



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

SWEDISH ROAD ADMINISTRATION INVITATION TO PRESENT AT
NORDICWAY CONFERENCE 31 JANUARY 2008

ROAD GRIP & RUNWAY FRICTION



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

1. HISTORY OF THE RT3™
2. EQUIPMENT DESCRIPTION
3. DESIGN SPECIFICATION
4. WINTER GRIP VALUE USE
5. WET RUNWAY FRICTION
6. SUMMARY



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

HISTORY:

- IN 1995 HALLIDAY DEVELOPED THE GRIP TECHNOLOGY TO BE USED IN INDY 500 TYPE RACING LATER USED WITH KENNY BRACK
- Ohio DOT APPROACHED HALLIDAY AT THE END OF 2001 – “CAN ROAD GRIP BE MEASURED UNDER A SNOWPLOW”





RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

HISTORY:

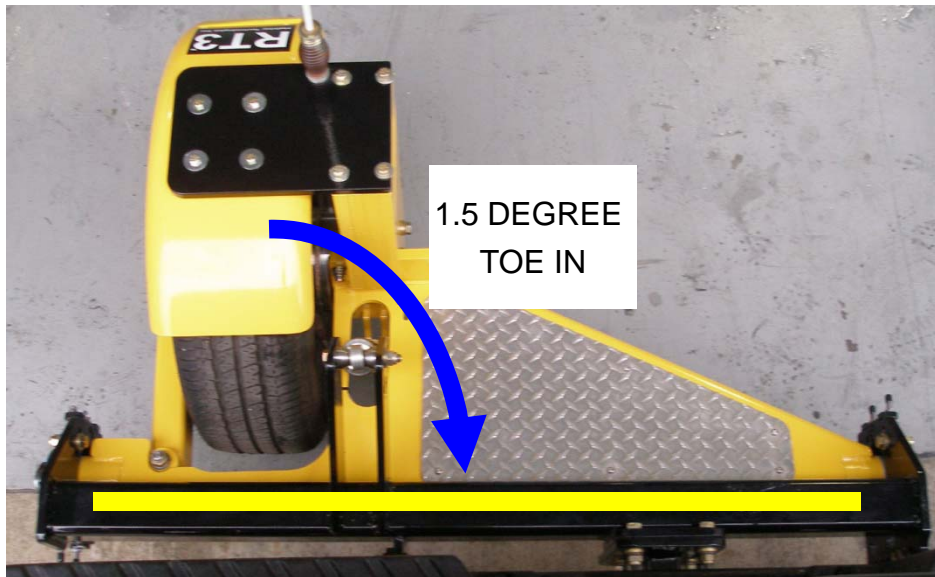
IN EARLY 2002 A PROTOTYPE
UNDER PLOW RT3™ WAS
PRODUCED AND
SUCCESSFULLY TESTED BY
OhioDOT





RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

EQUIPMENT DESCRIPTION:



- THE RT3™ MEASURES GRIP & FRICTION CONTINUOUSLY USING AN AUXILIARY WHEEL AT AN ANGLE OF 1.5 DEGREES
- THE SIDE FORCE ACTING BETWEEN SURFACE & TIRE IS MEASURED AS AN AXIAL FORCE BY THE GEM™ HUB



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

EQUIPMENT DESCRIPTION:

- THE GEM™ HUB HAS VERY LOW MECHANICAL FRICTION & IS ABLE TO DETECT VERY SMALL CHANGES IN FORCE AT THE SURFACE
- THIS METHOD IS SIMPLE
- IT IS ACCURATE, VERY REPEATABLE & EASY TO USE



SIDE FORCE (GRIP) TO AXIAL FORCE



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

Ohio DOT DESIGN SPEC.

