668	4.07
21	6+050	3mL	22	0.73	1.08	1.45	1.84	450	74	151	226	291	341	---	---	737	3.36
22	6+100	3mR	22	0.68	1.00	1.35	1.71	450	71	145	220	293	359	---	---	770	3.41
23	6+150	3mL	22	0.67	0.97	1.29	1.62	450	68	140	212	281	342	---	---	737	3.55
24	6+200	3mR	22	0.65	0.96	1.27	1.57	450	77	159	240	316	382	---	---	813	3.15

Runway Nominal Construction:

AC - Asphaltic Concrete	B - Crushed Base	SB - Subbase	WBM - Water Bound Macadam
Thicknesses in millimetres			
Station 5+000 - 5+290	75 AC + 150 B + 90 AC + 230 B + 305 SB		
5+290 - 5+351	130 AC + 180 WBM		
5+351 - 6+219	90 AC + 230 B + 305 SB		

Subgrade: Poorly graded gravel to sand (GP,SP)

Data Analysis:

n = 24
 Average Plate Ps = 710 kN
 Average HWD Deflection at 250 kN = 1.71 mm
 Average HWD Test Temperature = 20.8 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.002
 Temperature Corrected HWD Deflection at 250 kN = 1.71 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: TORONTO ISLAND

Runway: 15-33

Year of Testing: 1992

Location			HWD Test Data				Sept 15		Plate Load Test Data							July 8		
No	Station		Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN)	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
42	5+050	3mL	24	1.03	1.56	2.06	2.58*		450	52	104	157	209	260	309	356	603	4.78
43	5+100	2mR	25	1.27	2.01	2.68	3.40*		450	54	103	147	188	225	262	297	507	5.67
44	5+150	2mL	25	1.08	1.68	2.29	2.88*		450	50	102	155	208	259	306	349	592	4.78
45	5+200	3mR	25	0.60	0.89	1.19	1.50*		450	57	117	179	243	307	369	---	694	4.09
46	5+250	3mL	25	0.77	1.19	1.64	2.06*		450	54	108	163	217	269	320	367	621	4.61
47	5+300	2mR	25	1.09	1.72	2.30	2.88*		450	48	98	150	201	249	293	332	564	5.00
48	5+350	2mL	25	1.10	1.79	2.43	3.10*		450	47	97	149	200	248	290	325	553	5.00
49	5+400	2mR	24	1.26	2.01	2.68	3.40*		450	45	93	141	188	232	271	303	517	5.47
50	5+450	2mL	24	1.39	2.27	2.90	3.90*		450	43	83	122	158	192	222	249	425	7.06
51	5+500	2mR	25	1.28	2.05	2.76	3.45*		450	37	78	119	161	200	237	268	458	6.39
52	5+550	2mL	25	0.98	1.58	2.17	2.75*		450	58	116	173	226	274	315	347	589	4.50
53	5+600	2mR	24	1.40	2.32	2.77	3.88*		450	39	77	115	151	184	216	243	415	7.25
54	5+650	2mL	24	1.22	1.99	2.75	3.48*		450	49	98	146	191	232	266	294	502	5.50
55	5+700	2mR	25	1.20	1.92	2.63	3.30*		450	41	86	131	175	216	251	279	477	5.94
56	5+750	2mL	25	1.07	1.74	2.39	3.01*		450	48	97	147	194	239	279	313	534	5.25
57	5+800	2mR	25	1.22	2.01	2.78	3.50*		450	38	79	122	166	208	248	284	485	6.00
58	5+850	2mL	24	1.08	1.72	2.35	3.00*		450	48	98	148	196	240	279	310	528	5.26
59	5+900	2mR	25	1.12	1.80	2.48	3.15*		450	42	87	132	178	221	260	293	500	5.72

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase WBM - Water Bound Macadam
 Thicknesses in millimetres
 Station 5+000 - 5+914 65 AC + 180 WBM

Subgrade: Poorly graded gravel to sand (GP,SP)

Data Analysis:

n = 18

Average Plate Ps = 531 kN

Average HWD Deflection at 250 kN = 3.07 mm

Average HWD Test Temperature = 24.7 Deg Celsius

Average HWD Deflection Temperature Correction Factor = 0.972

Temperature Corrected HWD Deflection at 250 kN = 2.98 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: TORONTO INT'L

Runway: 06L-24R

Year of Testing: 1992

Location		HWD Test Data						Plate Load Test Data							July 10/11		
No	Station	Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN)	Plate (mm)	Load (kN) 1	Load (kN) 2	Load (kN) 3	Load (kN) 4	Load (kN) 5	Load (kN) 6	Load (kN) 7	Ps (kN)	Def @ 250 kN
1	6+500 2mL	21	0.24	0.35	0.46	0.57		450	91	182	272	361	448	---	---	929	2.75
2	6+600 3mR	21	0.19	0.28	0.38	0.47		450	76	151	224	296	368	442	518	841	3.33
3	6+700 3mL	20	0.22	0.33	0.44	0.54		450	78	155	231	307	382	456	529	857	3.25
4	6+800 3mR	20	0.18	0.27	0.36	0.45		450	96	189	281	373	466	---	---	958	2.65
5	6+900 3mL	21	0.24	0.36	0.48	0.59		450	87	174	261	348	434	521	---	933	2.90
6	7+100 3mR	21	0.22	0.33	0.43	0.54		450	66	132	198	263	328	393	457	756	3.78
7	7+200 3mL	21	0.23	0.35	0.46	0.57		450	90	178	264	351	438	---	---	912	2.83
8	7+300 3mR	21	0.17	0.26	0.35	0.43		450	77	154	231	308	385	462	538	869	3.28
9	7+400 3mL	21	0.15	0.23	0.31	0.38		450	108	214	321	432	---	---	---	1041	2.35
10	7+500 3mR	21	0.18	0.27	0.37	0.46		450	89	176	263	349	436	---	---	907	2.85
11	7+650 3mL	21	0.15	0.23	0.31	0.38		450	84	169	252	334	414	491	---	888	2.94
12	7+750 3mR	21	0.27	0.40	0.52	0.64		450	78	153	229	305	383	464	---	847	3.28
13	7+850 2mL	21	0.19	0.28	0.38	0.47		450	120	235	348	465	---	---	---	1103	2.13
14	7+950 3mR	21	0.24	0.36	0.47	0.58		450	75	151	227	303	379	454	---	832	3.26
15	8+050 2mL	21	0.20	0.31	0.41	0.51		450	105	206	308	414	---	---	---	1007	2.43
16	8+150 3mR	21	0.24	0.36	0.47	0.57		450	115	217	315	415	---	---	---	1010	2.33

* This data for Toronto Int'l was not included in the analysis due to the underlying PCC layer.

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase PCC - Portland Cement Concrete
 Thicknesses in millimetres
 Station 6+497 - 8+200 280 AC + 230 PCC + 400 SB

Subgrade: Sand, little silt and gravel to silty clay (SM,CL)

Data Analysis:

n = 16

Average Plate Ps = 918 kN

Average HWD Deflection at 250 kN = 0.51 mm

HWD Temperature Corrections not applied (not valid for PCC pavements).

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: VAL D'OR

Runway: 18-36

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data							July 18/19			
No	Station		Test Temp	Def. (mm) @ 100	Def. (mm) @ 150	Def. (mm) @ 200	Def. (mm) @ 250	Load (kN)	Plate (mm)	Load (kN) at 1	Load (kN) at 2	Load (kN) at 3	Load (kN) at 4	Load (kN) at 5	Load (kN) at 6	Load (kN) at 7	Ps (kN)	Def @ 250 kN
1	5+100	3mL	3	0.54	0.73	0.92	1.10	450	160	315	461	---	---	---	---	1306	1.57	
2	5+200	3mR	4	0.43	0.58	0.73	0.86	450	118	234	351	475	---	---	---	1120	2.13	
3	5+300	3mL	3	0.44	0.59	0.73	0.85	450	205	403	617	---	---	---	---	1593	1.23	
4	5+400	3mR	4	0.45	0.61	0.74	0.87	450	176	357	546	---	---	---	---	1468	1.42	
5	5+500	3mL	3	0.38	0.52	0.65	0.76	450	195	389	598	---	---	---	---	1561	1.30	
6	5+600	3mR	3	0.43	0.58	0.71	0.83	450	146	289	438	---	---	---	---	1259	1.73	
7	5+700	3mL	3	0.34	0.47	0.58	0.68	450	170	335	513	---	---	---	---	1407	1.50	
8	5+800	3mR	3	0.43	0.58	0.72	0.85	450	157	309	473	---	---	---	---	1330	1.63	
9	5+900	3mL	3	0.44	0.58	0.71	0.83	450	164	321	485	---	---	---	---	1353	1.57	
10	6+000	3mR	3	0.45	0.61	0.74	0.88	450	160	308	466	---	---	---	---	1316	1.62	
11	6+100	3mL	3	0.55	0.74	0.92	1.10	450	169	328	505	---	---	---	---	1391	1.52	
12	6+200	3mR	4	0.41	0.58	0.72	0.86	450	187	355	547	---	---	---	---	1469	1.37	
13	6+300	3mL	3	0.44	0.59	0.73	0.85	450	159	310	473	---	---	---	---	1329	1.60	
14	6+400	3mR	4	0.45	0.61	0.74	0.87	450	133	259	387	---	---	---	---	1150	1.90	
15	6+500	3mL	3	0.38	0.52	0.65	0.76	450	156	301	452	---	---	---	---	1289	1.67	
16	6+600	3mR	3	0.43	0.58	0.70	0.83	450	146	285	430	---	---	---	---	1243	1.76	

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 6+707 165 AC + 100 B + 160 SB

Subgrade: Silty sand to sandy silt (SM,ML)

Data Analysis:

n = 16
 Average Plate Ps = 1349 kN
 Average HWD Deflection at 250 kN = 0.86 mm
 Average HWD Test Temperature = 3.3 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 1.414
 Temperature Corrected HWD Deflection at 250 kN = 1.22 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: WIARTON

Runway: 05-23

Year of Testing: 1992

Location			HWD Test Data					Plate Load Test Data									
No	Station		Test Temp	Def. (mm)		@ Load (kN)		Plate (mm)	Load (kN) at Defl'n (mm) of							Ps (kN)	Def @ 250 kN
				100	150	200	250		1	2	3	4	5	6	7		
1	5+050	2mL	21	1.35	2.20	3.03*	3.85*	750	23	46	69	92	115	138	160	171	----
2	5+100	3mR	21	1.17	1.87	2.58	3.25*	750	20	40	60	79	99	118	138	145	----
3	5+150	2mL	21	1.37	2.14	2.90*	3.63*	750	34	68	101	134	166	198	230	251	----
4	5+200	3mR	21	1.58	2.53	3.40*	4.28*	750	20	40	59	77	96	115	135	142	----
5	5+250	2mL	22	1.54	2.37	3.15*	3.93*	750	29	57	84	111	138	166	193	209	----
6	5+300	3mR	22	1.20	1.86	2.50*	3.15*	750	28	56	85	112	140	168	195	211	----
7	5+350	2mL	22	1.18	1.90	2.65*	3.35*	750	29	60	93	126	159	192	224	244	----
8	5+400	3mR	22	0.91	1.46	2.04	2.55*	750	31	61	90	118	145	170	194	210	----
9	5+450	2mL	21	0.92	1.50	2.12	2.67*	750	31	61	90	118	146	175	203	220	----
10	5+500	3mR	22	0.89	1.41	1.94	2.46*	750	31	62	93	123	153	184	214	232	----
11	5+550	2mL	22	0.95	1.55	2.12	2.72*	750	32	64	95	126	157	188	220	239	----
12	5+600	3mR	22	0.68	1.14	1.62	2.09*	750	28	56	83	110	137	164	193	209	----
13	5+650	2mL	23	0.97	1.56	2.07	2.68*	750	38	76	112	149	186	225	264	289	----
14	5+700	3mR	23	1.50	2.32	3.09*	3.88*	750	24	48	70	93	116	139	164	175	----
15	5+750	4mL	23	0.80	1.31	1.77	2.25*	750	45	89	134	179	224	269	313	341	----
16	5+800	3mR	22	0.50	0.83	1.15	1.48*	750	58	112	164	216	270	326	386	416	----
17	5+850	2mL	22	0.52	0.81	1.06	1.37*	750	60	118	176	234	292	351	---	424	----
18	5+900	3mR	23	0.50	0.75	0.98	1.23*	750	64	127	190	253	319	388	---	465	----
19	5+950	2mL	23	0.41	0.63	0.84	1.05*	750	84	163	243	326	417	---	---	567	----
20	6+000	3mR	21	0.45	0.69	0.89	1.14*	750	100	194	293	405	---	---	---	644	----
21	6+050	2mL	21	0.34	0.55	0.75	0.95*	750	83	166	247	329	---	---	---	539	----
22	6+100	3mR	21	1.06	1.70	2.33*	2.94*	750	28	56	84	112	140	168	196	213	----
23	6+150	2mL	20	0.74	1.23	1.71	2.21*	750	32	63	94	125	156	187	219	238	----
24	6+200	3mR	20	1.21	1.97	2.75*	3.45*	750	25	49	73	95	118	140	163	174	----
25	6+250	2mL	20	1.46	2.28	3.08*	3.88*	750	19	40	62	84	106	129	150	160	----
26	6+300	3mR	20	1.25	2.00	2.70*	3.40*	750	29	55	80	103	126	148	171	184	----
27	6+350	2mL	20	1.24	2.00	2.72*	3.42*	750	25	50	76	101	127	154	180	194	----
28	6+400	4mR	19	1.11	1.80	2.43*	3.07*	750	29	58	86	114	143	171	199	215	----
29	6+450	2mL	19	1.20	1.93	2.62*	3.32*	750	24	47	69	92	114	137	160	170	----

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+000 - 6+500 115 AC + 255 B

Subgrade: Clayey sand to clay (SC,CL)

Data Analysis:

n = 29
 Average Plate Ps = 272 kN
 Average HWD Deflection at 250 kN = 2.75 mm
 Average HWD Test Temperature = 21.3 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.997
 Temperature Corrected HWD Deflection at 250 kN = 2.74 mm

1990 & 1992 FALLING WEIGHT DEFLECTOMETER VS PLATE LOAD DATA

Airport: YORKTON

Runway: 03-21

Year of Testing: 1990

Location			HWD Test Data July 25					Plate Load Test Data July 25								
No	Station	Test Temp	Def. (mm) @ 100	150	@ 200	Load (kN) 250	Plate Load (kN) at (mm)	1	2	3	4	5	6	7	Ps (kN)	Def @ 250 kN
1	5+100 3mL	28	2.50	3.35*	4.10*	4.75*	450	18	36	53	70	86	103	119	184	15.40
2	5+200 2mR	28	2.55	3.40*	4.10*	4.70*	450	23	45	67	88	108	127	143	231	14.70
3	5+300 3mL	28	2.40	3.20*	3.75*	4.30*	450	26	51	77	101	126	150	174	289	10.15
4	5+400 3mR	28	2.60	3.85*	5.00*	6.00*	450	16	32	47	62	78	93	109	164	16.00
5	5+500 3mL	28	2.55	3.45*	4.20*	5.00*	450	17	33	49	64	80	95	111	169	15.90
6	5+600 3mR	30	2.60	3.50*	4.25*	4.90*	450	18	35	53	70	88	104	121	188	15.20
7	5+700 3mL	30	2.50	3.80*	4.90*	5.95*	450	19	37	53	68	82	97	112	171	16.40
8	5+800 3mR	30	3.45*	4.80*	6.05*	6.95*	450	18	36	53	69	86	102	119	184	15.05
9	5+900 3mL	30	3.40*	4.75*	5.90*	7.00*	450	17	32	46	58	70	81	91	129	22.40
10	6+000 3mR	30	3.25*	4.30*	5.20*	5.90*	450	13	27	42	57	73	88	103	152	17.20
11	6+100 3mL	30	3.15*	4.30*	5.30*	6.05*	450	19	38	56	74	92	110	127	201	13.94
12	6+200 3mR	30	3.50*	4.30*	5.05*	5.75*	450	16	31	47	62	78	93	108	164	16.40
13	6+300 3mL	30	3.35*	4.45*	5.45*	6.20*	450	17	32	47	62	76	89	103	153	17.80

* Extrapolated values

Runway Nominal Construction:

AC - Asphaltic Concrete B - Crushed Base SB - Subbase
 Thicknesses in millimetres
 Station 5+095 - 6+372 90 AC + 230 B + 500 SB

Subgrade: Stiff, brown silty clay (CL) to 3m; underlain by hard till (3m+)

Data Analysis:

n = 13
 Average Plate Ps = 183 kN
 Average HWD Deflection at 250 kN = 5.65 mm
 Average HWD Test Temperature = 29.2 Deg Celsius
 Average HWD Deflection Temperature Correction Factor = 0.952
 Temperature Corrected HWD Deflection at 250 kN = 5.38 mm

APPENDIX B

INDIVIDUAL SITE PLOTS

Figure B1: Standard Plate Load vs HWD Deflection - Brandon (1990)

