

Table F.3 Data set 1 calculations

Target Properties				Projectile Properties						Penetration (mm)			Model Error
Identifier	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	No.	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed		
A	20	250	658	5.56	1	A.5.1	0.0040	2.78	824.50	16.82	6.14	0.37	
A	20	250	658	5.56	2	A.5.2	0.0040	2.78	821.15	16.68	7.23	0.43	
A	20	250	658	5.56	3	A.5.3	0.0040	2.78	818.10	16.56	7.03	0.42	
A	20	250	658	5.56	4	A.5.4	0.0040	2.78			5.28		
A	20	250	658	5.56	5	A.5.5	0.0040	2.78			7.26		
A	20	250	658	5.56	6	A.5.6	0.0040	2.78	822.06	16.72	6.08	0.36	
A	20	250	658	5.56	7	A.5.7	0.0040	2.78	815.66	16.46	7.51	0.46	
A	20	250	658	5.56	8	A.5.8	0.0040	2.78			7.05		
A	20	250	658	5.56	9	A.5.9	0.0040	2.78			7.25		
A	20	250	658	5.56	10	A.5.10	0.0040	2.78			6.27		
B	20	250	658	5.56	1	B.5.1	0.0040	2.78	813.53	16.38			
B	20	250	658	5.56	2	B.5.2	0.0040	2.78	829.98	17.04	7.31	0.43	
B	20	250	658	5.56	3	B.5.3	0.0040	2.78	826.33	16.89	7.35	0.44	
B	20	250	658	5.56	4	B.5.4	0.0040	2.78	814.74	16.42			
B	20	250	658	5.56	5	B.5.5	0.0040	2.78	813.22	16.36			
B	20	250	658	5.56	6	B.5.6	0.0040	2.78	824.50	16.82	6.51	0.39	
B	20	250	658	5.56	7	B.5.7	0.0040	2.78	816.88	16.51	7.54	0.46	
B	20	250	658	5.56	8	B.5.8	0.0040	2.78	810.17	16.24	6.60	0.41	
B	20	250	658	5.56	9	B.5.9	0.0040	2.78	818.71	16.58	7.21	0.43	
B	20	250	658	5.56	10	B.5.10	0.0040	2.78	811.39	16.29			

Observed variability	mean	6.85	std. dev.	0.64	COV	0.093	COUNT	11
Model error	mean	0.417	std. dev.	0.033	COV	0.079		

Table F.4 Data set 2 calculations

Target Properties				Projectile Properties						Penetration (mm)		Model Error
Identifier	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	No.	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed	
A	20	250	658	7.62	1	A.7.1	0.0096	3.91	782.74	18.52	6.14	0.33
A	20	250	658	7.62	2	A.7.2	0.0096	3.91	776.64	18.23	6.45	0.35
A	20	250	658	7.62	3	A.7.3	0.0096	3.91	779.08	18.34	6.26	0.34
A	20	250	658	7.62	4	A.7.4	0.0096	3.91	763.23	17.60	5.86	0.33
A	20	250	658	7.62	5	A.7.5	0.0096	3.91	770.85	17.96	6.07	0.34
A	20	250	658	7.62	6	A.7.6	0.0096	3.91	774.51	18.13	5.63	0.31
A	20	250	658	7.62	7	A.7.7	0.0096	3.91	770.54	17.94	5.99	0.33
A	20	250	658	7.62	8	A.7.8	0.0096	3.91	770.24	17.93	5.62	0.31
A	20	250	658	7.62	9	A.7.9	0.0096	3.91			5.85	
A	20	250	658	7.62	10	A.7.10	0.0096	3.91	774.51	18.13	5.97	0.33
A	20	250	658	7.62	11	A.7.11	0.0096	3.91	766.28	17.75	5.81	0.33
A	20	250	658	7.62	12	A.7.12	0.0096	3.91	780.60	18.41	6.32	0.34
A	20	250	658	7.62	13	A.7.13	0.0096	3.91			5.68	
B	20	250	658	7.62	1	B.7.1	0.0096	3.91	779.08	18.34	6.15	0.34
B	20	250	658	7.62	2	B.7.2	0.0096	3.91	776.03	18.20	6.32	0.35
B	20	250	658	7.62	3	B.7.3	0.0096	3.91	776.95	18.24	6.39	0.35
B	20	250	658	7.62	4	B.7.4	0.0096	3.91	778.16	18.30		
B	20	250	658	7.62	5	B.7.5	0.0096	3.91	772.37	18.03	6.19	0.34
B	20	250	658	7.62	6	B.7.6	0.0096	3.91	781.21	18.44	6.52	0.35
B	20	250	658	7.62	7	B.7.7	0.0096	3.91	771.15	17.97		
B	20	250	658	7.62	8	B.7.8	0.0096	3.91	773.29	18.07		
B	20	250	658	7.62	9	B.7.9	0.0096	3.91	781.21	18.44	6.20	0.34
B	20	250	658	7.62	10	B.7.10	0.0096	3.91	770.54	17.94	6.23	0.35