“ GRIP/FRICTION DISPLAY OUTPUT
NEEDS TO BE SIMPLE & EASILY
UNDERSTOOD BY ALL USERS”



RT3™ DISPLAY

RT3™ UNDER A SNOWPLOW



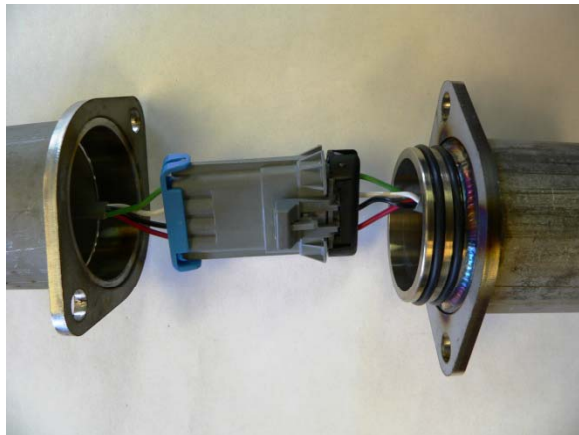
“ EQUIPMENT HAS TO
BE RUGGED”



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

Ohio DOT DESIGN SPEC.

OhioDOT: "ALL ELECTRO-MECHANICAL COMPONENTS HAVE TO OPERATE TROUBLE FREE IN HARSH WINTER CONDITIONS"



ELECTRICAL COUPLING



GEM™ HUB



HYDRAULIC MODULE



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

TWO RT3™ VERSIONS

THE RT3™ MEASURES PRIMARY GRIP VALUE CONTINUOUSLY



UNDER TRUCK MODEL – RIGHT HAND MOUNT



TOW HITCH MODEL – RIGHT HAND MOUNT



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

GRIP IS DEPENDENT ON MANY THINGS

- A. TIRE TYPE
- B. TREAD PATTERN
- C. COMPOUND
- D. CONSTRUCTION
- E. TIRE PRESSURE
- F. TREAD DEPTH
- G. SURFACE TEMPERATURE
- H. VERTICAL TIRE LOAD
- I. ROAD CONDITION etc etc

**THE RT3™ MEASURES
THE RESULT OF ALL
OF THESE**



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

WINTER GRIP VALUE USE

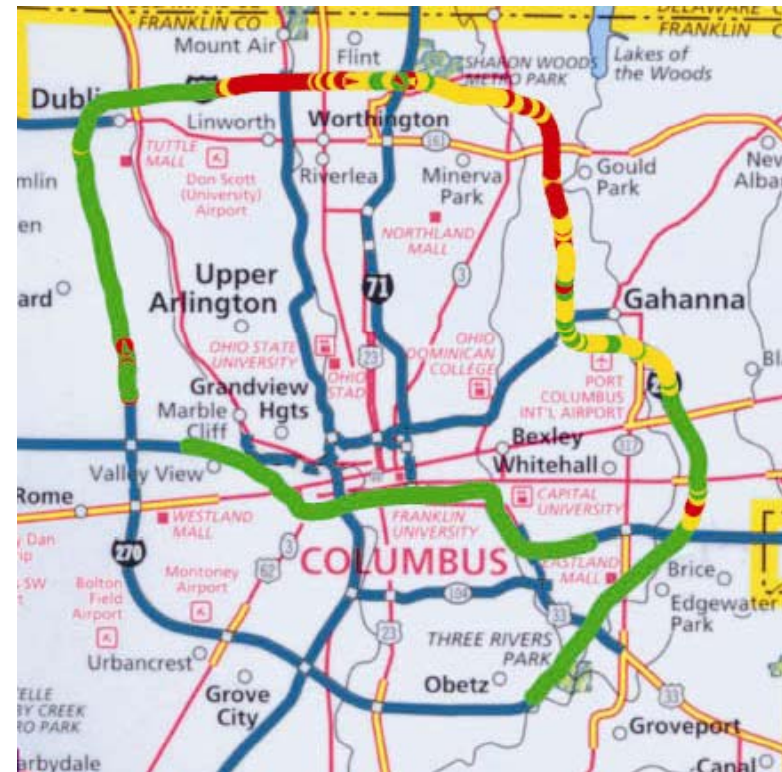
- A. MEASURE CONTRACTORS LEVEL OF PERFORMANCE
- B. USE DE-ICING MATERIAL ONLY WHEN NECESSARY
- C. OPTIMISE THE USE OF EXPENSIVE SPREADERS/PLOWS
- D. OPTIMISE THE USE OF STAFF – IMPROVE BEST PRACTICES
- E. IMPROVE THE CHANCES OF KEEPING TRAFFIC FLOWING
- F. OBTAIN SAFER CONDITIONS SOONER etc etc