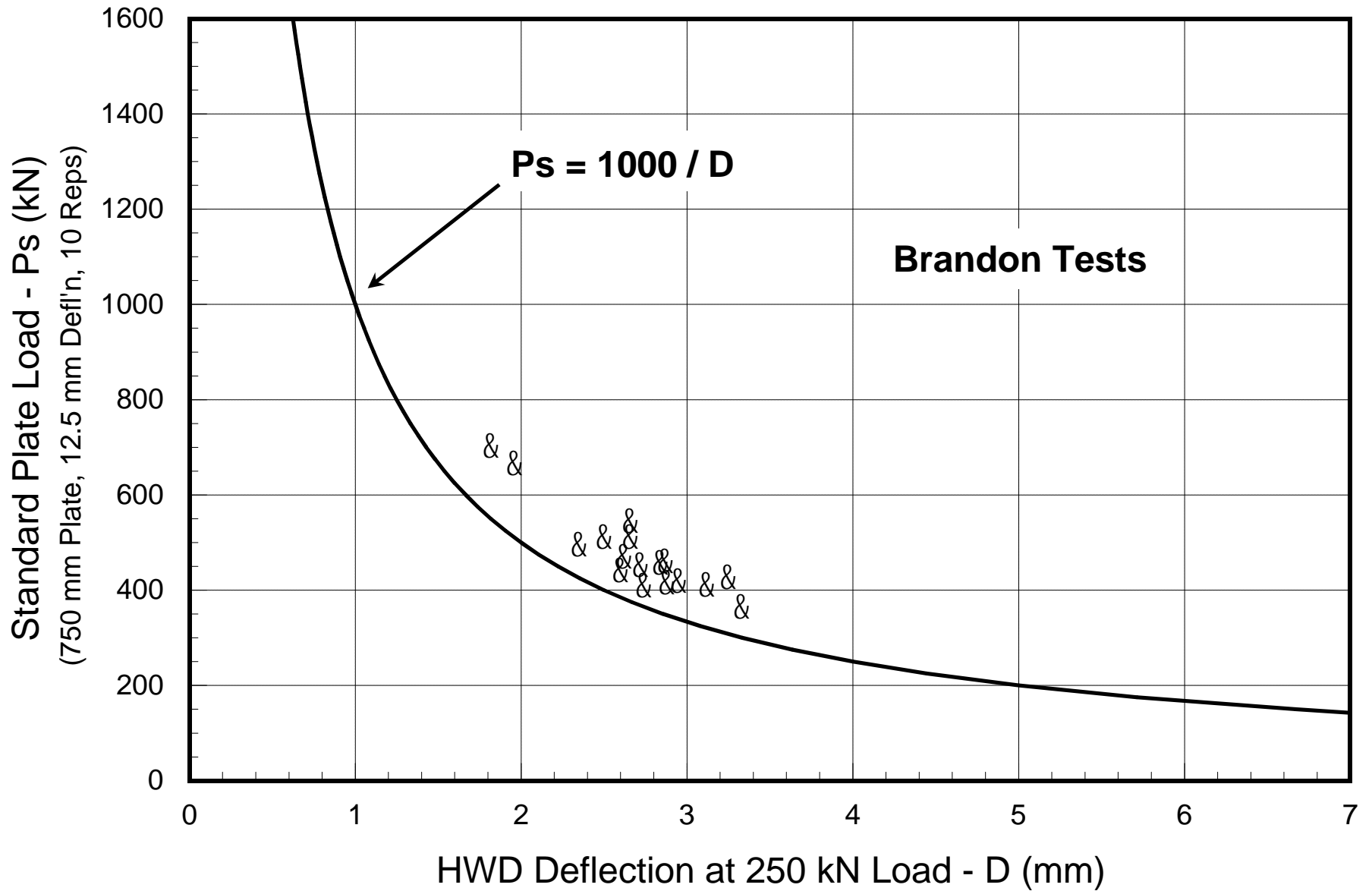


Figure B2: Standard Plate Load vs HWD Deflection - Dauphin (1990)

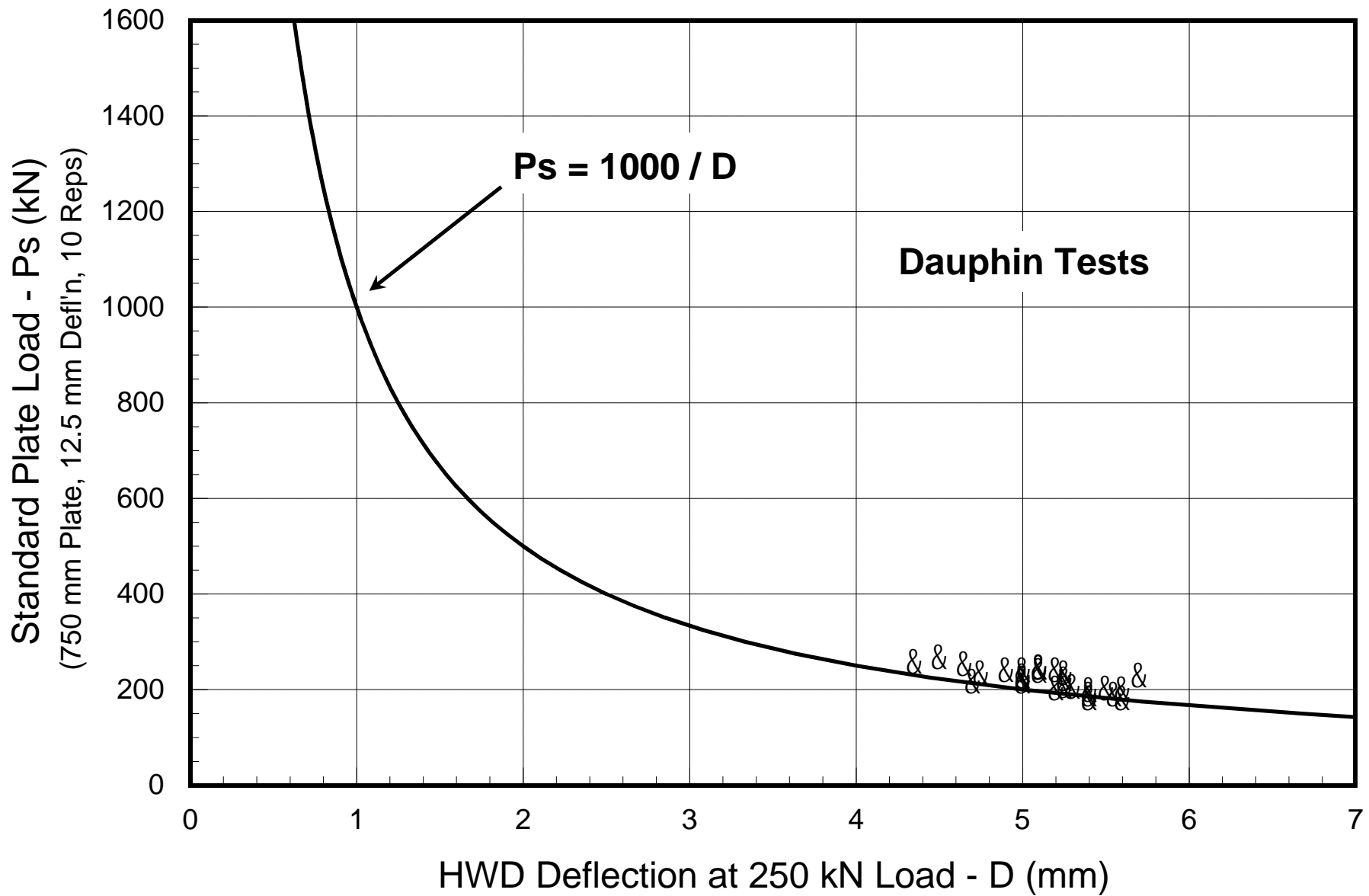


Figure B3: Standard Plate Load vs HWD Deflection - Flin Flon (1990)

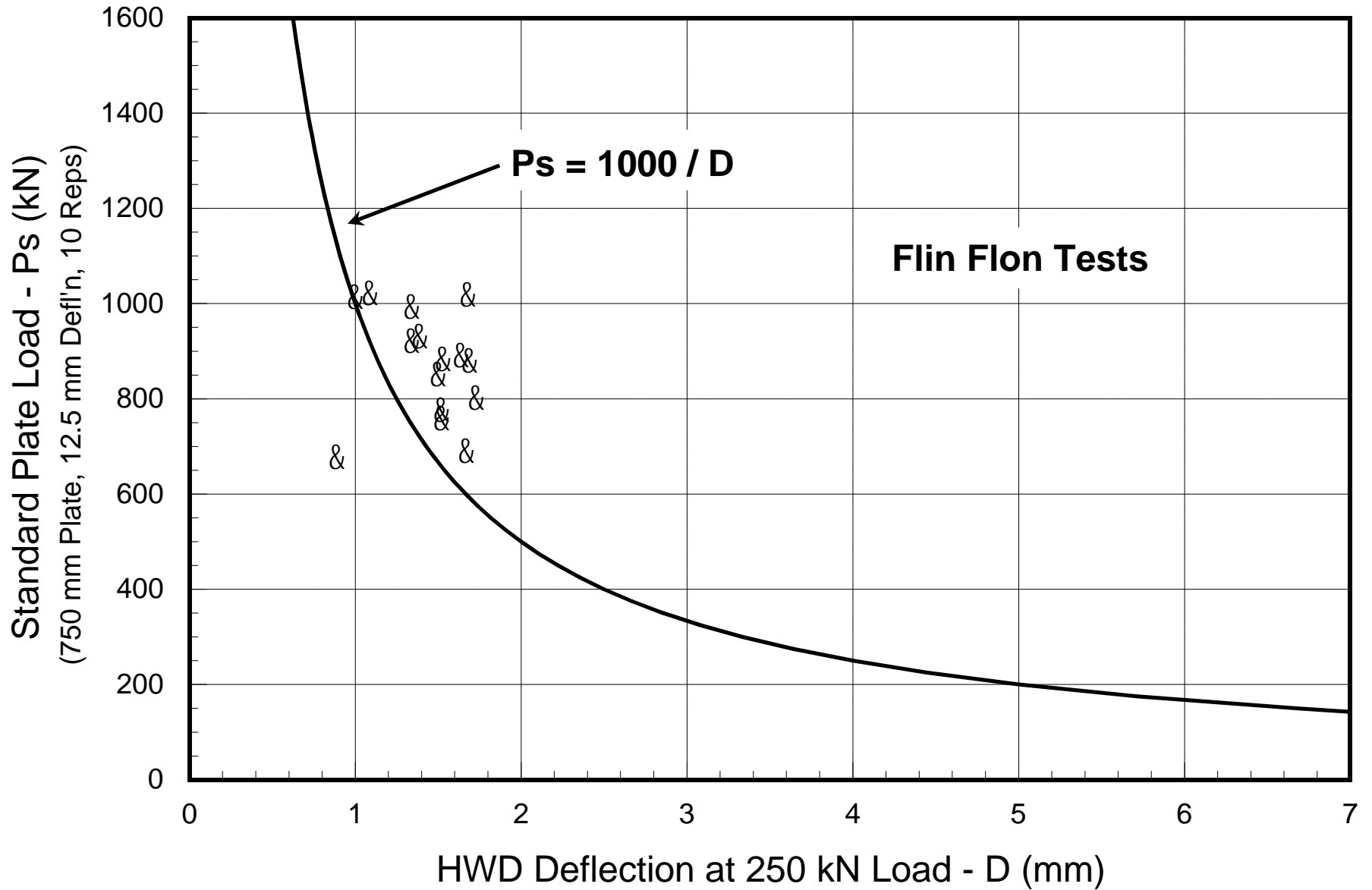


Figure B4: Standard Plate Load vs HWD Deflection - Oshawa (1992)

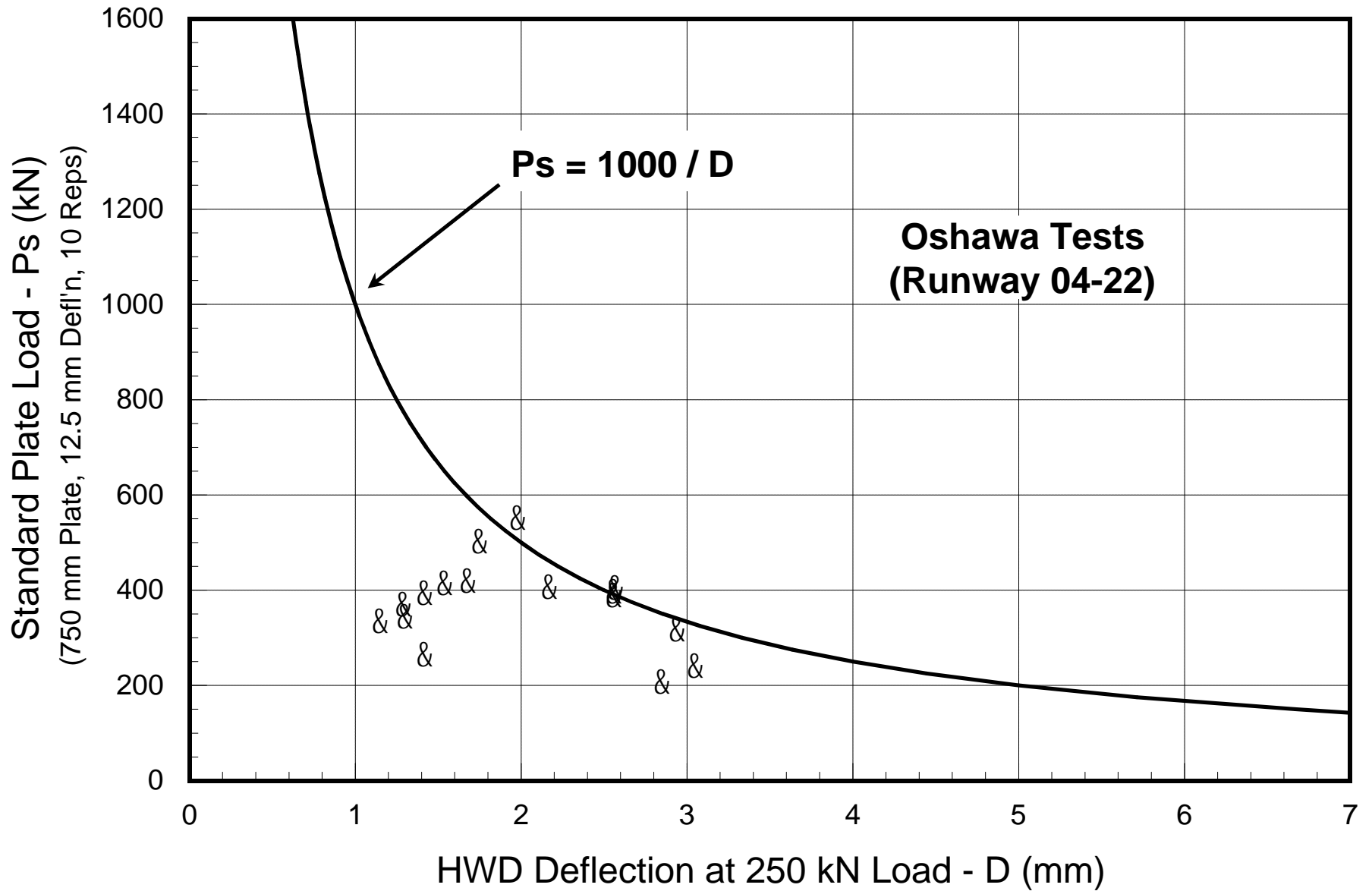


Figure B5: Standard Plate Load vs HWD Deflection - Oshawa (1992)

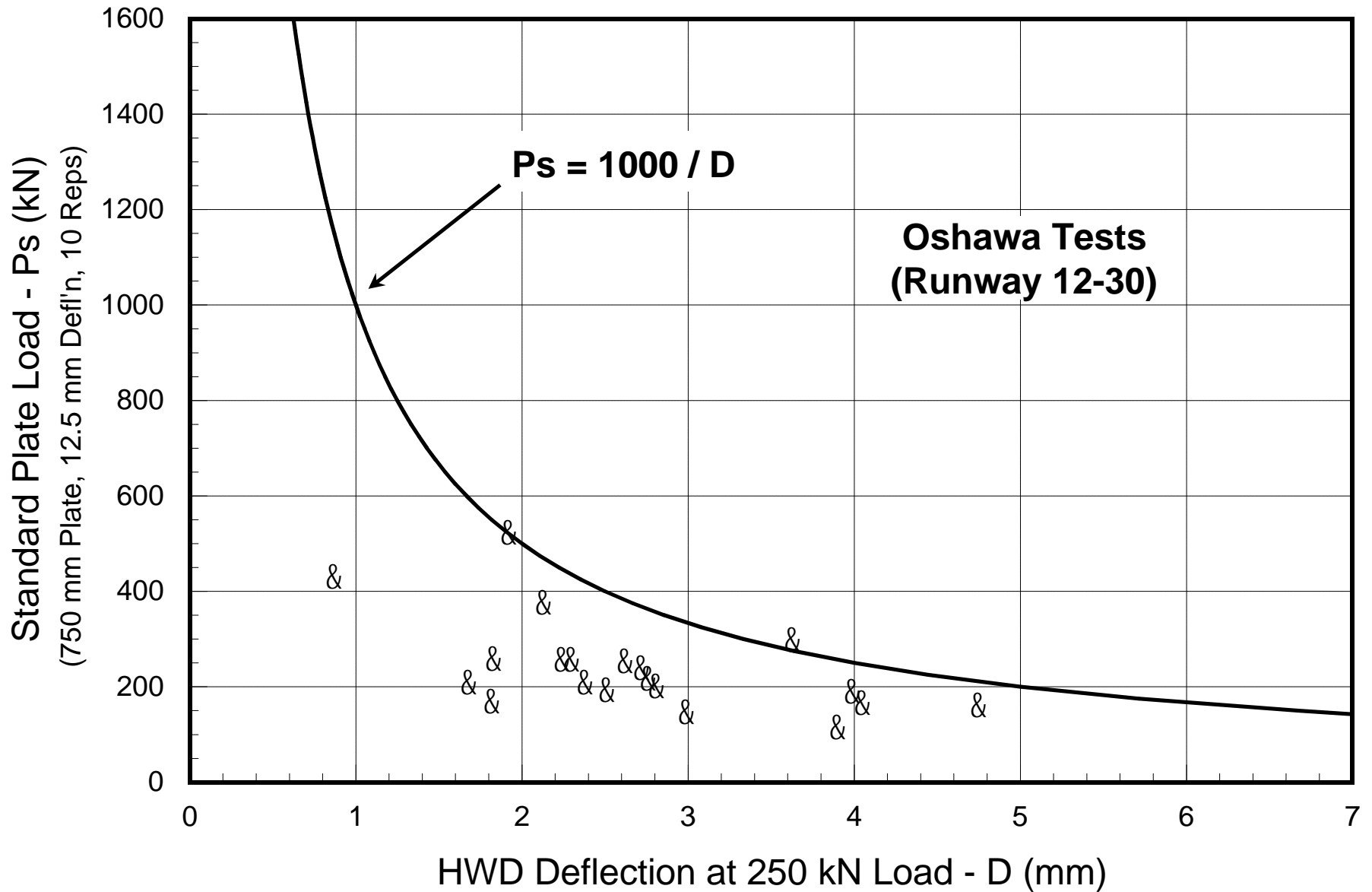


Figure B6: Standard Plate Load vs HWD Deflection - Ottawa (1992)