B	20	250	658	7.62	11	B.7.11	0.0096	3.91	755.00	17.23	
B	20	250	658	7.62	12	B.7.12	0.0096	3.91	755.00	17.23	

Observed variability mean 6.08 std. dev. 0.27 COV 0.045 COUNT 18

Model error mean 0.337 std. dev. 0.012 COV 0.036

Table F.5 Data set 3 calculations

Target Properties				Projectile Properties						Penetration (mm)			Model Error
Identifier	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	No.	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed		
C	20	350	458	5.56	1	C.5.1	0.0040	2.78	821.75	22.46	8.26	0.37	
C	20	350	458	5.56	2	C.5.2	0.0040	2.78	815.05	22.10	7.26	0.33	
C	20	350	458	5.56	3	C.5.3	0.0040	2.78	807.73	21.70			
C	20	350	458	5.56	4	C.5.4	0.0040	2.78	814.44	22.07	7.04	0.32	
C	20	350	458	5.56	5	C.5.5	0.0040	2.78	803.16	21.46	6.39	0.30	
C	20	350	458	5.56	6	C.5.6	0.0040	2.78			7.32		
C	20	350	458	5.56	7	C.5.7	0.0040	2.78	806.51	21.64	7.75	0.36	
C	20	350	458	5.56	8	C.5.8	0.0040	2.78	822.36	22.50	8.18	0.36	
C	20	350	458	5.56	9	C.5.9	0.0040	2.78	811.70	21.92	6.55	0.30	
C	20	350	458	5.56	10	C.5.10	0.0040	2.78	812.92	21.98	7.85	0.36	
D	20	350	458	5.56	1	D.5.1	0.0040	2.78			11.10		
D	20	350	458	5.56	2	D.5.2	0.0040	2.78			7.35		
D	20	350	458	5.56	3	D.5.3	0.0040	2.78			8.29		
D	20	350	458	5.56	4	D.5.4	0.0040	2.78	815.35	22.12	7.40	0.33	
D	20	350	458	5.56	5	D.5.5	0.0040	2.78	820.84	22.41	7.67	0.34	

D	20	350	458	5.56	6	D.5.6	0.0040	2.78			7.58	
D	20	350	458	5.56	7	D.5.7	0.0040	2.78			7.22	
D	20	350	458	5.56	8	D.5.8	0.0040	2.78	751.65	18.79	6.86	0.37
D	20	350	458	5.56	9	D.5.9	0.0040	2.78	819.32	22.33	8.11	0.36
D	20	350	458	5.56	10	D.5.10	0.0040	2.78	817.49	22.23		