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

GRIP VALUE – INDIRECT APPLICATIONS

1. FREEWAY OVERHEAD
SIGNS TO INDICATE ROAD
GRIP CONDITION SAFETY
2. INTERNET TO INDICATE
ROAD GRIP CONDITION TO
PUBLIC





RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

ROAD GRIP TESTING



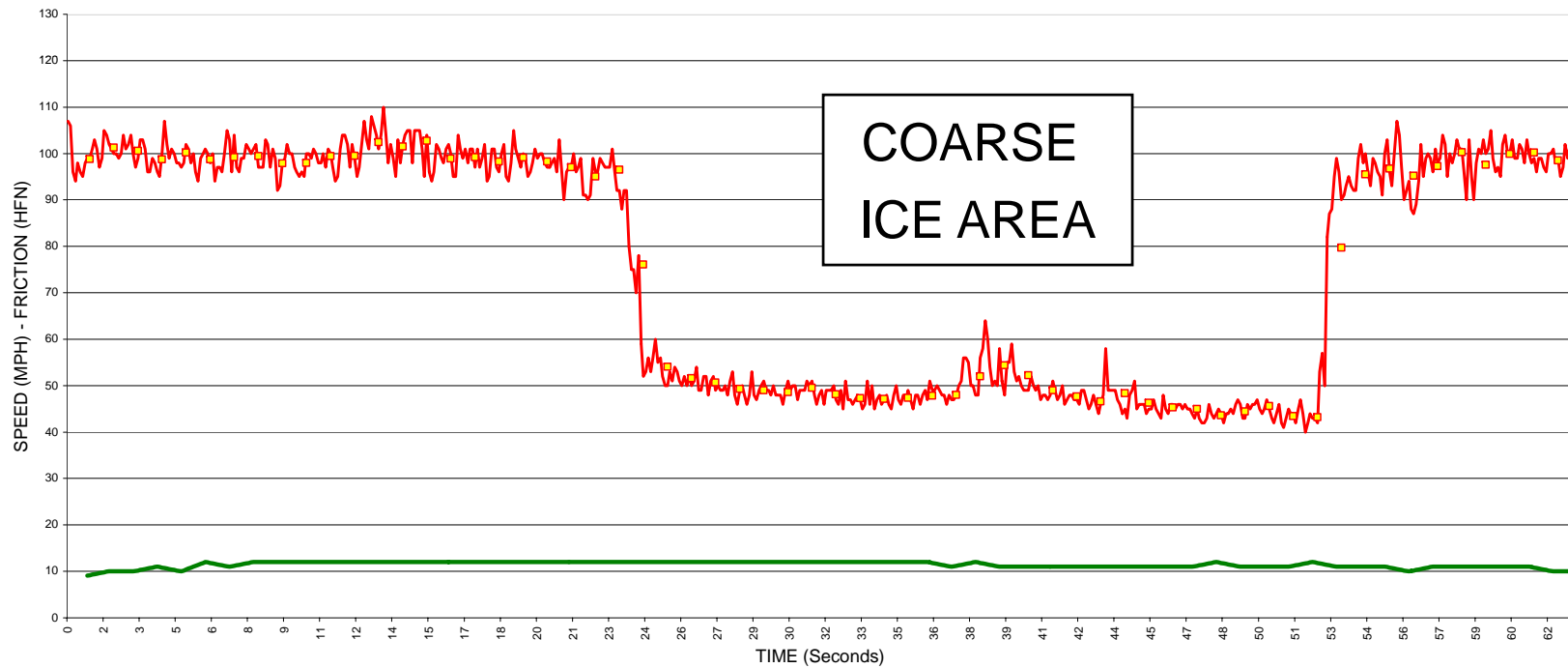
THE RT3™ CAN BE USED YEAR ROUND WORLDWIDE TO
REFERENCE RUNWAYS & ROADWAYS



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

TYPICAL ROAD GRIP TESTING RESULT

060319-TRC-SE200-9.0mm-29psi-10mph-4 BALLAST





RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

RUNWAY & WET ROAD FRICTION MEASUREMENT

THE STANDARD RT3™ TOW
HITCH VERSION CAN BE
USED TO DO THIS BY:

- ADDING A WATER SYSTEM
- CHANGING THE TIRE TYPE TO
AN UNTREADED TIRE





RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

AIRPORT RUNWAY ACCREDITATION:



IN 2007 THE RT3™ SUCCESSFULLY COMPLETED RUNWAY FRICTION TESTS AT NASA GODDARD FLIGHT CENTER IN VIRGINIA
– WE ARE CURRENTLY AWAITING F.A.A. ACCREDITATION



RT3™

ROAD GRIP & RUNWAY FRICTION MEASUREMENT

RUNWAY FRICTION



RT3™ WAS 1 OF 15 FRICTION MEASUREMENT UNITS FROM SWEDEN, CANADA, USA, RUSSIA, SCOTLAND & ENGLAND



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

2007 WALLOPS FAA RT3™ RESULTS (95kph)

RT3™ Test summary 2007 Wallops													
95 kph													
Site	Speed(Kph)	RUN 1 R	RUN 12	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9	RUN 10	10 RUN	10 RUN
RUNWAY 4/22												AVERAGE	STD DEVN
A	95kph/60mph	0.54	0.50	0.46	0.44	0.42	0.42	0.48	0.45	0.37	0.42	0.45	0.046
B	95kph/60mph	0.74	0.72	0.67	0.71	0.72	0.74	0.74	0.73	0.70	0.71	0.72	0.021
C	95kph/60mph	0.68	0.69	0.70	0.74	0.73	0.73	0.71	0.72	0.68	0.70	0.71	0.021
D	95kph/60mph	0.58	0.60	0.47	0.55	0.55	0.48	0.48	0.47	0.43	0.46	0.51	0.056
E	95kph/60mph	0.44	0.52	0.35	0.34	0.39	0.29	0.34	0.33	0.27	0.24	0.35	0.083
F	95kph/60mph	0.75	0.77	0.68	0.68	0.72	0.69	0.73	0.67	0.67	0.68	0.70	0.036
G	95kph/60mph	0.84	0.86	0.84	0.84	0.85	0.83	0.86	0.82	0.83	0.82	0.84	0.013
ECHO 1													
		RUN 1A	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6 R	RUN 7	RUN 8	RUN 9	RUN 10		
ECHO 1	95kph/60mph	0.00	0.00	0.58	0.64	0.65	0.63	0.65	0.68	0.62	0.61	0.63	0.030
EK 1	95kph/60mph	0.14	0.20	0.18	0.14	0.16	0.19	0.17	0.15	0.15	0.16	0.16	0.022
EK 2	95kph/60mph	0.55	0.72	0.70	0.68	0.63	0.69	0.65	0.59	0.60	0.55	0.64	0.063
ECHO 2													
		RUN 1 R	RUN 2 R	RUN 3	RUN 4	RUN 5	RUN 6	RUN 7	RUN 8	RUN 9 R	RUN 10		
RS 4	95kph/60mph	0.58	0.56	0.60	0.74	0.63	0.59	0.70	0.66	0.63	0.60	0.63	0.056
ECHO 2	95kph/60mph	0.54	0.53	0.52	0.55	0.55	0.54	0.55	0.56	0.58	0.55	0.55	0.015
EK 3	95kph/60mph	0.56	0.52	0.49	0.56	0.57	0.57	0.61	0.59	0.57	0.57	0.56	0.034
EK 4	95kph/60mph	0.37	0.26	0.31	0.39	0.35	0.33	0.38	0.35	0.30	0.38	0.34	0.041