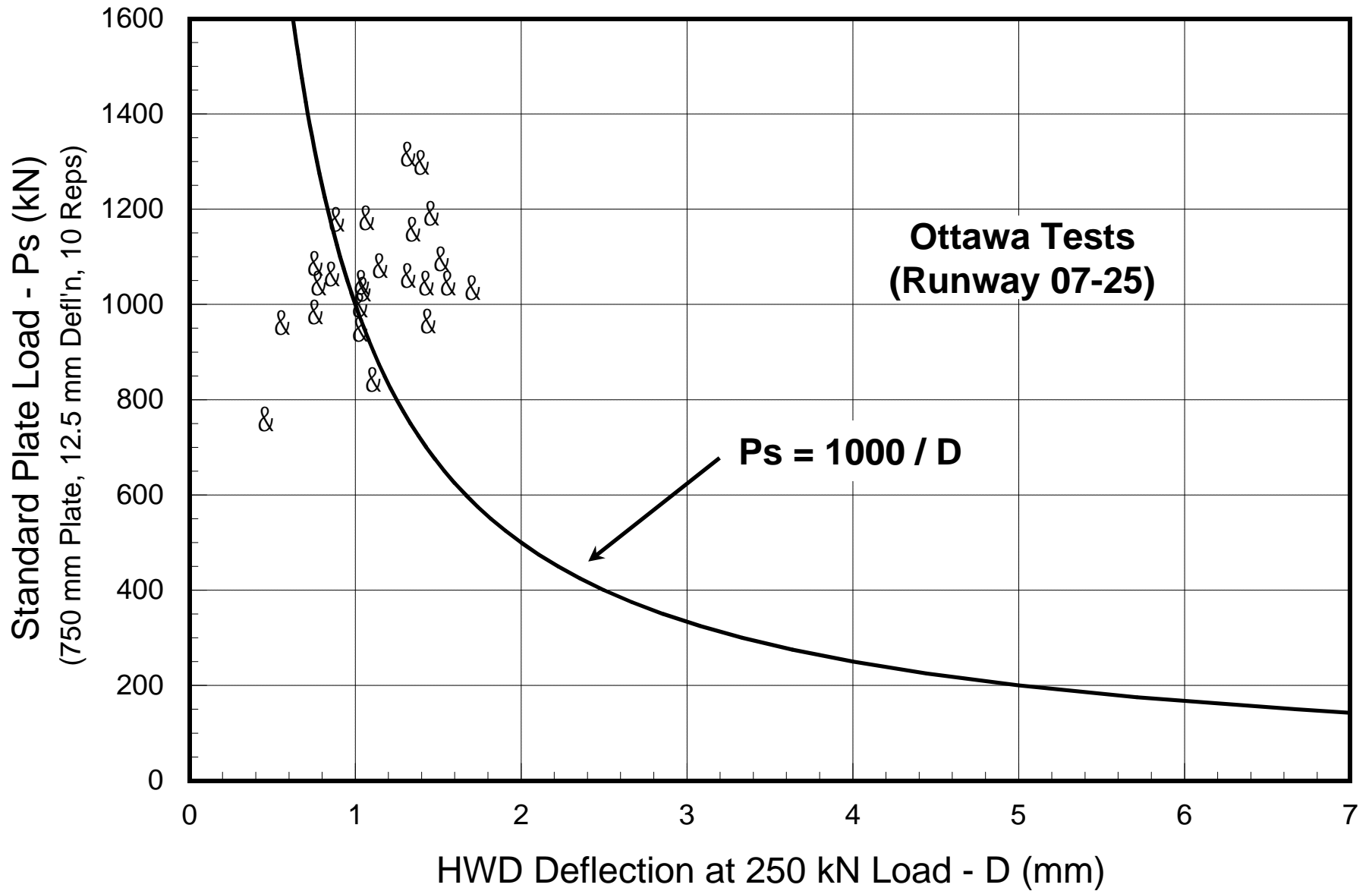


Figure B7: Standard Plate Load vs HWD Deflection - Ottawa (1992)

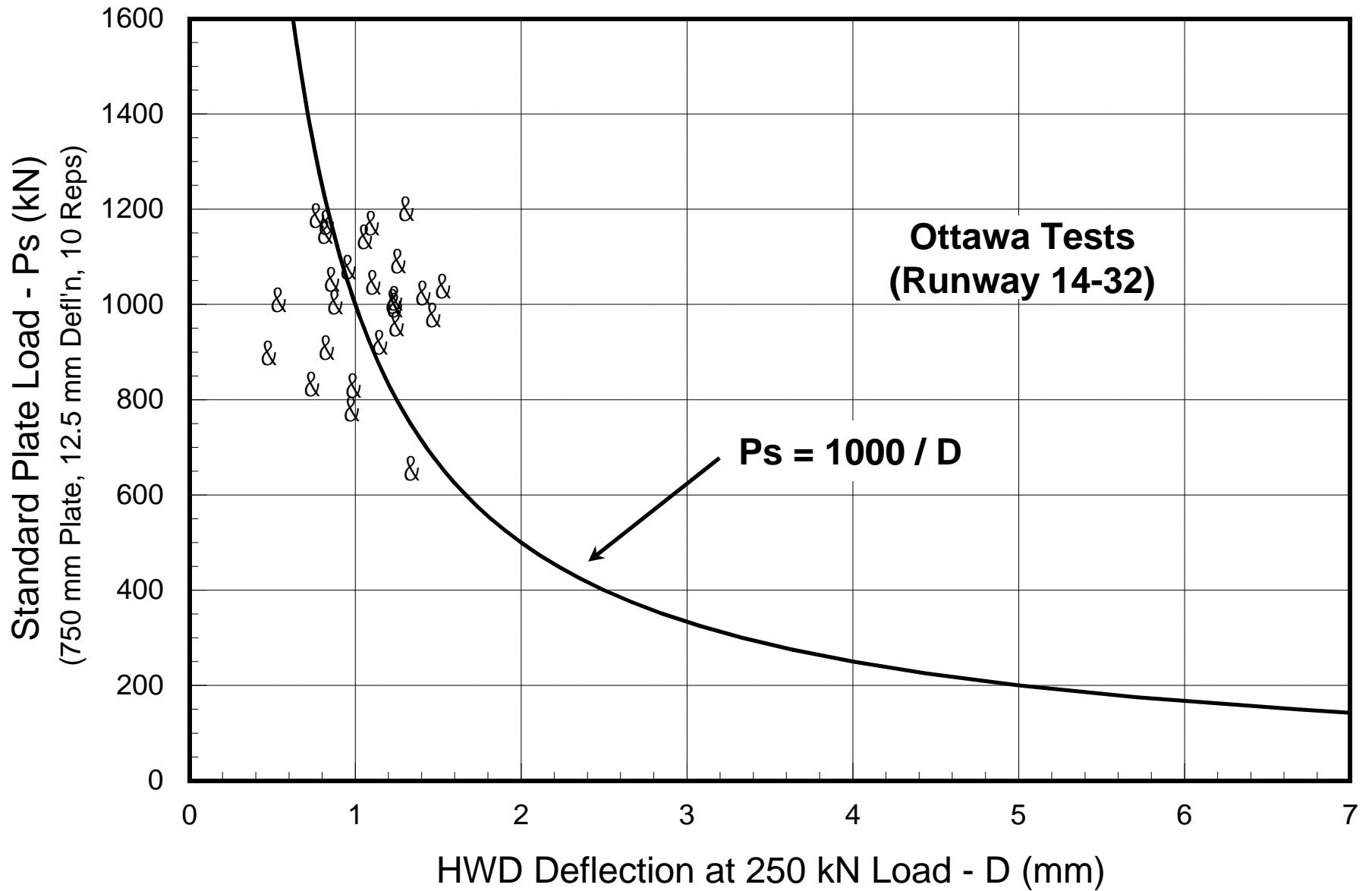


Figure B8: Standard Plate Load vs HWD Deflection - Pembroke (1992)

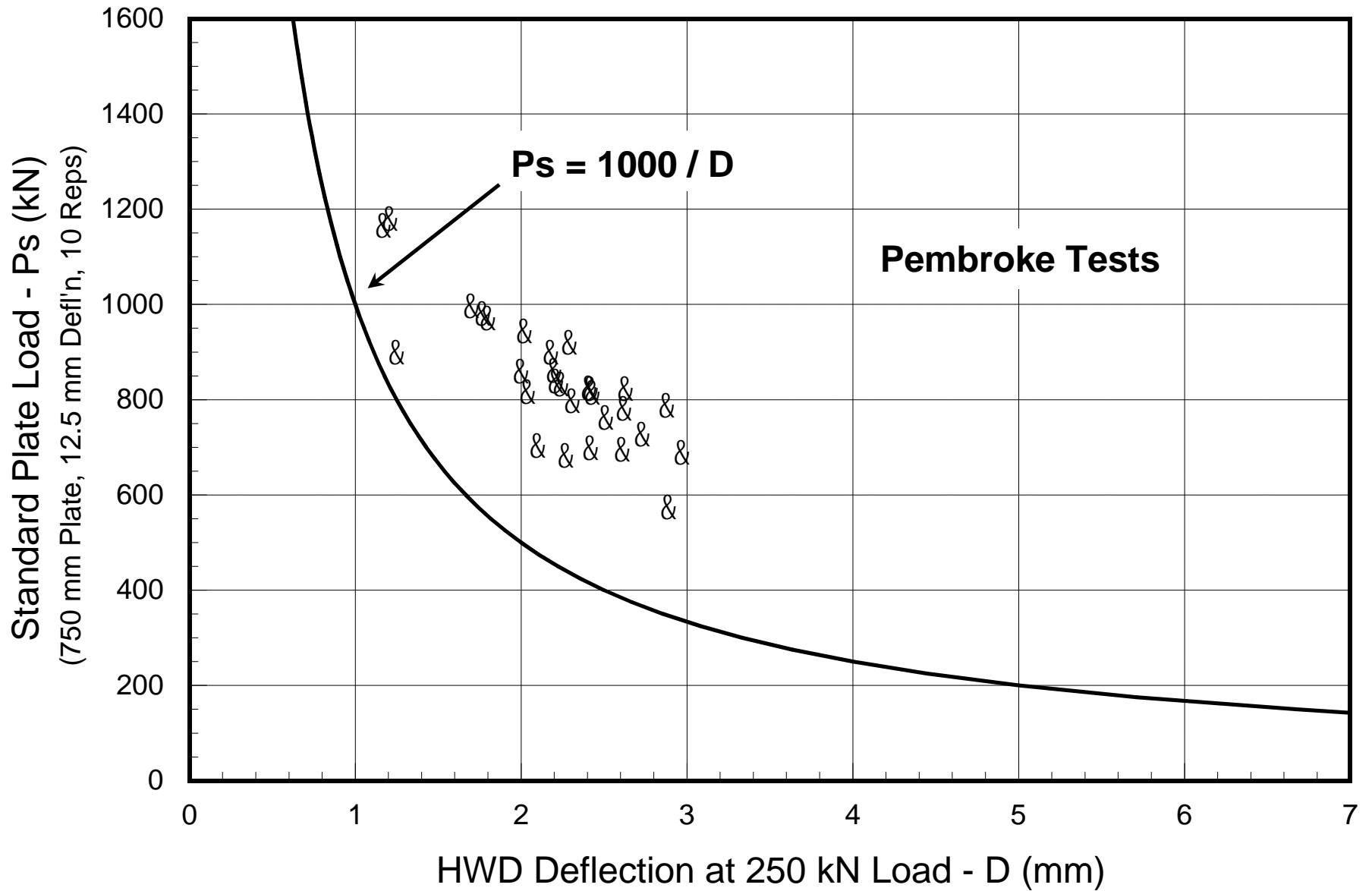


Figure B9: Standard Plate Load vs HWD Deflection - Regina (1990)

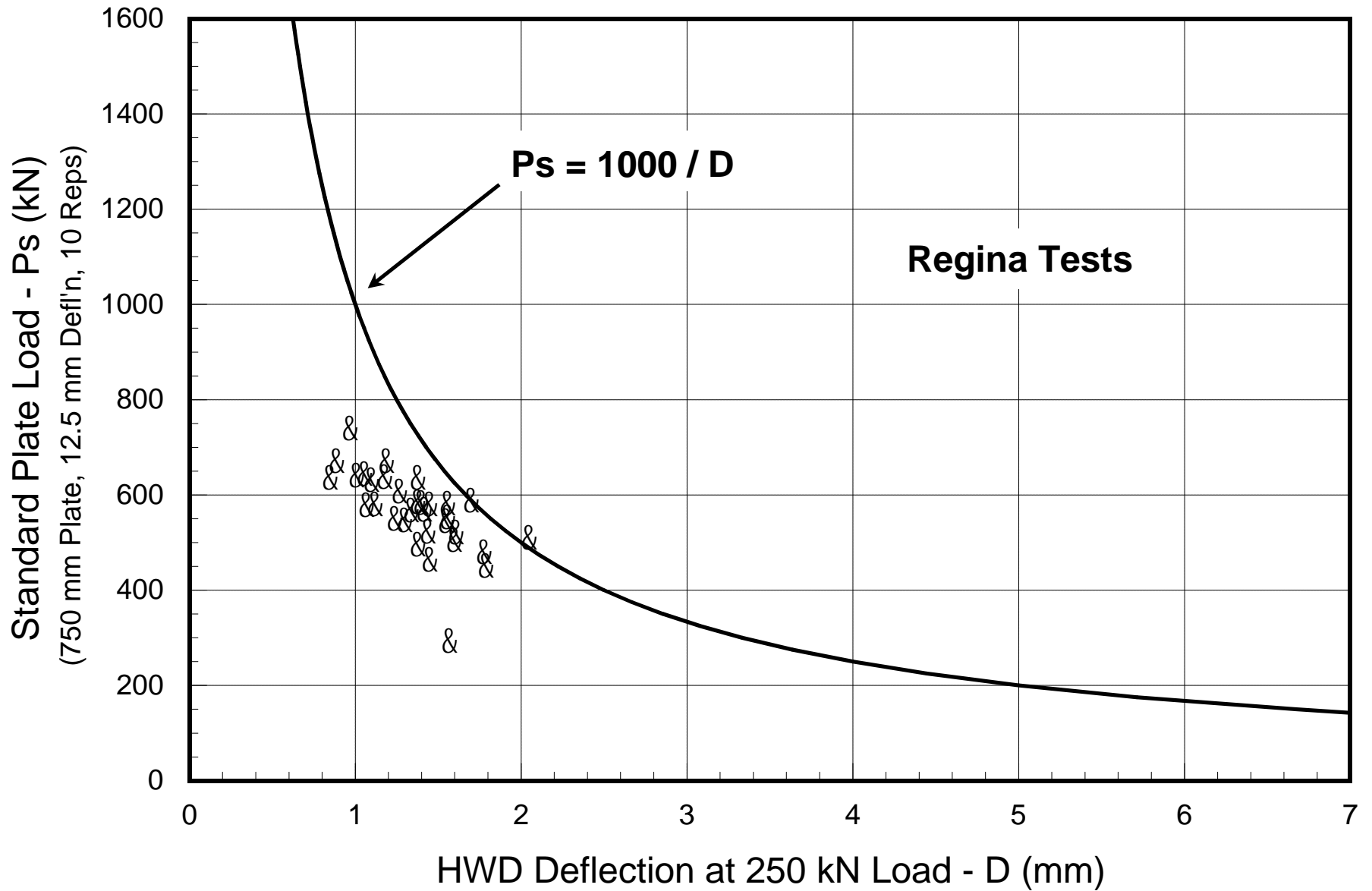


Figure B10: Standard Plate Load vs HWD Deflection - Rouyn (1992)