Observed variability mean 7.68 std. dev. 1.02 COV 0.133 **COUNT** 12

Model error mean 0.341 std. dev. 0.026 COV 0.075

Table F.6 Data set 4 calculations

Target Properties				Projectile Properties						Penetration (mm)		Model Error
Identifier	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	No.	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed	
C	20	350	458	7.62	1	C.7.1	0.0096	3.91			6.45	
C	20	350	458	7.62	2	C.7.2	0.0096	3.91			5.98	
C	20	350	458	7.62	3	C.7.3	0.0096	3.91	761.71	23.57	6.18	0.26
C	20	350	458	7.62	4	C.7.4	0.0096	3.91	766.28	23.86		
C	20	350	458	7.62	5	C.7.5	0.0096	3.91	764.14	23.73	6.33	0.27
C	20	350	458	7.62	6	C.7.6	0.0096	3.91	769.93	24.09	6.37	0.26
C	20	350	458	7.62	7	C.7.7	0.0096	3.91	771.76	24.20	6.33	0.26
C	20	350	458	7.62	8	C.7.8	0.0096	3.91	771.76	24.20	6.32	0.26
C	20	350	458	7.62	9	C.7.9	0.0096	3.91	775.42	24.43	6.11	0.25
C	20	350	458	7.62	10	C.7.10	0.0096	3.91	781.82	24.84	6.14	0.25
C	20	350	458	7.62	11	C.7.11	0.0096	3.91	781.82	24.84	6.17	0.25
C	20	350	458	7.62	12	C.7.12	0.0096	3.91	781.82	24.84	6.02	0.24

D	20	350	458	7.62	1	D.7.1	0.0096	3.91	772.37	24.24		
D	20	350	458	7.62	2	D.7.2	0.0096	3.91	762.62	23.63	6.04	0.26
D	20	350	458	7.62	3	D.7.3	0.0096	3.91	771.46	24.18	6.37	0.26
D	20	350	458	7.62	4	D.7.4	0.0096	3.91	771.46	24.18	6.43	0.27
D	20	350	458	7.62	5	D.7.5	0.0096	3.91	763.23	23.67	5.78	0.24
D	20	350	458	7.62	6	D.7.6	0.0096	3.91	773.59	24.32	6.47	0.27
D	20	350	458	7.62	7	D.7.7	0.0096	3.91	773.90	24.33	6.18	0.25
D	20	350	458	7.62	8	D.7.8	0.0096	3.91	707.76	20.35	6.23	0.31
D	20	350	458	7.62	9	D.7.9	0.0096	3.91	777.55	24.57	6.19	0.25
D	20	350	458	7.62	10	D.7.10	0.0096	3.91	770.54	24.12	5.91	0.24
D	20	350	458	7.62	11	D.7.11	0.0096	3.91	773.59	24.32	5.84	0.24
D	20	350	458	7.62	12	D.7.12	0.0096	3.91	777.25	24.55	6.03	0.25

Observed variability

mean

6.17

std. dev.

0.20

COV

0.032

COUNT 20

Model error

mean

0.257

std. dev.

0.015

COV

0.057

Table F.7 Data set 5 calculations

Target Properties				Projectile Properties						Penetration (mm)		Model Error
Identifier	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	No.	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed	
E	25	250	658	5.56	1	E.5.1	0.0040	2.78	826.33	16.89	8.12	0.48
E	25	250	658	5.56	2	E.5.2	0.0040	2.78	811.39	16.29		
E	25	250	658	5.56	3	E.5.3	0.0040	2.78	824.80	16.83	7.76	0.46
E	25	250	658	5.56	4	E.5.4	0.0040	2.78	803.47	15.97	8.12	0.51
E	25	250	658	5.56	5	E.5.5	0.0040	2.78			7.75	

E	25	250	658	5.56	6	E.5.6	0.0040	2.78	823.58	16.78	7.59	0.45
E	25	250	658	5.56	7	E.5.7	0.0040	2.78			8.98	
E	25	250	658	5.56	8	E.5.8	0.0040	2.78			8.14	
E	25	250	658	5.56	9	E.5.9	0.0040	2.78			8.08	
E	25	250	658	5.56	10	E.5.10	0.0040	2.78			8.81	
F	25	250	658	5.56	1	F.5.1	0.0040	2.78				
F	25	250	658	5.56	2	F.5.2	0.0040	2.78	804.08	16.00		
F	25	250	658	5.56	3	F.5.3	0.0040	2.78	824.50	16.82	6.43	0.38
F	25	250	658	5.56	4	F.5.4	0.0040	2.78	826.63	16.91	8.21	0.49
F	25	250	658	5.56	5	F.5.5	0.0040	2.78	822.97	16.76	8.23	0.49
F	25	250	658	5.56	6	F.5.6	0.0040	2.78	809.26	16.20	8.16	0.50
F	25	250	658	5.56	7	F.5.7	0.0040	2.78	800.42	15.85	10.07	0.64
F	25	250	658	5.56	8	F.5.8	0.0040	2.78	817.49	16.54	8.13	0.49
F	25	250	658	5.56	9	F.5.9	0.0040	2.78	809.87	16.23	8.71	0.54
F	25	250	658	5.56	10	F.5.10	0.0040	2.78	828.16	16.97	7.63	0.45