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

2007 WALLOPS F.A.A. RESULTS (65kph) – ALL METERS

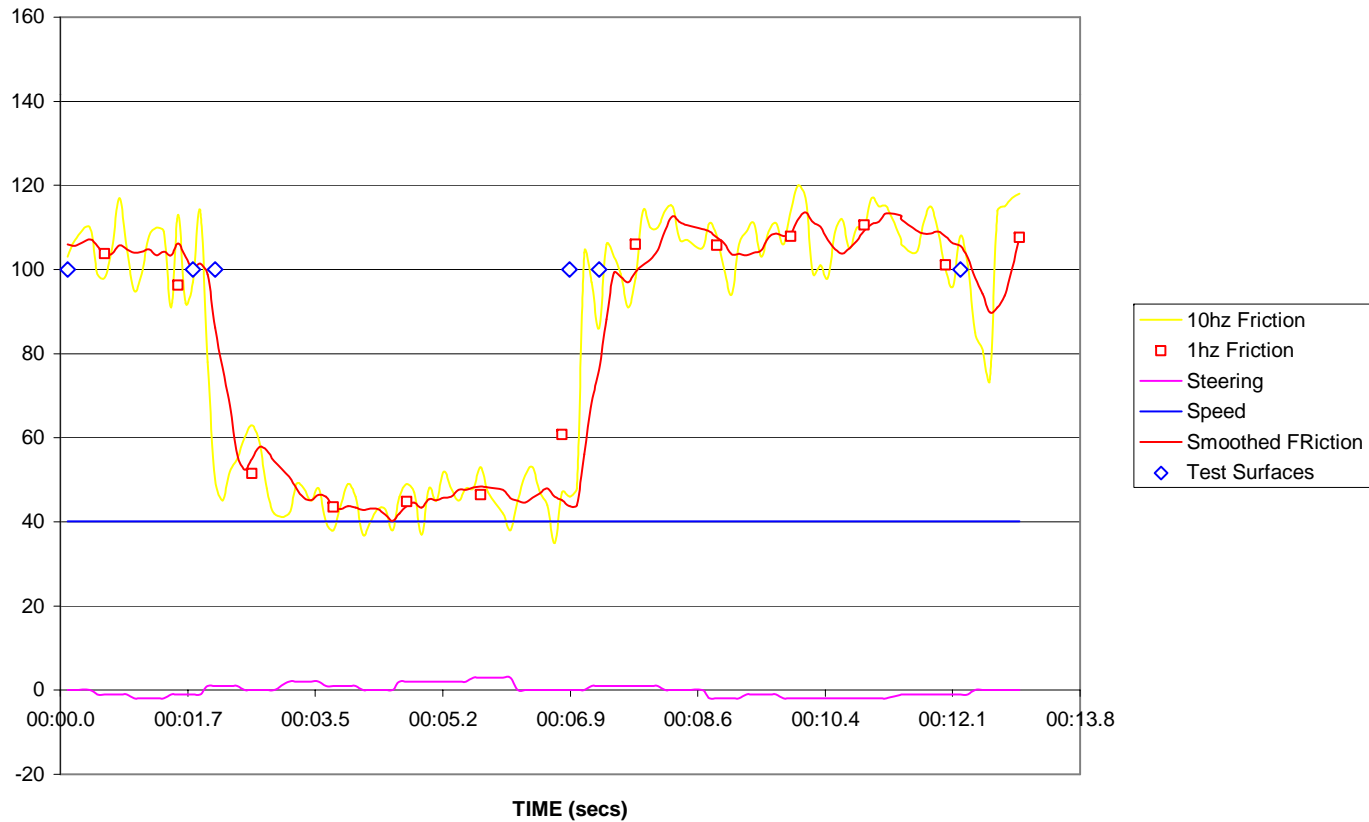
2007 WALLOPS COMPARISON - 40 MPH																											
		HALLIDAY RT3		VDOT-E274		ILLINOIS E275		TRANS CANADA		GRIP TESTER		FAA		FAA		NASA		FAA		SOUTH CAROLINA		DOUGLAS		NAC		RUSSIAN	
								SFT 85		DEPT NATL DEFENSE		SARSYS		RUNWAY FR TESTER		GRIP TESTER		BV 11		BV 11		MU METER		DFT (COFFIN)		METER	
Site	Speed (mph)	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD
A	40	0.69	0.075	29.3	3.22	29.9	4.32	0.64	0.010	0.55	0.032	0.5	0.023	0.48	0.017	0.55	0.033	0.52	0.063	0.55	0.095	0.66	0.094	0.48	0.016	0.66	0.026
B	40	0.76	0.007	56.3	0.89	58.5	2.46	0.87	0.010	0.68	0.017	0.83	0.020	0.82	0.029	0.73	0.008	0.87	0.046	0.71	0.097	0.62	0.101	0.61	0.010	0.68	0.015
C	40	0.78	0.004	53.6	2.68	59.4	2.84	0.84	0.030	0.67	0.019	0.82	0.019	0.79	0.036	0.74	0.017	0.82	0.041	0.70	0.095	0.62	0.096	0.60	0.015	0.66	0.024
D	40	0.67	0.043	31.1	2.04	34.7	4.60	0.6	0.020	0.57	0.027	0.48	0.039	0.47	0.024	0.58	0.036	0.48	0.050	0.55	0.081	0.63	0.103	0.48	0.012	0.63	0.026
E	40	0.56	0.056	37.1	4.11	29.8	2.88	0.7	0.040	0.54	0.024	0.59	0.049	0.58	0.037	0.55	0.149	0.52	0.066	0.60	0.086	0.65	0.097	0.55	0.021	0.71	0.021
F	40	0.80	0.018	60.4	2.81	55.6	9.05	0.86	0.010	0.68	0.024	0.79	0.025	0.79	0.018	0.74	0.032	0.78	0.071	0.71	0.110	0.67	0.103	0.71	0.020	0.80	0.024