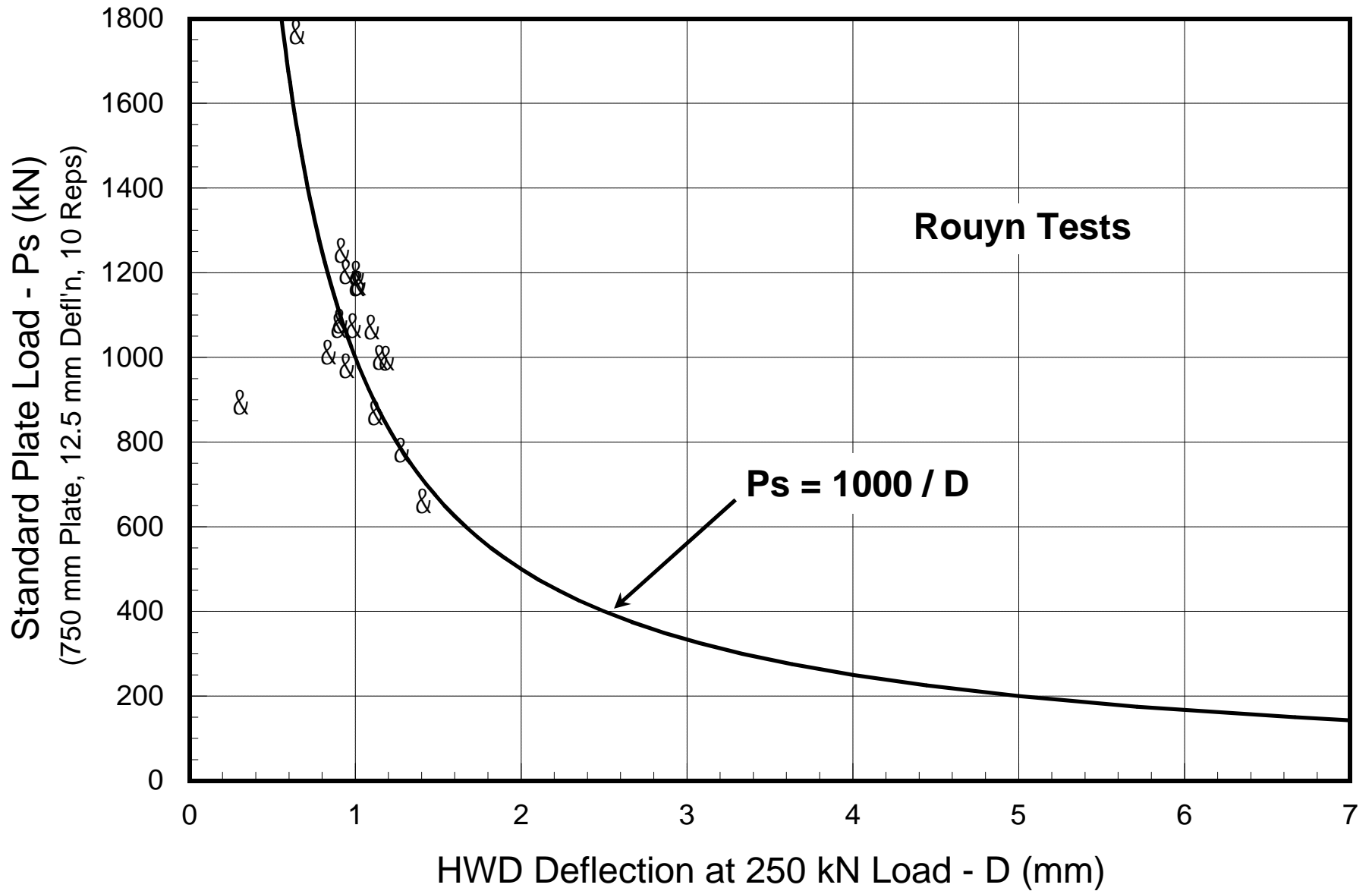


Figure B11: Standard Plate Load vs HWD Deflection - St. Catharines (1992)

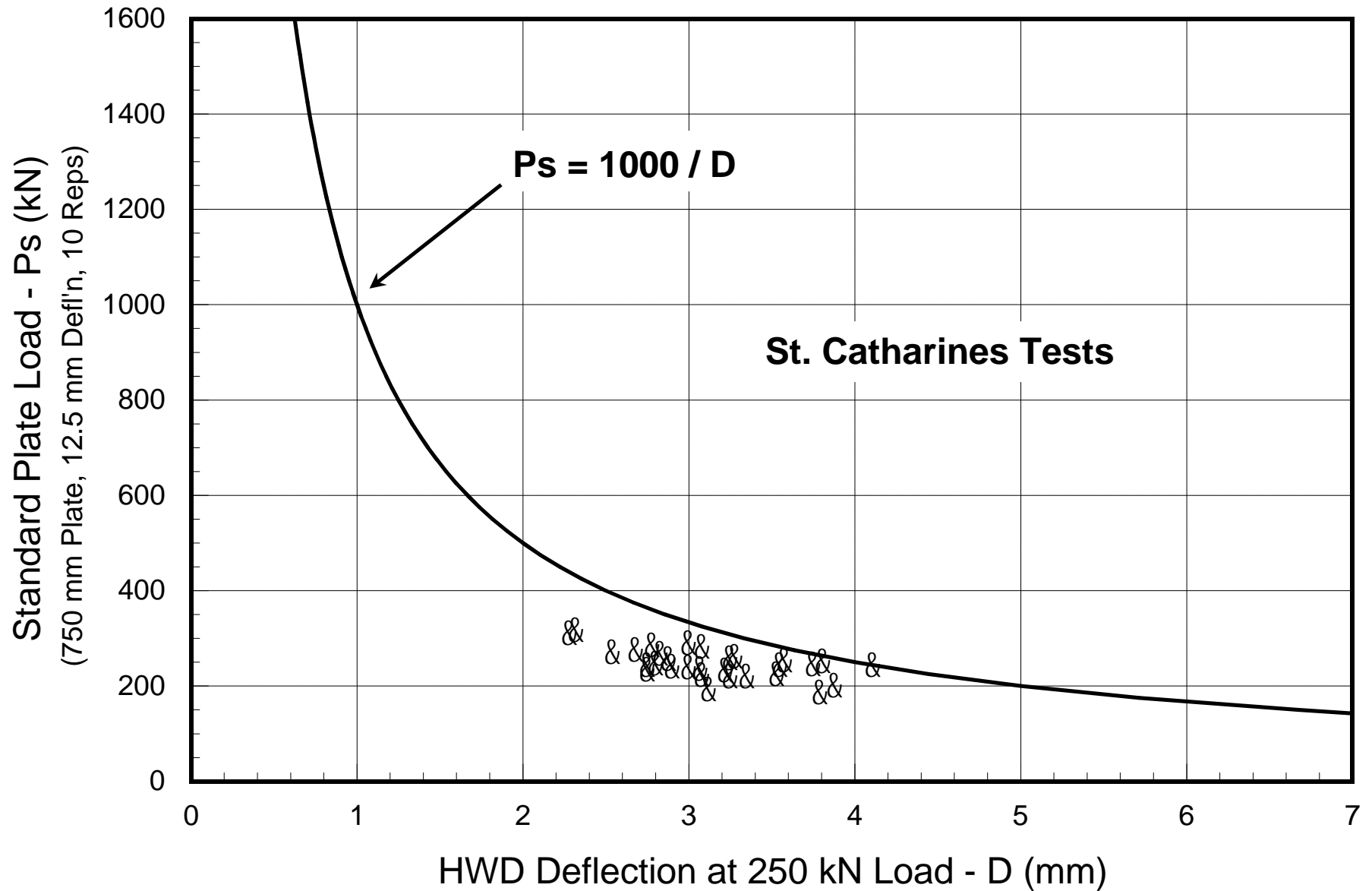


Figure B12: Standard Plate Load vs HWD Deflection - St. Hubert (1992)

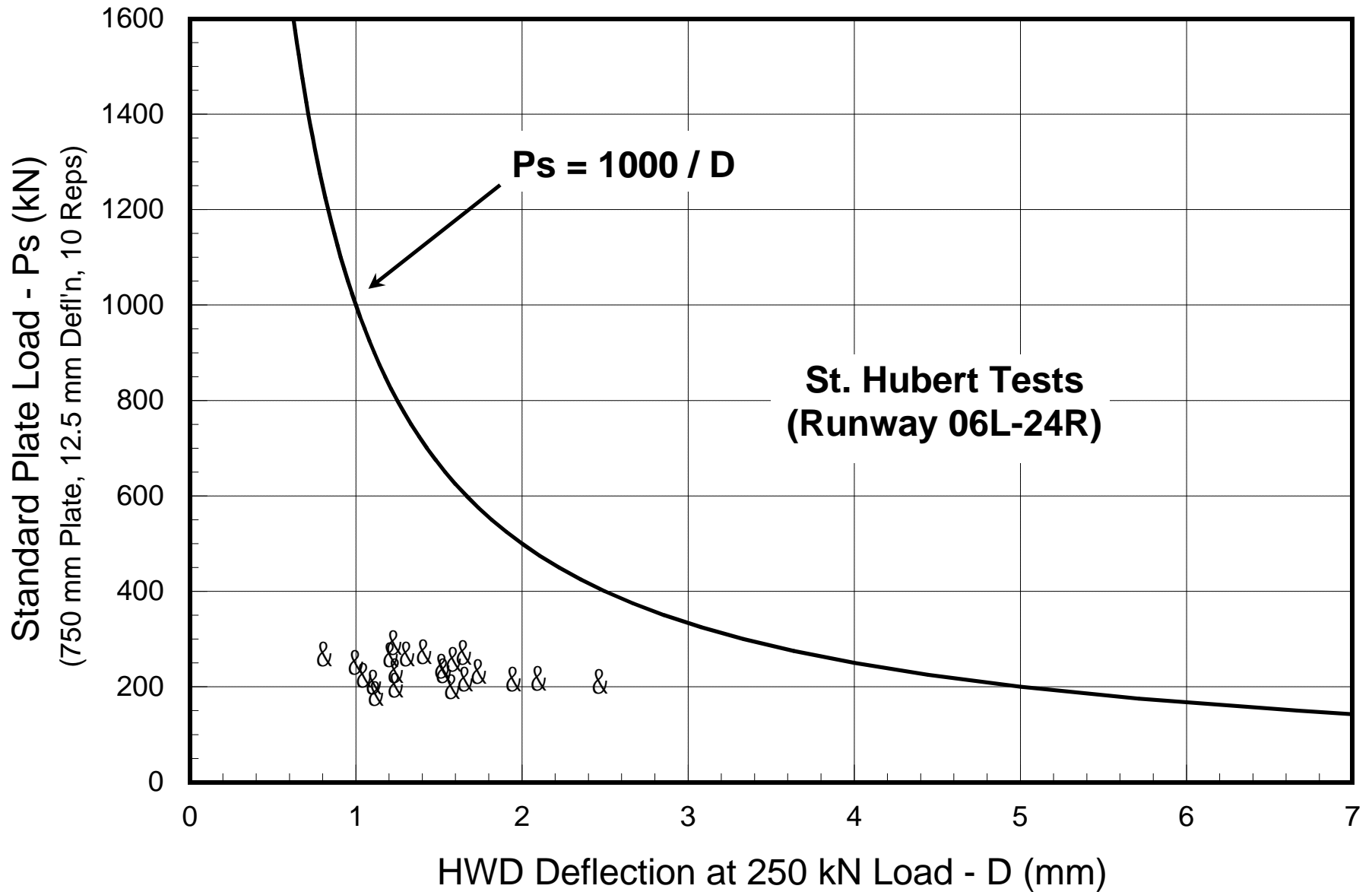


Figure B13: Standard Plate Load vs HWD Deflection - St. Hubert (1992)

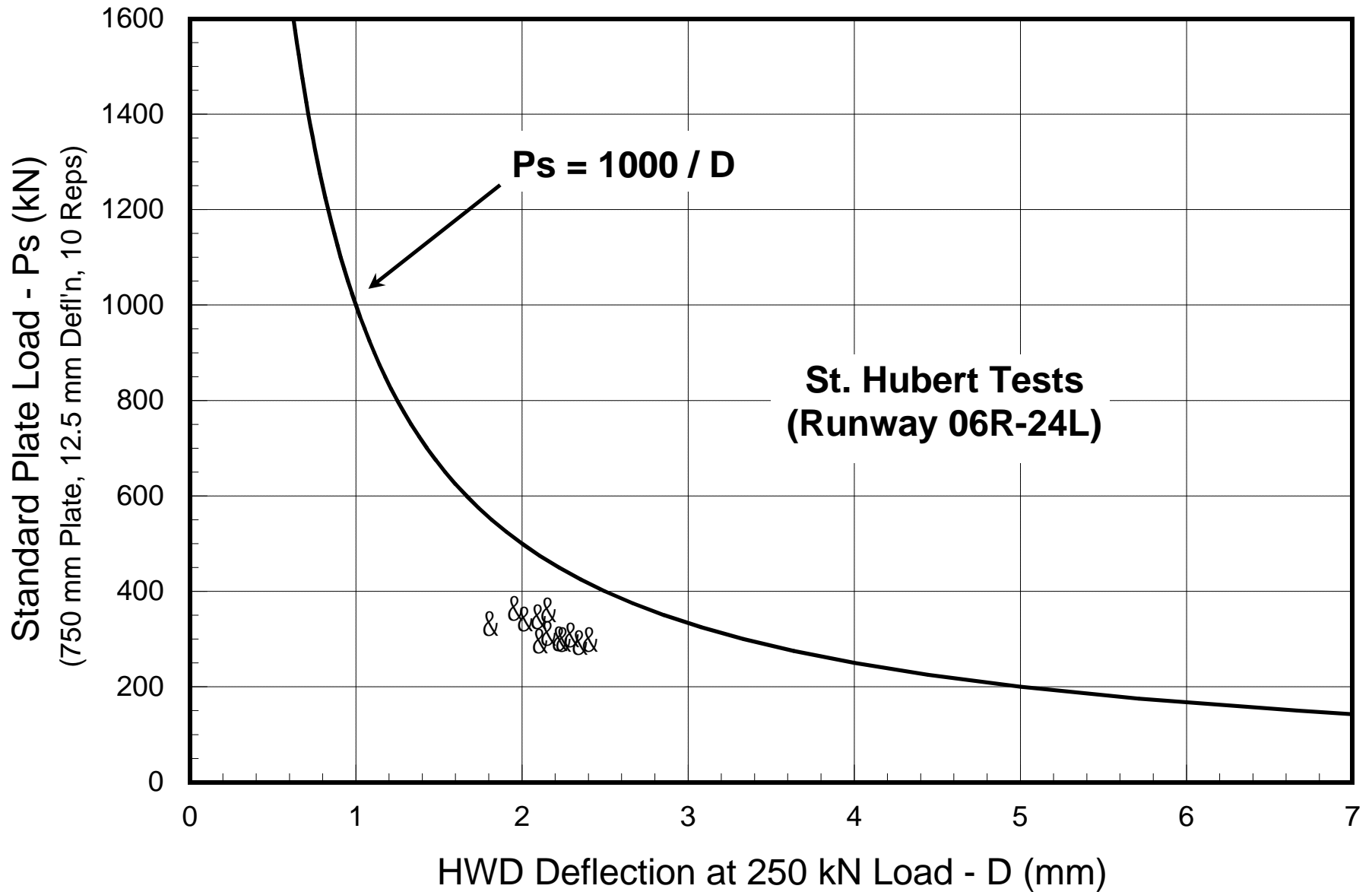


Figure B14: Standard Plate Load vs HWD Deflection - St. Hubert (1992)

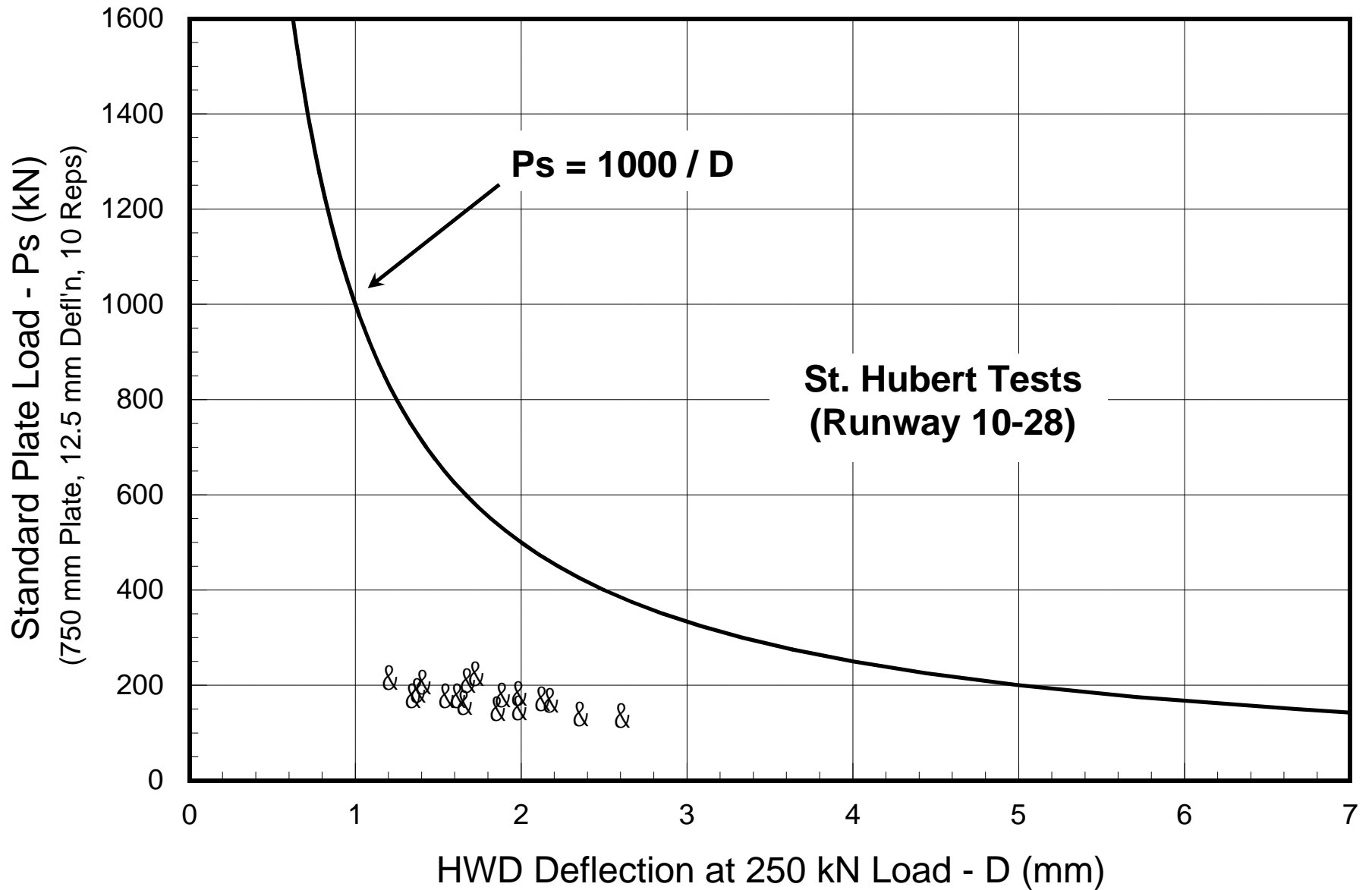


Figure B15: Standard Plate Load vs HWD Deflection - St. Hubert (1992)