Observed variability mean 8.17 std. dev. 0.75 COV 0.092 COUNT 12

Model error mean 0.490 std. dev. 0.060 COV 0.122

Table F.8 Data set 6 calculations

Identifier	Target Properties			Projectile Properties					Penetration (mm)			Model Error
	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	No.	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed	
E	25	250	658	7.62	1	E.7.1	0.0096	3.91			6.47	
E	25	250	658	7.62	2	E.7.2	0.0096	3.91	767.50	17.80	6.76	0.38

E	25	250	658	7.62	3	E.7.3	0.0096	3.91	765.67	17.72	6.42	0.36
E	25	250	658	7.62	4	E.7.4	0.0096	3.91	776.95	18.24	6.78	0.37
E	25	250	658	7.62	5	E.7.5	0.0096	3.91	759.88	17.45	6.77	0.39
E	25	250	658	7.62	6	E.7.6	0.0096	3.91	763.53	17.62	6.47	0.37
E	25	250	658	7.62	7	E.7.7	0.0096	3.91	763.53	17.62	6.32	0.36
E	25	250	658	7.62	8	E.7.8	0.0096	3.91	767.80	17.82	6.46	0.36
E	25	250	658	7.62	9	E.7.9	0.0096	3.91	754.39	17.20	6.46	0.38
E	25	250	658	7.62	10	E.7.10	0.0096	3.91	762.92	17.59	6.20	0.35
E	25	250	658	7.62	11	E.7.11	0.0096	3.91	772.68	18.04	6.75	0.37
E	25	250	658	7.62	12	E.7.12	0.0096	3.91	765.36	17.70	6.37	0.36
F	25	250	658	7.62	1	F.7.1	0.0096	3.91			6.94	
F	25	250	658	7.62	2	F.7.2	0.0096	3.91	698.31	14.74	6.93	0.47
F	25	250	658	7.62	3	F.7.3	0.0096	3.91	761.10	17.51	6.59	0.38
F	25	250	658	7.62	4	F.7.4	0.0096	3.91	767.50	17.80	6.54	0.37
F	25	250	658	7.62	5	F.7.5	0.0096	3.91			6.74	
F	25	250	658	7.62	6	F.7.6	0.0096	3.91	709.58	15.22	6.61	0.43
F	25	250	658	7.62	7	F.7.7	0.0096	3.91	756.83	17.31	6.68	0.39
F	25	250	658	7.62	8	F.7.8	0.0096	3.91	762.62	17.58		
F	25	250	658	7.62	9	F.7.9	0.0096	3.91	772.68	18.04	6.79	0.38
F	25	250	658	7.62	10	F.7.10	0.0096	3.91				
F	25	250	658	7.62	11	F.7.11	0.0096	3.91				
F	25	250	658	7.62	12	F.7.12	0.0096	3.91				

Observed variability

mean

6.60

std. dev.

0.20

COV

0.031

Model error

mean

0.380

std. dev.

