7 CATERING ROAD WEST
HONG KONG INTERNATIONAL AIRPORT, LANTAU, HONG KONG

PERFORMANCE REVIEW ON EASYROLLER

BACKGROUND INFORMATION

FMC brand loaders have been supplied with aluminum rollers for the past 20 years and in more recent times the equivalent Guangtai loaders have also adopted this product. In an effort to embrace new technology an alternative nylon product Easyroll has been placed on trial within GSEL dating back to 2008 initially on Commander 30 14,000kg main deck loaders. The trial of the product, a photograph of which is shown below, was extended to include the higher operational usage but lighter weight 7,000 kg lower deck units in 2011.

The installation records are shown in the table below.

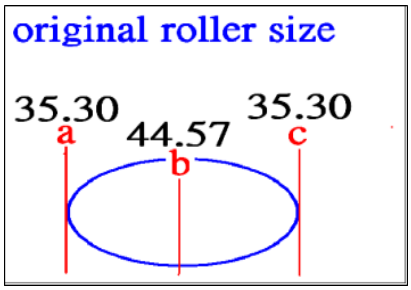
INSTALLATION RECORDS

AA number	Type of equipment	Installation		Quantity of rollers	Job number	Engine hour operated (up to 31-7-2012)
		Date	Engine hour			
HAS00207	Lower deck	19-05-2011	29818	672	S11041589	2628
HAS00012	Lower deck	19-01-2012	18980	576	S11121157	1229
HAS01855	Main deck	29-05-2012	6066	720	S12050211	335
JAT00099	Main deck	01-04-2009	17701	1032	S09020914	6708
JAT00510	Main deck	08-04-2008	2606	1680	A98194	8460
JAT00511	Main deck	29-11-2011	4329	720	S11111885	446

TRIAL METHODOLOGY

To provide a representative test protocol one roller from each yellow highlighted positional node on the main platform, as shown in the diagram below, was selected for measurement. The selected nodes have been carefully chosen to give a full representation of the primary areas of the main platform.

細台 Bridge platform									
前大台 Front part of mainplatform (not easyroller)									
後大台 Rear part of mainplatform (using easyroller)									
12A	12B	12C	12D	12E	12F	12G	12H	12I	12J
11A	11B	11C	11D	11E	11F	11G	11H	11I	11J
10A	10B	10C	10D	10E	10F	10G	10H	10I	10J
9A	9B	9C	9D	9E	9F	9G	9H	9I	9J
8A	8B	8C	8D	8E	8F	8G	8H	8I	8J
7A	7B	7C	7D	7E	7F	7G	7H	7I	7J
6A	6B	6C	6D	6E	6F	6G	6H	6I	6J
5A	5B	5C	5D	5E	5F	5G	5H	5I	5J
4A	4B	4C	4D	4E	4F	4G	4H	4I	4J
3A	3B	3C	3D	3E	3F	3G	3H	3I	3J
2A	2B	2C	2D	2E	2F	2G	2H	2I	2J
1A	1B	1C	1D	1E	1F	1G	1H	1I	1J



For each of the 6 units placed under test roller the diameter of the roller in the middle part and both ends as shown in the above diagram were taken, both at the time of installation and at subsequent regular intervals. By way of example the resulting measurements for one

each of the lower deck 7,000 kg and main deck 14,000 kg loaders are appended to this report, and were found to be consistent for all of the trial units.

Discussions with Ramp Handling operators determined minimum roller dimensions for satisfactory load transfer at the three measurement points as 27.65mm at points a and c, plus 41.82mm at the central point b.

The photo shows the Easyroll product as installed on HAS00207.

TRIAL RESULTS

The sample data included at the end of this report covers one lower deck 7,000 kg loader and one 14,000 kg main deck loader however the results were found to be consistent for the other trial units.

Without any information to the contrary it has been assumed that a linear wear pattern occurs in order to estimate the likely useful lifetime of the Easyroll. In the case of Hong Kong airport typical usage levels of 1,500 operational engine hours per annum for the 14,000 kg units and 2,500 for the 7,000 kg units have been taken.

Extrapolation of the trial results indicate a projected lifetime of the Easyroll of 7 years or 10,500 operational hours for the 14,000 kg units. For the 7,000 kg units the projected lifetime is 13 years or 32,500 operational hours.

Discussions with the end user have confirmed that from an operator perspective there is no noticeable difference between the aluminum and Easyroll product.

It can be concluded that Easyroll is durable and suitable for the operation at Hong Kong International Airport.