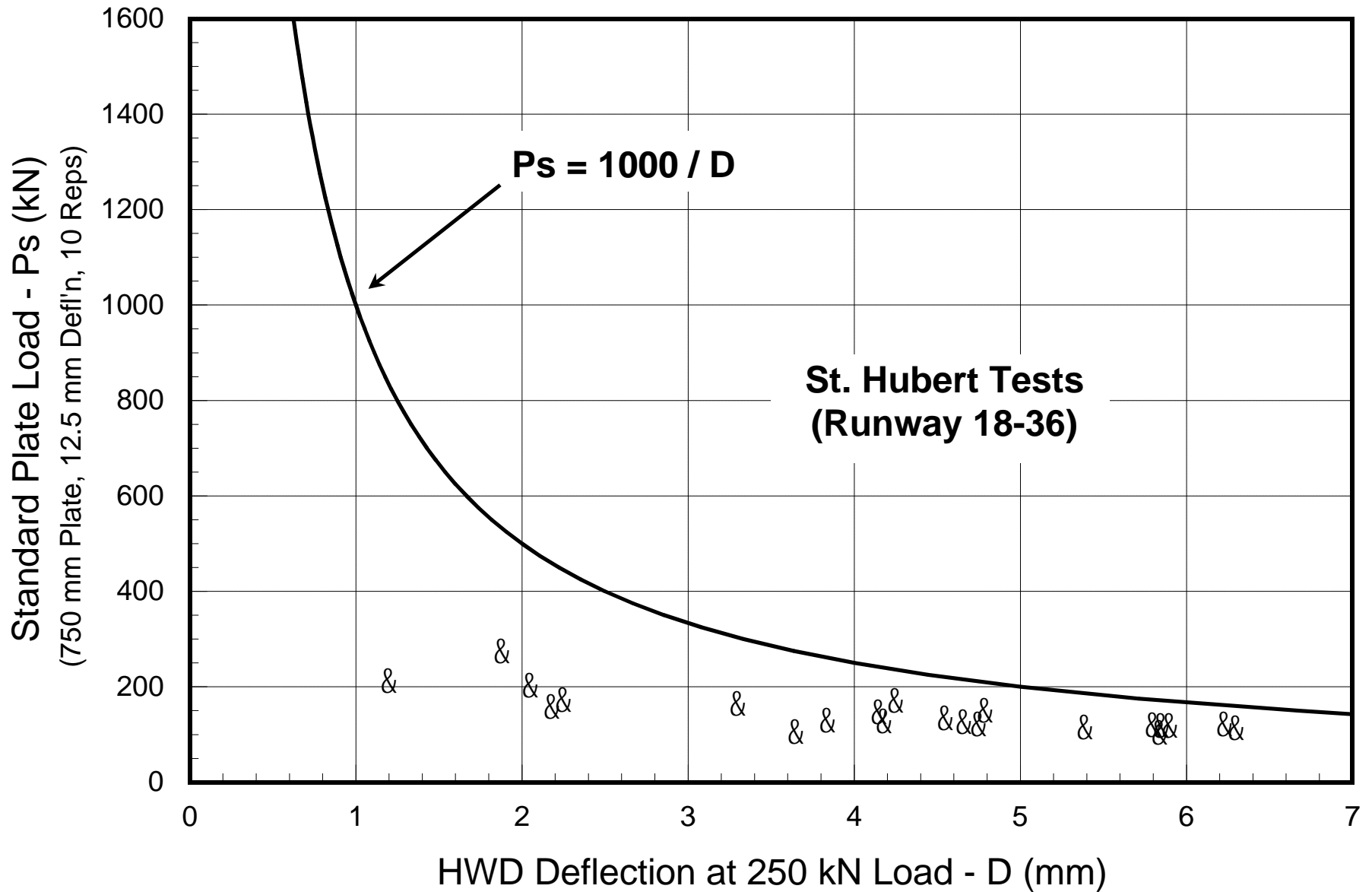


Figure B16: Standard Plate Load vs HWD Deflection - St. Jean (1992)

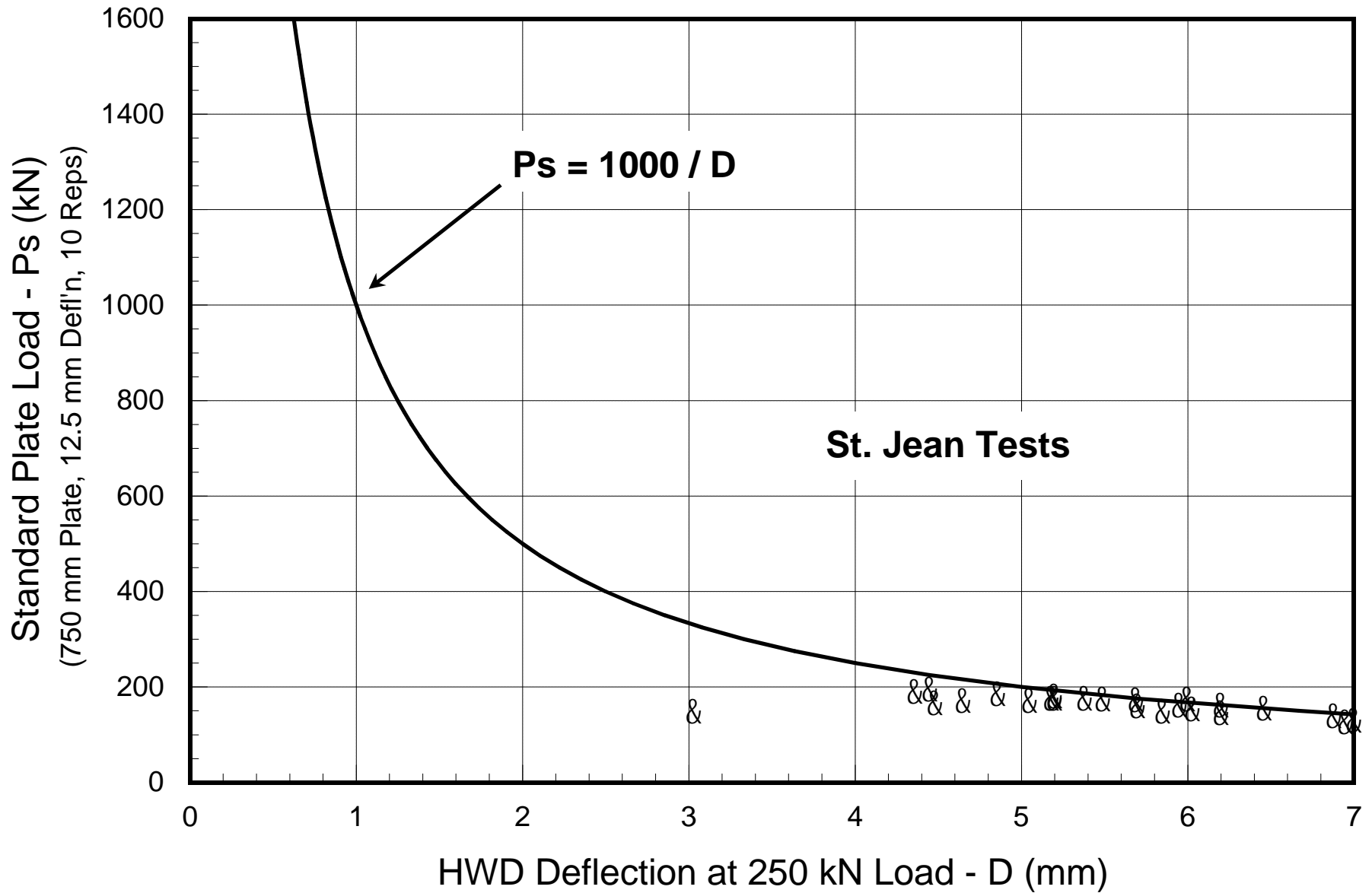


Figure B17: Standard Plate Load vs HWD Deflection - Sherbrooke (1992)

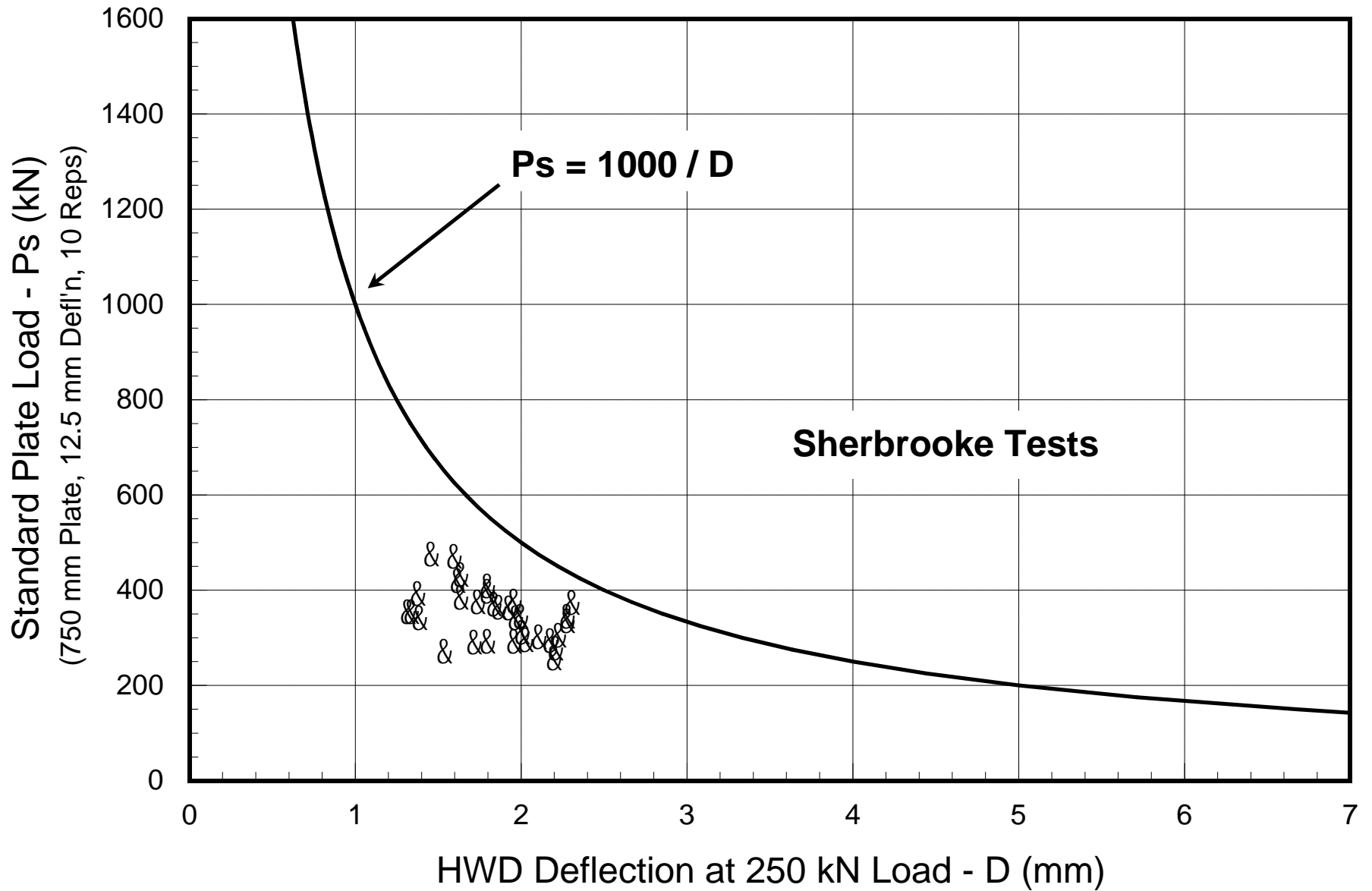


Figure B18: Standard Plate Load vs HWD Deflection - Swift Current (1990)

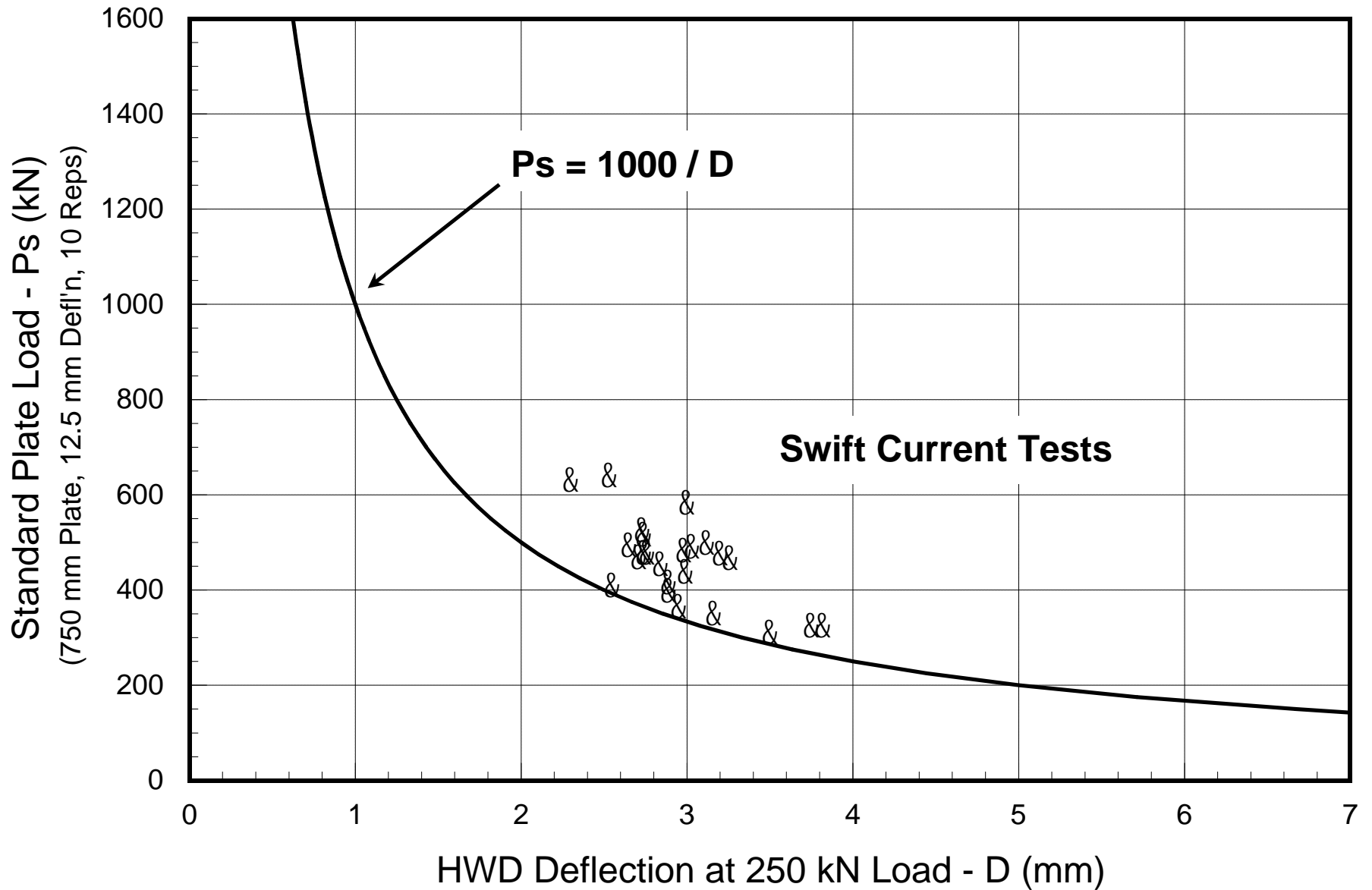


Figure B19: Standard Plate Load vs HWD Deflection - The Pas (1990)

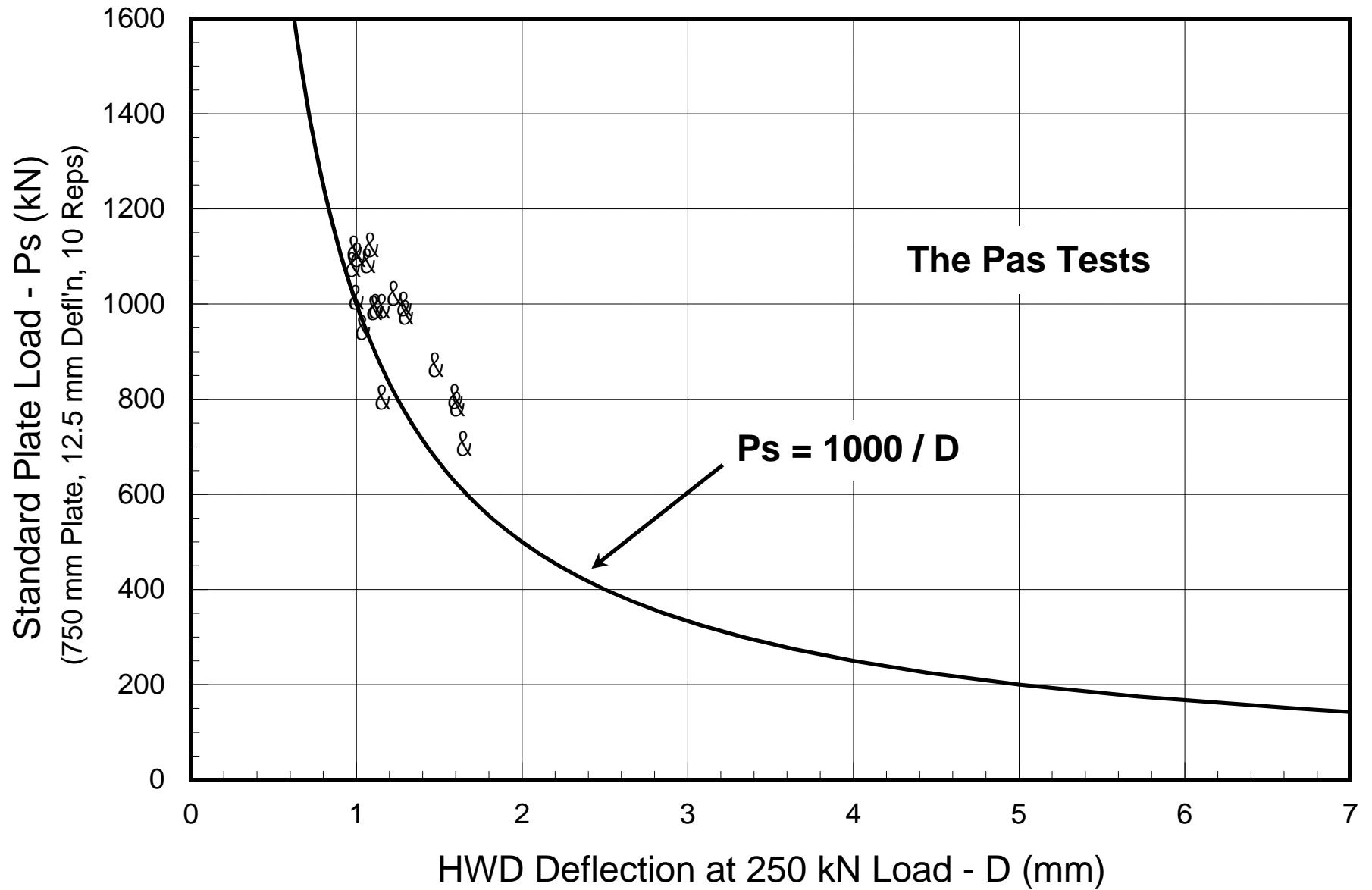


Figure B20: Standard Plate Load vs HWD Deflection - Thompson (1990)