0.029

COV

0.078

COUNT

17

Table F.9 Data set 7 calculations

Target Properties				Projectile Properties						Penetration (mm)		Model Error
Identifier	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	Number	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed	
G	25	350	458	5.56	1	G.5.1	0.0040	2.78	822.36	22.50		
G	25	350	458	5.56	2	G.5.2	0.0040	2.78	815.66	22.13	8.05	0.36
G	25	350	458	5.56	3	G.5.3	0.0040	2.78	804.38	21.52	6.71	0.31
G	25	350	458	5.56	4	G.5.4	0.0040	2.78	808.95	21.77	7.22	0.33
G	25	350	458	5.56	5	G.5.5	0.0040	2.78	810.78	21.87	8.39	0.38
G	25	350	458	5.56	6	G.5.6	0.0040	2.78	804.08	21.51	7.19	0.33
G	25	350	458	5.56	7	G.5.7	0.0040	2.78	815.05	22.10	7.35	0.33
G	25	350	458	5.56	8	G.5.8	0.0040	2.78			8.39	
G	25	350	458	5.56	9	G.5.9	0.0040	2.78	817.18	22.21	7.52	0.34
G	25	350	458	5.56	10	G.5.10	0.0040	2.78	829.37	22.88	8.34	0.36
H	25	350	458	5.56	1	H.5.1	0.0040	2.78				
H	25	350	458	5.56	2	H.5.2	0.0040	2.78				
H	25	350	458	5.56	3	H.5.3	0.0040	2.78			6.38	
H	25	350	458	5.56	4	H.5.4	0.0040	2.78			7.92	
H	25	350	458	5.56	5	H.5.5	0.0040	2.78			7.32	
H	25	350	458	5.56	6	H.5.6	0.0040	2.78			6.02	
H	25	350	458	5.56	7	H.5.7	0.0040	2.78			6.90	
H	25	350	458	5.56	8	H.5.8	0.0040	2.78	821.45	22.45	6.71	0.30
H	25	350	458	5.56	9	H.5.9	0.0040	2.78	822.36	22.50	8.12	0.36
H	25	350	458	5.56	10	H.5.10	0.0040	2.78			8.52	

Observed variability

Model error

mean

mean

7.47

0.342

std. dev.

std. dev.

0.77

0.026

COV

COV

0.103

0.076

COUNT

10

Table F.10 Data set 8 calculations

Target Properties				Projectile Properties						Penetration (mm)		Model Error
Identifier	Thickness (mm)	Grade (MPa)	Yield Strength (MPa)	Calibre (mm)	No.	Identifier	Mass (kg)	Radius (mm)	Estimated Impact Velocity (m/s)	Predicted	Observed	
G	25	350	458	7.62	1	G.7.1	0.0096	3.91				
G	25	350	458	7.62	2	G.7.2	0.0096	3.91	754.69	23.14	6.17	0.27
G	25	350	458	7.62	3	G.7.3	0.0096	3.91	755.30	23.18	6.15	0.27
G	25	350	458	7.62	4	G.7.4	0.0096	3.91			6.33	
G	25	350	458	7.62	5	G.7.5	0.0096	3.91	698.00	19.80	6.06	0.31
G	25	350	458	7.62	6	G.7.6	0.0096	3.91	768.41	23.99	6.12	0.26
G	25	350	458	7.62	7	G.7.7	0.0096	3.91	773.59	24.32	6.26	0.26
G	25	350	458	7.62	8	G.7.8	0.0096	3.91	767.19	23.91	6.35	0.27
G	25	350	458	7.62	9	G.7.9	0.0096	3.91	767.50	23.93	6.04	0.25
G	25	350	458	7.62	10	G.7.10	0.0096	3.91	771.15	24.16	6.01	0.25
G	25	350	458	7.62	11	G.7.11	0.0096	3.91	768.72	24.01	5.87	0.24
G	25	350	458	7.62	12	G.7.12	0.0096	3.91	768.72	24.01	6.10	0.25
H	25	350	458	7.62	1	H.7.1	0.0096	3.91				
H	25	350	458	7.62	2	H.7.2	0.0096	3.91			6.17	
H	25	350	458	7.62	3	H.7.3	0.0096	3.91	750.12	22.86	5.95	0.26
H	25	350	458	7.62	4	H.7.4	0.0096	3.91	778.16	24.60	6.10	0.25
H	25	350	458	7.62	5	H.7.5	0.0096	3.91			5.99	
H	25	350	458	7.62	6	H.7.6	0.0096	3.91	749.21	22.81	5.77	0.25
H	25	350	458	7.62	7	H.7.7	0.0096	3.91	755.00	23.16	5.78	0.25
H	25	350	458	7.62	8	H.7.8	0.0096	3.91	746.77	22.66	5.87	0.26
H	25	350	458	7.62	9	H.7.9	0.0096	3.91	756.52	23.25	5.82	0.25
H	25	350	458	7.62	10	H.7.10	0.0096	3.91	766.28	23.86	5.75	0.24
H	25	350	458	7.62	11	H.7.11	0.0096	3.91	765.06	23.78	6.31	0.27

H	25	350	458	7.62	12	H.7.12	0.0096	3.91		COUNT	18
Observed variability		mean	6.05	std. dev.	0.19	COV	0.031				
Model error		mean	0.258	std. dev.	0.014	COV	0.055				