G	40	0.85	0.015	67	2.78	65.2	3.58	0.95	0.010	0.77	0.021			0.92	0.022	0.84	0.030	0.90	0.073	0.77	0.113	0.68	0.096			0.82	0.021
Actual Speed				40.5		40.1		67		40.3																	
Echo 1	40	0.68	0.014	40.5	1.89	42.2	1.48	0.71	0.030	0.57	0.030	0.59	0.035	0.80	0.044	0.55	0.028	0.63	0.129			0.61	0.012	0.53	0.034		
EK 1	40	0.32	0.022	16.6	1.19	14.2	1.48	0.36	0.050	0.23	0.026	0.22	0.031	0.41	0.064	0.17	0.018	0.22	0.040			0.58	0.013	0.34	0.024		
EK 2	40	0.70	0.016	39.4	1.49	35.3	2.58	0.78	0.040	0.61	0.032	0.65	0.040	0.83	0.037	0.64	0.040	0.66	0.040			0.58	0.019	0.61	0.034		
Actual Speed				38.5		41.1		66		38.9																	
R 4	40	0.72	0.014	32.4	3.17	28.7	2.87	0.62	0.020	0.51	0.035	0.45	0.028	0.67	0.038	0.50	0.035	0.57	0.055	0.63	0.046	0.73	0.083	0.53	0.023	0.50	0.017
Echo 2	40	0.68	0.034	43.1	3.11	40.3	2.00	0.7	0.030	0.55	0.033	0.61	0.028	0.84	0.030	0.63	0.054	0.61	0.043	0.38	0.092	0.70	0.074	0.57	0.020	0.65	0.034
EK 3	40	0.68	0.022	30.6	2.67	30	5.94	0.69	0.030	0.54	0.061	0.5	0.040	0.75	0.047	0.59	0.040	0.57	0.060	0.72	0.064	0.72	0.097	0.51	0.024	0.72	0.041
EK 4	40	0.55	0.026	21.7	2.60	23	6.38	0.57	0.030	0.45	0.021	0.45	0.058	0.68	0.047	0.39	0.040	0.44	0.036	0.68	0.056	0.68	0.062	0.47	0.021	0.60	0.035
Actual Speed				39.2		40.3		68																			