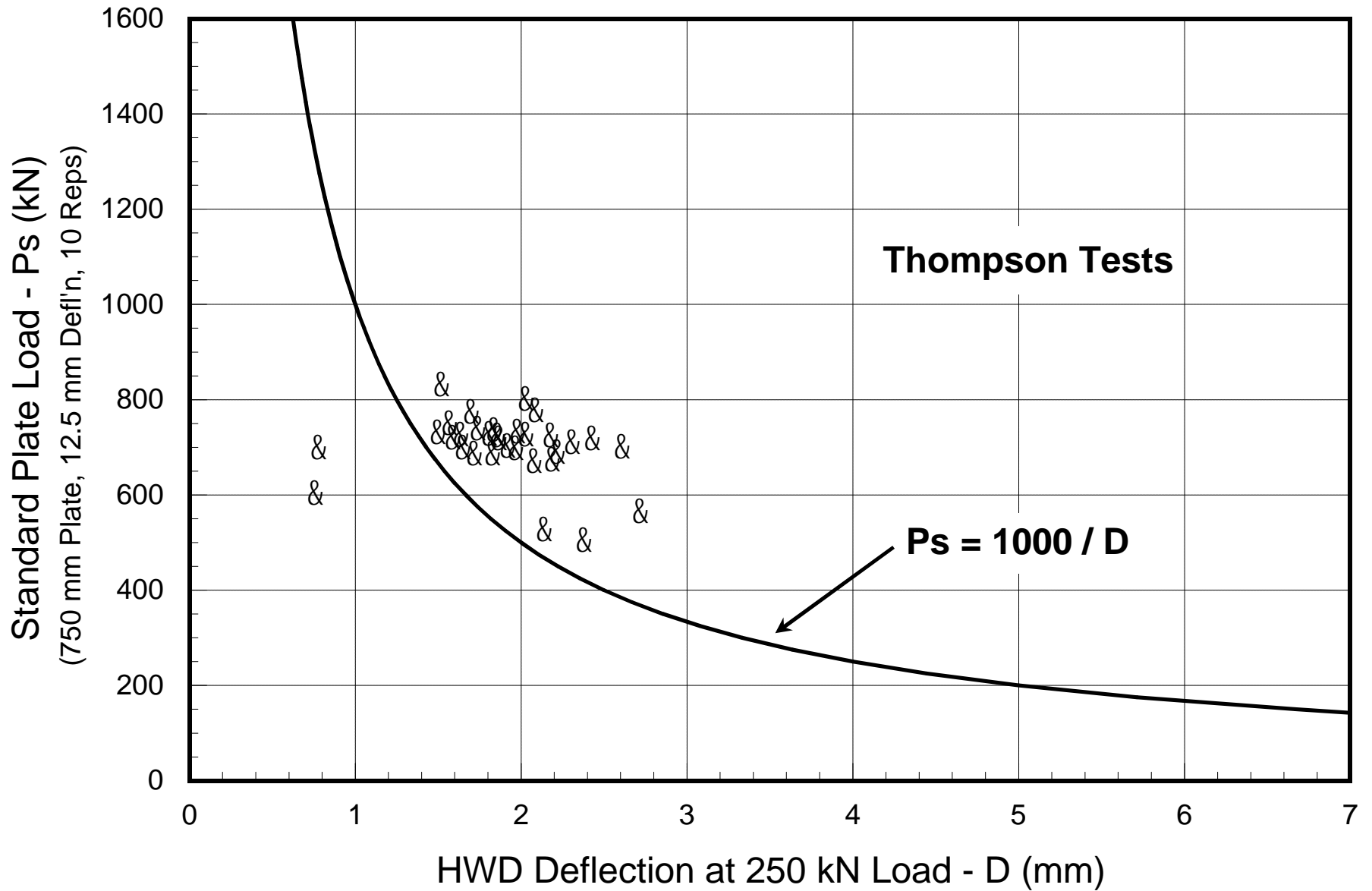


Figure B21: Standard Plate Load vs HWD Deflection - Toronto Island (1992)

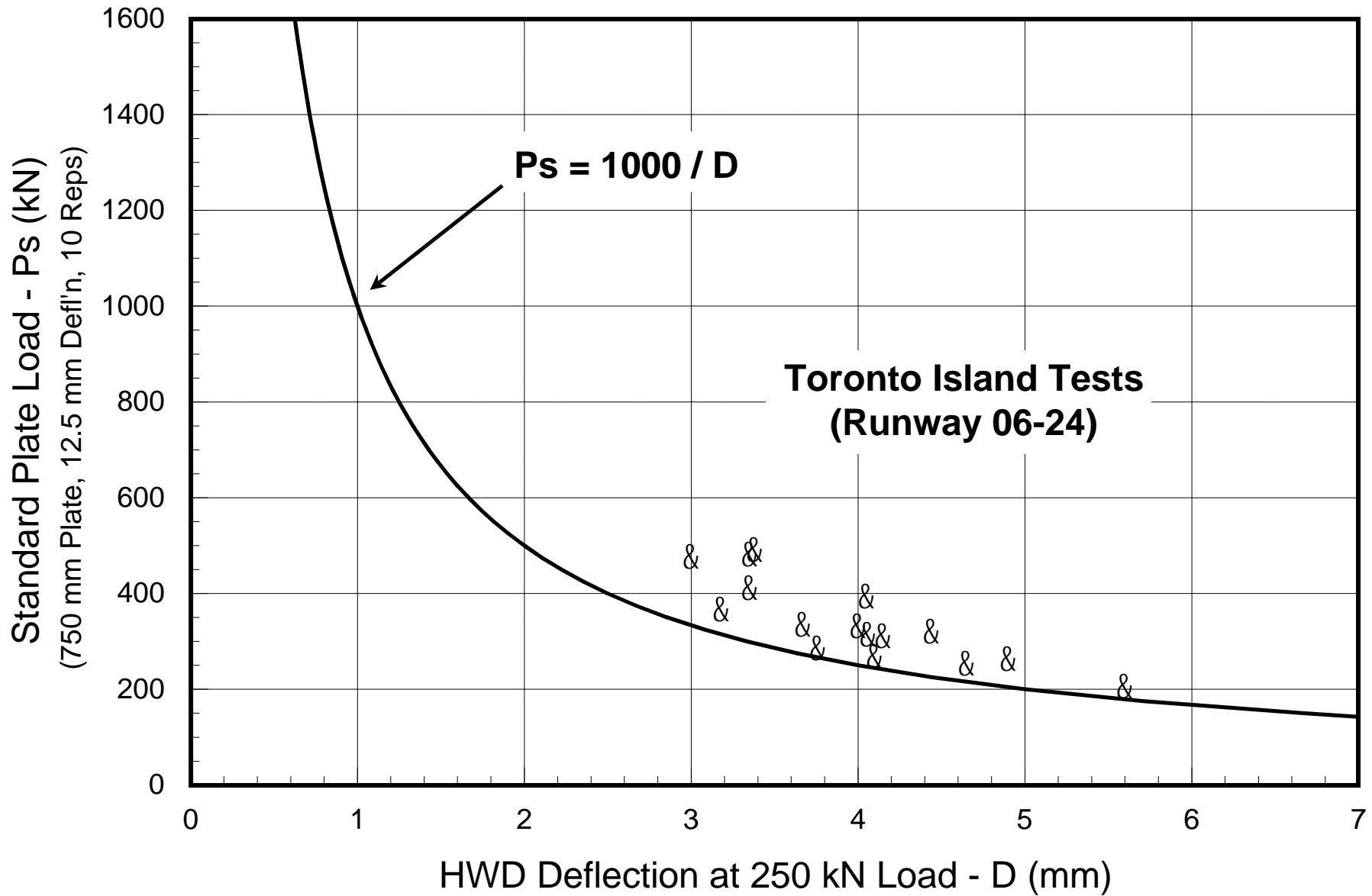


Figure B22: Standard Plate Load vs HWD Deflection - Toronto Island (1992)

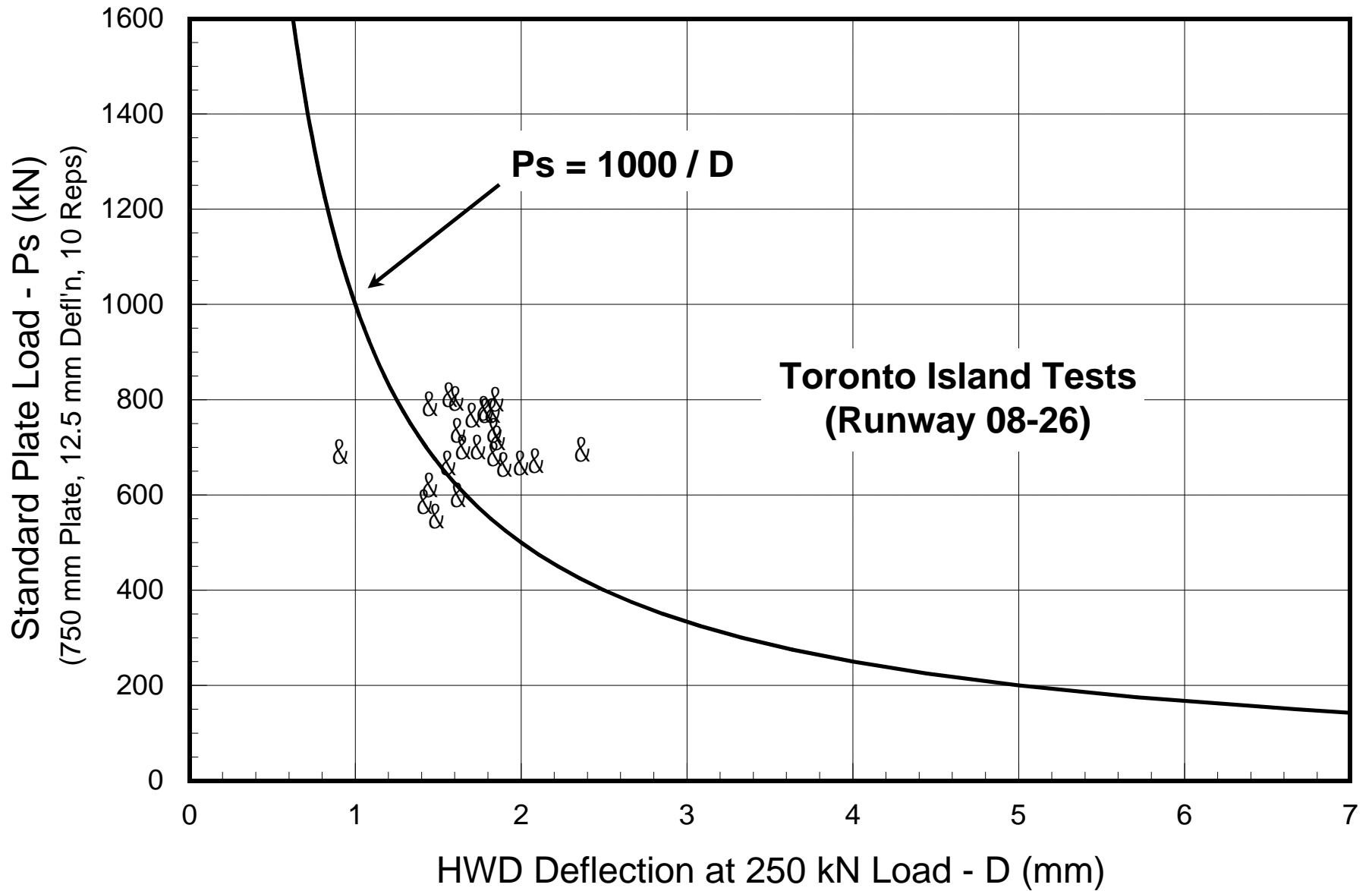


Figure B23: Standard Plate Load vs HWD Deflection - Toronto Island (1992)

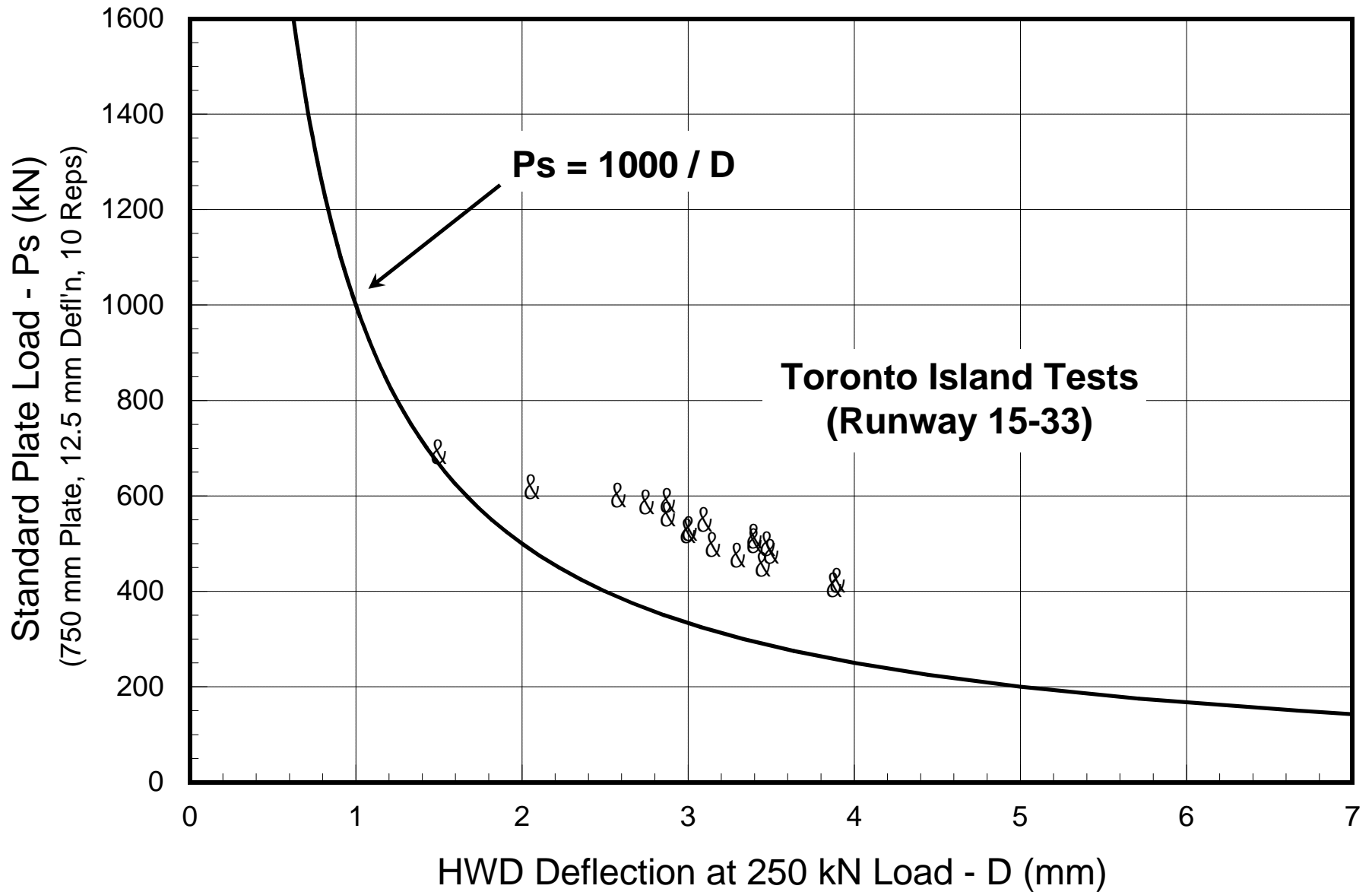


Figure B24: Standard Plate Load vs HWD Deflection - Toronto Int'l (1992)

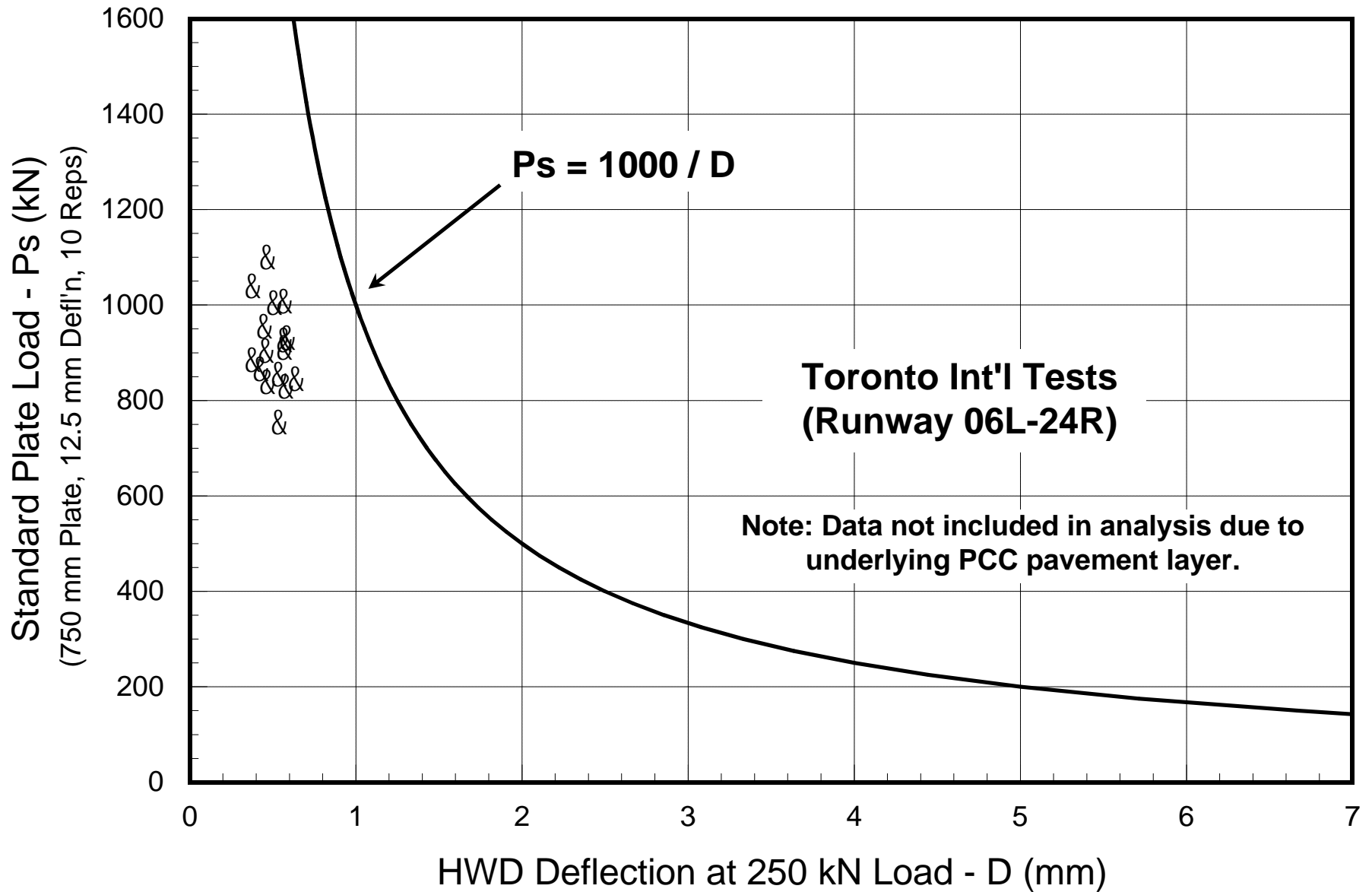


Figure B25: Standard Plate Load vs HWD Deflection - Val D'Or (1992)

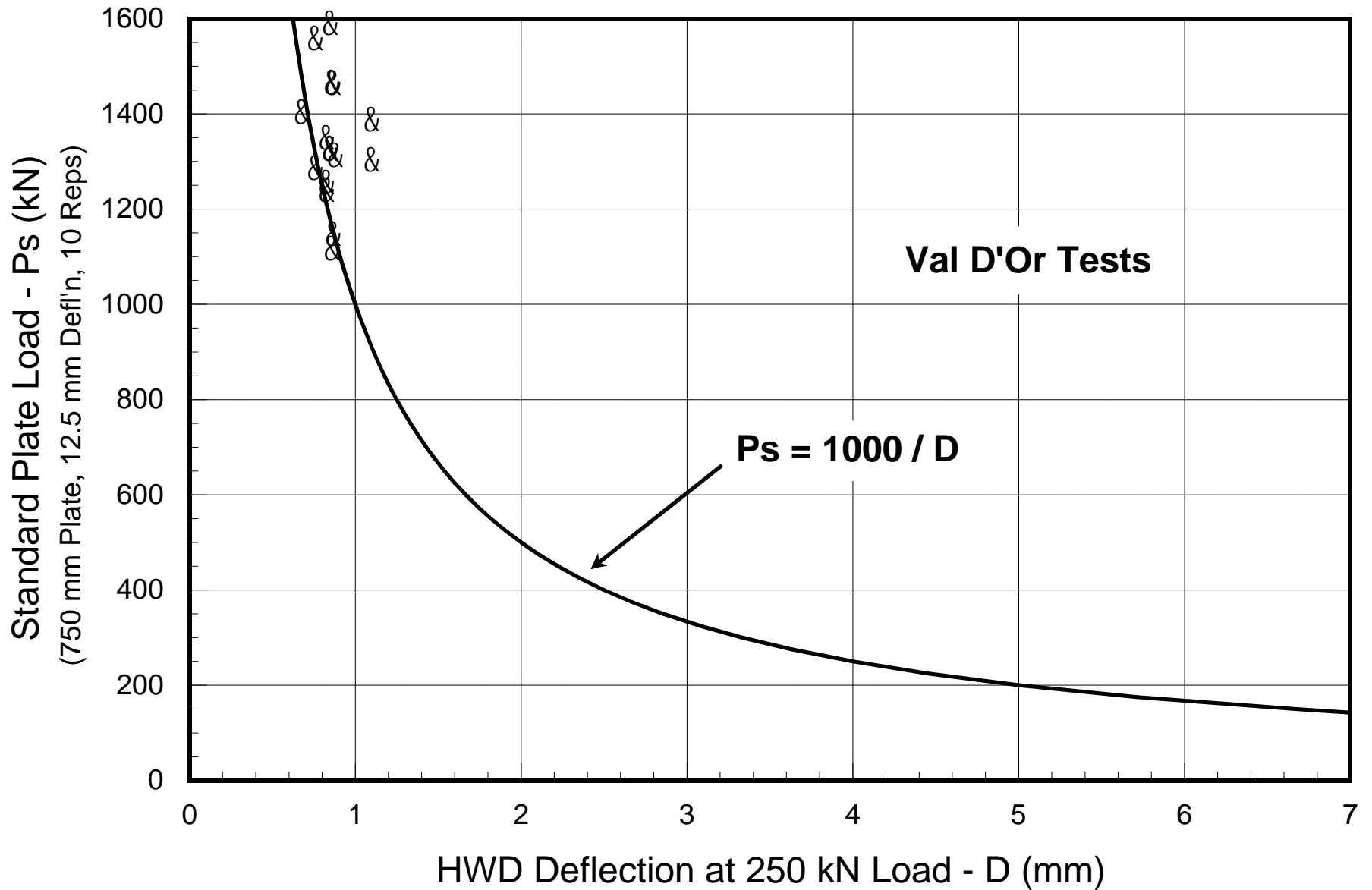


Figure B26: Standard Plate Load vs HWD Deflection - Wiarnton (1992)

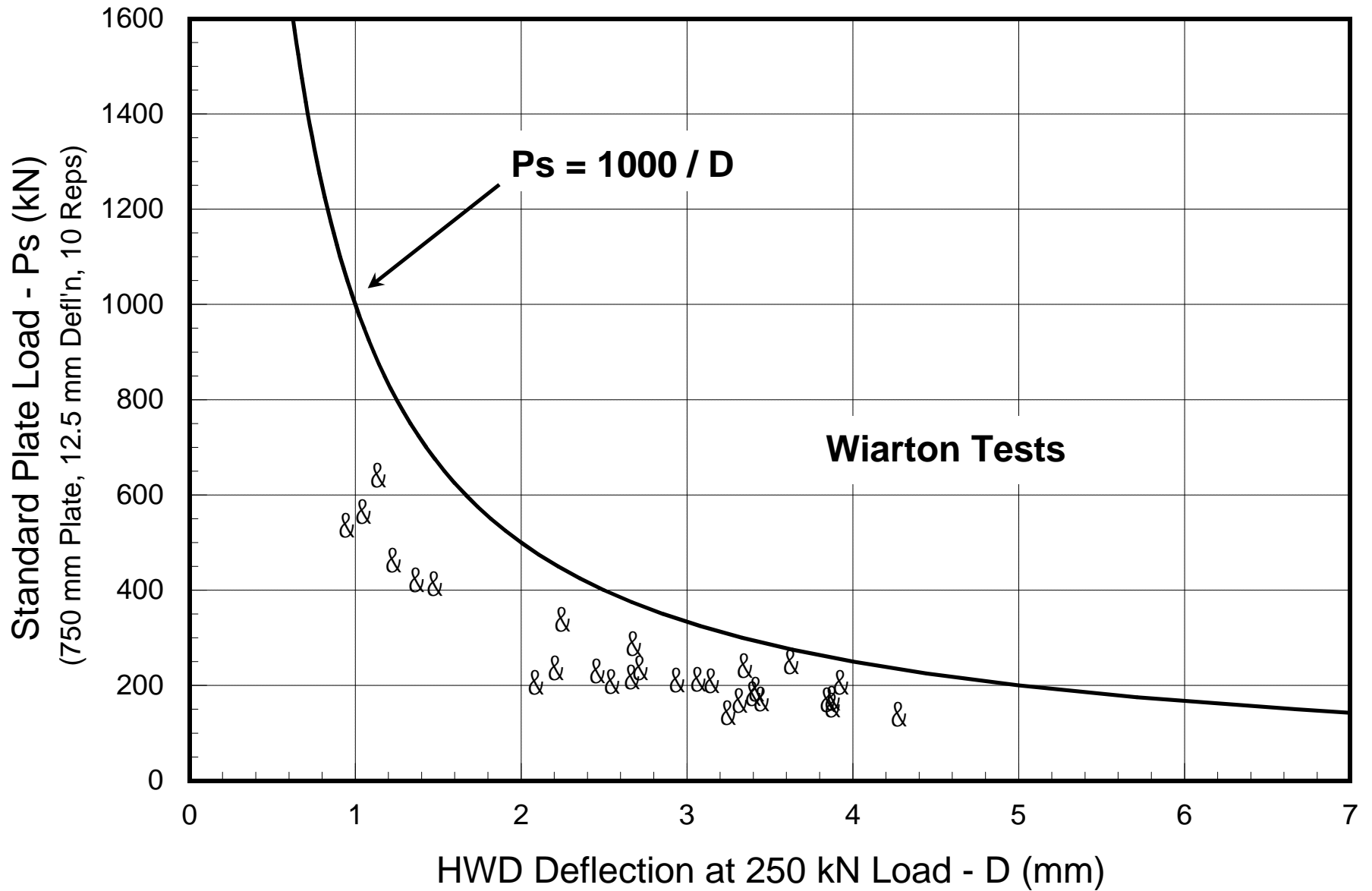
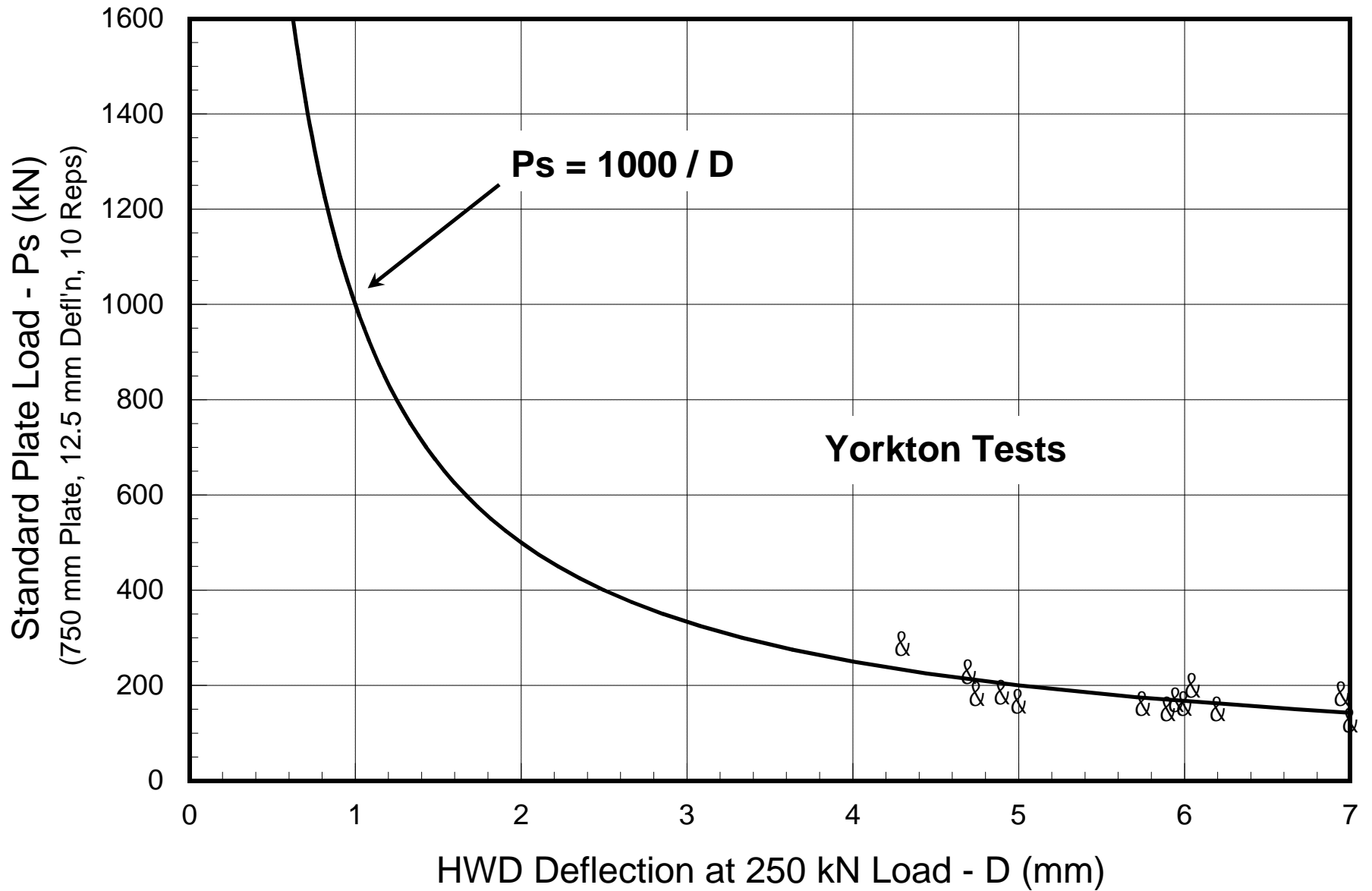
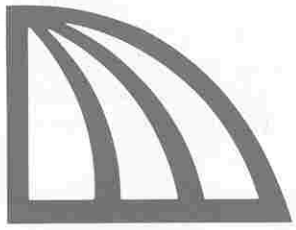


Figure B27: Standard Plate Load vs HWD Deflection - Yorkton (1990)



APPENDIX C

DESCRIPTION OF THE HEAVY FALLING WEIGHT DEFLECTOMETER



Dynatest

NEWSLETTER

Volume 7 Number 2

Autumn 1987



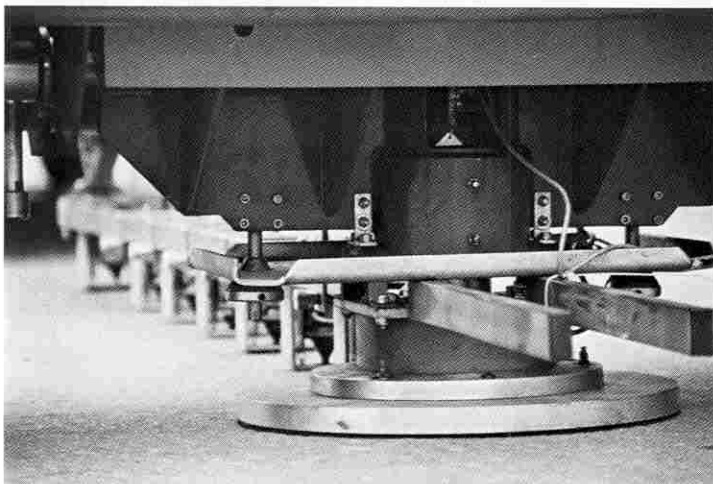
Introducing the Dynatest 8081 Heavy Weight Deflectometer

DYNATEST — the name which has become synonymous with the “FWD” (Falling Weight Deflectometer) — is proud to introduce a new and even higher load FWD. Our newest FWD model is called the Dynatest 8081 Heavy Weight Deflectometer (HWD) Test System, and it has been specifically designed to fully meet the needs of both highway and airfield pavement deflection testing, up to and including the effect of very heavy aircraft loads.

The Dynatest 8081 HWD spans a (peak) loading range of some 30

- 240 kN (6,500 - 54,000 lbf), thus covering the half-axis load imposed by a moderately heavy truck upwards through the single wheel load of a fully loaded Boeing 747 aircraft. In addition, the proven Dynatest electronics technology used in our lighter load FWD models has been utilized in the Model 8081 HWD to insure highly accurate deflection readings, from the center deflection (measured through the center of the loading plate) out to the seventh deflection — which may be placed as far as 2.5 m (8 ft) from the center of the HWD-imposed load.

These deflection readings, which are **guaranteed** to an absolute accuracy of $2\% \pm 2$ microns ($2\% \pm 0.1$ mils), are obtained using the Dynatest 8600 System Processor and a set of application specific velocity transducers (“deflectors”), which are very rugged and easily movable. The Dynatest load-deflection measuring systems almost **never** need recalibration. The 8600 System Processor is delivered **precalibrated**, for each and every deflector provided with an HWD or FWD Test System. This calibration is typically stable for years, requiring only an infrequent, “relative” check; eg, once every 6 - 12 months (occasionally, an adjustment of a half percent may be needed on one or more of the Dynatest deflectors).



Even though velocity signals generated under the very short duration HWD/FWD impulse loading sequence are not “flat” throughout the full spectrum of frequencies generated by an HWD/FWD impulse load, these frequencies are analyzed and conditioned (virtually in real time) by the 8600 System Processor, thus insuring that the HWD/FWD equipment generates the correct deflection readings — for each and every drop of the weight package, and for each and every HWD/FWD test point, regardless of pavement type, sensor spacings, drop heights used, etc.