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

TYPICAL RUNWAY FRICTION TESTING RESULT

ECHO 1 40MPH RUN 8





RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

2007 WALLOPS F.A.A. RESULTS (95kph) – ALL METERS

2007 WALLOPS COMPARISON - 60 MPH																											
		HALLIDAY RT3		VDOT-E274		ILLINOIS E275		TRANS CANADA		GRIP TESTER		FAA		FAA		NASA		FAA		SOUTH CAROLINA		DOUGLAS		NAC		RUSSIAN	
								SFT 85		DEPT NATL DEFENSE		SARSYS		RUNWAY FR TESTER		GRIP TESTER		BV 11		BV 11		MU METER		DFT (COFFIN)		METER	
Site	Speed (mph)	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD	AVERAGE	SD
A	60	0.49	0.036	19.2	2.77	30.3	5.47	0.49	0.020	0.4	0.105	0.39	0.033	0.36	0.032	0.40	0.042	0.34	0.027	0.49	2 RUNS	0.80	0.022	0.51		0.65	0.014
B	60	0.72	0.025	54.2	0.96	51.9	1.37	0.8	0.010	0.63	0.070	0.74	0.028	0.74	0.022	0.71	0.032	0.75	0.020	0.65	2 RUNS	0.78	0.058	0.60		0.64	0.010
C	60	0.68	0.019	49.8	10.34	50.6	0.70	0.78	0.020	0.63	0.043	0.71	0.039	0.71	0.023	0.71	0.030	0.71	0.025	0.68	2 RUNS	0.75	0.066	0.59		0.64	0.019
D	60	0.50	0.044	25.2	4.53	36.3	2.75	0.47	0.020	0.41	0.109	0.37	0.044	0.32	0.019	0.44	0.025	0.30	0.043	0.44	2 RUNS	0.73	0.079	0.51		0.62	0.022
E	60	0.35	0.048	33.7	13.33	27.3	5.92	0.48	0.040	0.31	0.168	0.45	0.050	0.36	0.042	0.32	0.046	0.32	0.034	0.50	2 RUNS	0.70	0.071	0.58		0.73	0.023
F	60	0.70	0.031	49.2	6.10	45.4	2.97	0.71	0.030	0.51	0.130	0.68	0.041	0.59	0.031	0.49	0.058	0.60	0.038	0.72	2 RUNS	0.68	0.081	0.65		0.77	0.017
G	60	0.84	0.013	53	2.18	51.8	2.33	0.85	0.020	0.62	0.091			0.74	0.028	0.62	0.077	0.78	0.027	0.70	2 RUNS	0.66	0.093		0.77	0.019	
Actual Speed				60.8		60.2		97																			
Echo 1	60	0.64	0.019	35.4	9.66	33.7	4.31	0.52	0.020	0.36	0.030	0.44	0.019	0.63	0.034	0.41	0.020	0.43	0.072			0.66	0.095	0.45	0.026		
EK 1	60	0.17	0.020	8.9	1.98	8.2	1.79	0.17	0.010	0.12	0.011	0.1	0.017	0.28	0.029	0.10	0.007	0.09	0.010			0.68	0.091	0.32	0.024		
EK 2	60	0.64	0.055	33.1	3.97	25.2	1.62	0.58	0.030	0.39	0.033	0.5	0.022	0.67	0.034	0.48	0.038	0.44	0.059			0.61	0.064	0.51	0.026		
Actual Speed				59.2		59.8		94		60																	
R 4	60	0.63	0.040	28.5	2.73	27.7	1.06	0.47	0.020			0.35	0.019	0.58	0.019	0.39	0.021	0.39	0.014			0.68	0.076	0.43	0.170	0.46	0.025
Echo 2	60	0.56	0.013	30.7	1.94	41		0.52	0.030			0.48	0.049	0.68	0.036	0.41	0.007	0.39	0.014			0.68	0.068	0.47	0.024	0.68	0.014
EK 3	60	0.57	0.031	22.8	2.15	33.7	2.71	0.5	0.020			0.39	0.067	0.58	0.045	0.43	0.030	0.36	0.028			0.66	0.073	0.35	0.116	0.75	0.023
EK 4	60	0.34	0.032	13.4	5.10	10.3	0.95	0.37	0.020			0.28	0.022	0.47	0.023	0.22	0.023	0.27	0.027			0.63	0.040	0.35	0.122	0.66	0.027
Actual Speed				59.5		59.5		96																			



RT3™ ROAD GRIP & RUNWAY FRICTION MEASUREMENT

QUESTIONS & COMMENTS?