This accuracy is critical if a deflection basin is to be used to evaluate material parameters and pavement structural condition. Typical

analysis procedures rely heavily on the deflection measurements taken furthest from the applied load (ie, from the outermost deflectors) for the calculation of subgrade strength parameters (layer material). These parameters, in turn, further influence subsequent strength estimates for the pavement layers above the subgrade.

Unfortunately, the outermost deflections are the smallest in the deflection basin [eg, on the order of 25 - 50 microns (1 - 2 mils) or so], and hence they are the most difficult to measure accurately. For example, an error of 10 microns (0.4 mils) on one (or more) of the outermost deflections is totally unacceptable for a reasonable estimate of the subgrade strength properties. Errors of this relative magnitude result in **significantly** different bearing capacity assessments of a pavement than would be obtained by accurate, reproducible deflection measurements. Thus, inferior accuracy results in analyses which may be described as “device-dependent”.

Dynatest manufactures the only deflection measuring devices that have a proven record of **accurately measuring** actual pavement deflection basins. If your pavement jurisdiction covers both roads and airfields, the right choice of a deflection measuring device, is therefore, the Dynatest 8081 HWD Test System. Whether you need an HWD or an FWD, in fact, the right choice has always been — and still is — DYNATEST: for fast, reliable, accurate, and wheel-load simulating load-deflection data.

OTHER DYNATEST FWD's

Dynatest is proud to continue to offer the “old faithful” Falling Weight Deflectometer, the Dynatest 8000E FWD Test System. To date, Dynatest has manufactured and sold over fifty of these standard FWD's world-wide. The Dynatest Model 8000E FWD offers the customer/user the most reliable, accurate, and time-proven FWD available anywhere.

The Model 8000E FWD spans a peak loading range of approximately 7 - 120 kN (1,500 - 27,000 lbf), thus providing a large range of usefulness from tests on weak, unbound materials to moderately heavy airfield pavements.

Dynatest Pavement Analysis Software

If your agency has chosen the best deflection measuring instrument from Dynatest, whether it be the new 8081 HWD or the standard 8000E FWD, why not also choose the best software for analyzing your HWD/FWD load-deflection data? Accurate data calls for a proper and efficient approach to analyzing the data obtained.

Dynatest has developed a series of software products — all of which are able to run on PC's — to “fill the bill”. Some of these products are presented in the following sections:

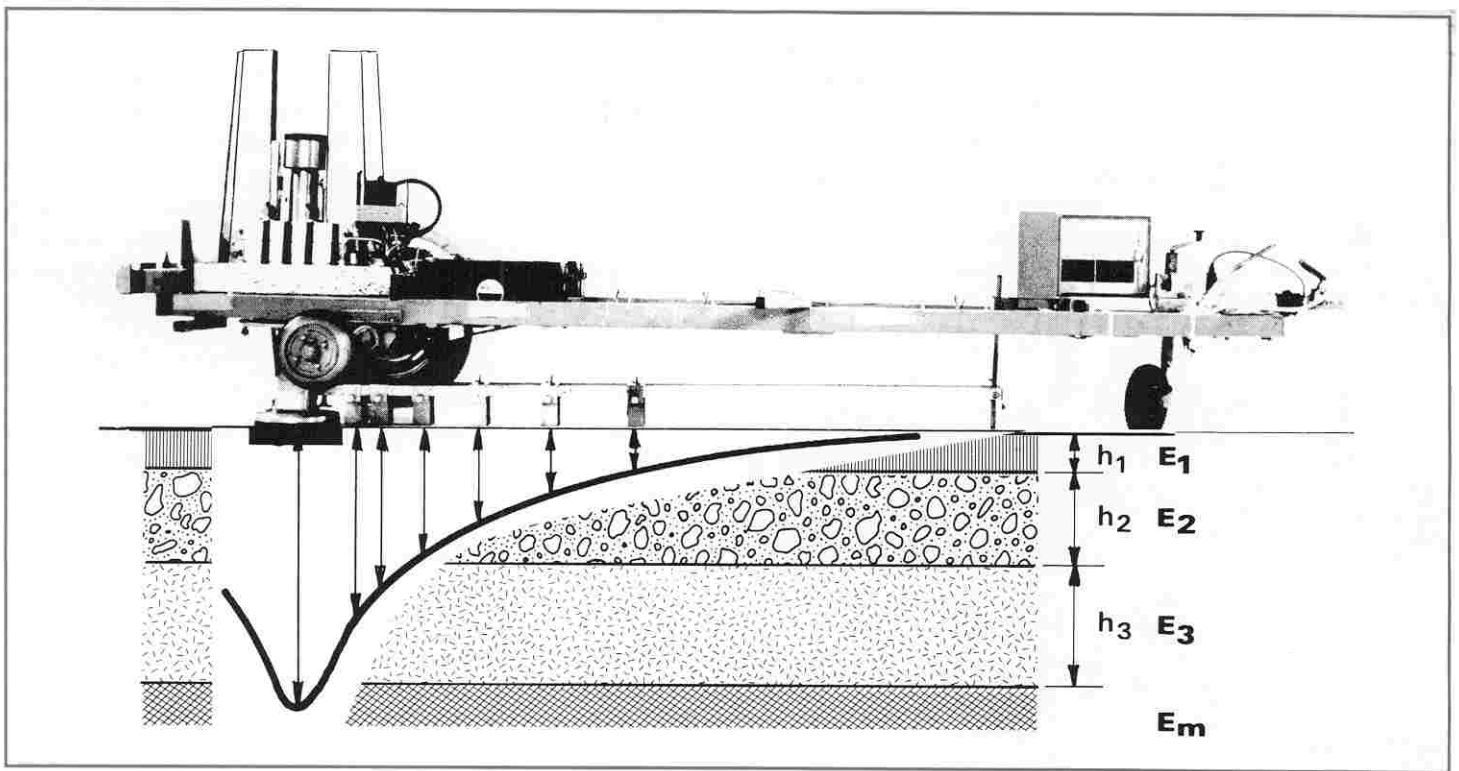
ISSEM4

On the research-oriented side, the Dynatest ISSEM4 program is now available for use on a PC equipped with a compatible math co-processor.

The ISSEM4 program is capable of calculating the elastic moduli of a pavement structure (taking the non-linearity of the materials into consideration), given the load-deflection data obtained by a Dynatest HWD or FWD.

The ISSEM4 program is written in FORTRAN, and a back-calculation of a single given deflection basin (assuming the layer thicknesses are known) takes as little as two minutes or less on a PC, depending on the number of layers chosen and on the accuracy of the “seeded” moduli values used to initiate the program. Typically, an ISSEM4 run with a three layer, non-linear elastic system takes four to six minutes on a PC-AT or six to eight minutes on a PC-XT.

The ISSEM4 program is based on a quasi-finite element back calculation technique. The non-linearity of all the unbound layers in the pavement system are considered, and the program utilizes the ELSYM5 program as a forward-calculating subroutine.



ELMOD

For quick and accurate, production-oriented processing of HWD or FWD load-deflection data on a PC, Dynatest is pleased to provide the ELMOD program. The ELMOD program has been specifically developed for use on Dynatest HWD/FWD data files, exactly as they are generated in the field.

As with the ISSEM4 program, ELMOD calculates the elastic moduli of a given pavement structure, although only the non-linearity of the subgrade layer is considered in the back-calculation process. In addition, however, the ELMOD program calculates the remaining life of the pavement section (both structurally and functionally) as well as the overlay required for a given (future) design life. This is carried out for each and every HWD/FWD test point in a given data file.

The ELMOD program utilizes a very efficient and fast-executing process known as the "Boussinesq-Odemark" method. Based on the same fundamental theory used in the better-known elastic layered programs (such as ELSYM5, CHEVRON, BISAR, etc), this approach uses the "equivalent thickness" concept for its approximations to layered elastic responses to surface loadings rather than the numerical integration procedures used by the other programs. The results obtained by this method compare very well with other analyses and match actual pavement stresses and strains under dynamic surface loads as well as — or even better than — the elastic layered approaches.

Additionally, the process of back-calculation, remaining life determination, and overlay design, etc, takes place in a small fraction of the time required by other programs. Roughly, the moduli calculation portion of the ELMOD program takes considerably less than

one second per HWD/FWD test point on a PC-AT, while the remaining life and overlay design is generally accomplished in five seconds or less per test point.

This means that a whole HWD/FWD data file consisting of, say, 100 test points is processed by the ELMOD program in ten minutes or so on a PC-AT, from the back-calculated moduli to the estimated overlay requirements for the project, for all 100 test points.

Most of the variables contained in both the back-calculation portion and the remaining life/overlay design portions of the ELMOD program are user-controlled. These include: seasonal temperature variations, "springtime" weakening factors, fatigue or performance relationships, and design load levels and configurations, etc.

Another version of the ELMOD program, called "ELASH", incorporates the "Revised AASHTO Design Guide" equations into the ELMOD program, thus allowing the user to base his/her pavement rehabilitation design entirely on AASHTO-based performance relationships.

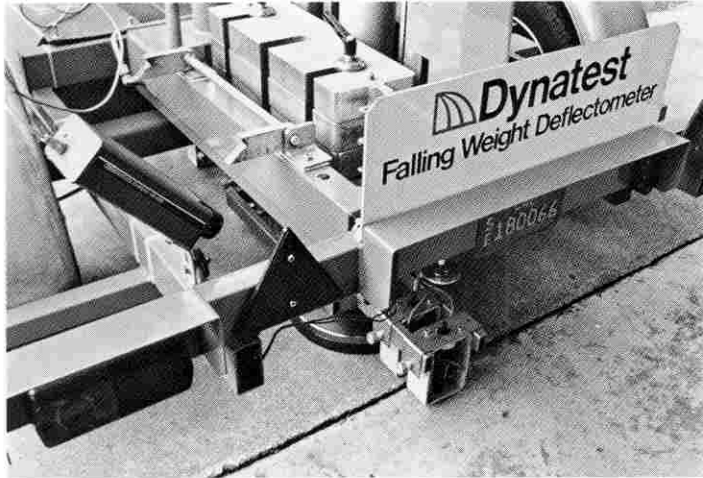
ELCON

The Dynatest ELCON computer program is an extension of the ELMOD program for use on Jointed portland cement Concrete Pavement (JCP).

In addition to the features of the ELMOD program, ELCON also calculates the "k"-values (Modulus of Subgrade Reaction) of the foundation support layers under JCP slabs, at both the interior, joints and corners of each slab based on HWD/FWD test results. The conventional load transfer and differential deflections are also calculated for joint and corner HWD/FWD load-deflection test results.

The calculations carried out by the ELCON program for the interior portion of a JCP slab are based on the same Boussinesq-Odemark theory used in the ELMOD program. The calculations at the joints and corners, however, are based on Westergaard's newest equations.

As with the ELMOD program, most of the variables used in calculating the remaining life and needed overlays for JCP are user-controlled, and program execution is somewhat faster than the ELMOD program (eg, 100 HWD/FWD test points may be processed by a PC-AT in less than ten minutes).



DMS

The Dynatest pavement maintenance and rehabilitation (M & R) Management System (DMS) software is capable of dealing with pavement management in ways which no other pavement management program can offer. The uniqueness of the Dynatest DMS software is its ability to differentiate between **functional** and **structural** distress modes, thus providing the user with logical cause-and-effect algorithms for use in managing any size network of pavements, from airfields to whole states or countries.

For principal collectors and thoroughfares, HWD or FWD data is gathered and used to **predict**, using rational, mechanistic models, future pavement performance in terms of structural (ie, fatigue cracking, etc) and functional (ie, loss of ride quality) deterioration for each feasible M & R alternative. This innovative approach allows the roadway agency to ascertain the cumulative effect of various pavement maintenance and/or rehabilitation alternatives on both the agency's total budget and on the networks current and future condition. In turn, this results in a most powerful management tool for budgeting purposes, so that the agency can quantify the consequences of various budget levels — ie, whether the roadway network, taken as a whole as well as project by project, will further deteriorate, remain the same, or improve. For the decision maker, these consequence analyses can be useful in determining appropriate budget levels.

OTHER DYNATEST PRODUCTS AND SERVICES

In addition to the hardware and software products described in this Newsletter, Dynatest also manufactures and markets several other products. Also, Dynatest maintains a substantial engineering and support staff who lead in the field of engineering consulting services associated with both these Dynatest products and in general. Our

staff, presently with offices in Australia, Canada, Denmark, Great Britain, Italy and the United States, can provide clients with the highest quality pavement design, analysis and pavement management services.

The Dynatest staff may be reached at any of the telephone (or FAX) numbers listed below.

Dynatest

DYNATEST ENGINEERING A/S
Krogholmgaardsvej 4A
DK-2950 Vedbaek
DENMARK
Telephone (02) 89 0211
Telefax (02) 89 22 57

Dynatest

DYNATEST LIMITED
52 Ashwarren Road
Downsview (Toronto)
Ontario M3J-1Z5
CANADA
Telephone (416) 630-1072
Telefax (416) 630-7045

Dynatest

DYNATEST ITALIA S.R.L.
Via F.lli Rosselli 30
27058 Voghera
ITALY
Telephone (0383) 213532
Telefax (0383) 214447

Dynatest

DYNATEST CONSULTING, INC.
209 Bald Street
Post Office Box 71
Ojai, California 93023
USA
Telephone (805) 646-2230
Telefax (805) 640-0345

Dynatest

DYNATEST U.K. Ltd.
4 Setts Way
Wingerworth
Chesterfield S42 6NZ
ENGLAND
Telephone (0246) 207 117
Telefax (0246) 211 403

Dynatest

DYNATEST PMS Pty. Ltd.
39 Wesley Street
Dundas 2117
AUSTRALIA
Telephone (02) 630 8130

Dynatest 8081 HWD Heavy Weight Deflectometer

Dynatest 8081 HWD Specifications

Loading range:	30-240 kN (6,500-54,000 lbf)
No. of deflectors:	Seven (7), one center mounted plus six mounted in spring-loaded, movable holders along a raise/lower bar (R/L bar)
Length of R/L bar:	2.5 m (8 ft.) (from center of loading plate)
Load pulse shape:	Essentially half-sine
Load pulse duration:	25-30 msec. (rise time 10 msec. min.)
Load measurement:	By load cell mounted directly on top of the loading plate
Accuracy, load:	2 percent +/- 2 kPa (1 kPa = 1 kN/m.sq. = 0.145 psi)
Resolution, load:	Metric, pressure : 1 kPa Metric, force : 0.04 kN English, pressure : 0.1 psi English, force : 8 lbf
Deflection range:	2.54 mm (100 mil) max.
Accuracy, deflections:	2 percent +/- 2 microns (1 micron = 0.001 mm = 0.04 mil) Deflectors are precision pre-calibrated, and no user calibration is necessary
Resolution, deflection:	Metric: 1 micron = 0.001 mm English: 0.04 mil = 0.00004 inch
Repeatability:	Typ. 1 percent or better
Data output:	Displayed and/or printed and/or stored (on disc): Test setup and site identification, peak load and peak deflections and/or load history and/or deflections history (as 300 plotted and/or tabulated values of each signal over the 60 msec. sampling period)
System capacity:	Up to 50 test points per hour, only one person needed for operation
Power requirements:	12 VDC only (from 90A alternator system in towing vehicle), average current drain 60A max.
Amb. temperature ranges:	Trailer: -20C to +55C (-5F to +130 F) Electronics: +5C to +40 C (+40F to +105F)
Trailer dimensions:	L: 4.05 m (160 inches) W: 1.75 m (69 inches) H: 1.40 m (56 inches)
Trailer weight:	1,350 kg (3,000 lbs.)
Optional hardware:	Automated measurement of air and/or pavement surface temperature(s). Automated distance measurement

Example of Heavy Falling Weight Deflectometer (HWD) Test Results

Date: 920917 File: A:\Wiaraton.fwd
 Road: Wiaraton Airport Subsection: 05/23
 FWD S/N: 8082-019 Operator ID: Test Equipment Operator Name
 Stationing: Kilometres
 Diameter of Plate: 450 mm Deflector Distances: 450, 600, 900, 1200, 1500, 1800
 Transport Canada Sequence: 21234

Chainage: 5.049 -> 6.451

Stn: 5.049		Lane:		Temp Air: 20		Temp Pvt: 26		09:23
kPa	kN	Df1	Df2	Df3	Df4	Df5	Df6	Df7
299	47.55	572	214	132	50	19	7	6
614	97.65	1309	518	331	130	49	17	15
857	136.30	1960	799	518	207	77	25	20
1027	163.34	2418	1015	667	273	104	37	26

Stn: 5.050		Lane:		Temp Air: 21		Temp Pvt: 26		09:26
kPa	kN	Df1	Df2	Df3	Df4	Df5	Df6	Df7
301	47.87	583	242	147	53	21	9	8
618	98.29	1318	584	369	139	51	22	15
863	137.25	1976	909	586	224	81	32	21
1042	165.72	2463	1162	762	298	108	42	27

Stn: 5.051		Lane:		Temp Air: 21		Temp Pvt: 26		09:28
kPa	kN	Df1	Df2	Df3	Df4	Df5	Df6	Df7
298	47.39	565	253	157	60	23	8	7
617	98.13	1317	612	394	153	58	20	15
861	136.94	1996	951	621	247	91	31	21
1041	165.56	2482	1212	801	327	122	44	28

Stn: 5.099		Lane:		Temp Air: 20		Temp Pvt: 27		09:29
kPa	kN	Df1	Df2	Df3	Df4	Df5	Df6	Df7
294	46.76	488	219	142	64	29	9	7
618	98.29	1137	536	362	168	75	28	16
869	138.21	1724	844	577	272	124	47	24
1049	166.84	2149	1077	743	356	162	66	30

Stn: 5.100		Lane:		Temp Air: 21		Temp Pvt: 27		09:30
kPa	kN	Df1	Df2	Df3	Df4	Df5	Df6	Df7
293	46.60	476	223	148	64	27	12	7
619	98.45	1099	544	375	172	73	30	21
870	138.37	1613	826	578	272	117	48	29
1054	167.63	1981	1042	736	354	157	66	36