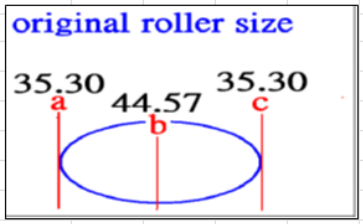
地勤設備工程有限公司
GROUND SUPPORT ENGINEERING LIMITED

Report no.: TR-15-12

Report Date: 8 Aug 2012

JAT00510 Weihai GaungTai WGSJT14

29-Oct-11 Hour meter 5290hr



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3A	3B	3C	3D	3E	3F	3G	3H	3I	3J
2A	2B	2C	2D	2E	2F	2G	2H	2I	2J
1A	1B	1C	1D	1E	1F	1G	1H	1I	1J

	Installation			First measurement			Operational Hours		
Hourmeter (hr)	5290			5864			574		
Date	29-Oct-11			07-Aug-12					
Location	Diameter at (mm)			Diameter at (mm)			Diameter at (mm)		
	a	b	c	a	b	c	a	b	c
1B	35.30	44.57	35.30	35.18	44.57	35.30	0.12	0.00	0.00
1I	35.30	44.57	35.30	35.22	44.54	35.21	0.08	0.03	0.09
2C	35.30	44.57	35.30	34.49	44.57	35.17	0.81	0.00	0.13
2H	35.30	44.57	35.30	34.86	44.57	34.54	0.44	0.00	0.76
3D	35.30	44.57	35.30	34.96	44.55	34.98	0.34	0.02	0.32
3G	35.30	44.57	35.30	34.82	44.50	34.65	0.48	0.07	0.65
4E	35.30	44.57	35.30	35.30	44.57	34.80	0.00	0.00	0.50
4F	35.30	44.57	35.30	35.10	44.56	35.23	0.20	0.01	0.07
6E	35.30	44.57	35.30	34.95	44.57	34.76	0.35	0.00	0.54
6F	35.30	44.57	35.30	34.57	44.57	34.95	0.73	0.00	0.35
7B	35.30	44.57	35.30	35.16	44.56	35.15	0.14	0.01	0.15
7I	35.30	44.57	35.30	34.32	44.57	35.09	0.98	0.00	0.21
8C	35.30	44.57	35.30	34.98	44.57	35.00	0.32	0.00	0.30
8H	35.30	44.57	35.30	35.30	44.57	34.89	0.00	0.00	0.41
9D	35.30	44.57	35.30	35.18	44.56	34.81	0.12	0.01	0.49
9G	35.30	44.57	35.30	34.79	44.55	34.90	0.51	0.02	0.40
10D	35.30	44.57	35.30	34.88	44.54	34.53	0.42	0.03	0.77
10G	35.30	44.57	35.30	34.76	44.55	35.00	0.54	0.02	0.30
11C	35.30	44.57	35.30	34.52	44.57	34.36	0.78	0.00	0.94
11H	35.30	44.57	35.30	34.53	44.57	34.50	0.77	0.00	0.80
12B	35.30	44.57	35.30	35.11	44.53	35.18	0.19	0.04	0.12
12I	35.30	44.57	35.30	34.53	44.56	35.30	0.77	0.01	0.00
Average	**35.30**	**44.57**	**35.30**	**34.89**	**44.56**	**34.92**	**0.4132**	**0.0123**	**0.3773**
Average Wear per 1000 engine hours							0.7198	0.0214	0.6573
Minimum diameter for operation							27.65	41.82	27.65
Hours for roller wear to the minimum diameter							10,628	128,619	11,639
Project lifetime (1000hrs)							10,628		
Average operation hour per year (1000hrs)							1,500		
Project lifetime (years)							7.0850		

GSEL 地勤設備工程有限公司 GROUND SUPPORT ENGINEERING LIMITED

Report no.: TR-15-12

Report Date: 8 Aug 2012

HAS 00207 FMC COMMANDER 15

19-May-11 Hour meter 29819hr

FRONT 車 頭

14A	14B	14C	14D	14E	14F	14G	14H
13A	13B	13C	13D	13E	13F	13G	13H
12A	12B	12C	12D	12E	12F	12G	12H
11A	11B	11C	11D	11E	11F	11G	11H
10A	10B	10C	10D	10E	10F	10G	10H
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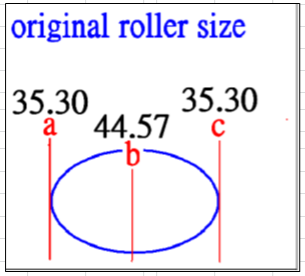
1A	1B	1C	1D	1E	1F	1G	1H



	Installation			First measurement			Second measurement			Third measurement			Fourth measurement			Operational Hours		
Hourmeter (hr)	29819			29995.2			30178			30388.3			32484			2665		
Date	19-May-11			23-Jun-11			22-Jul-11			24-Aug-11			06-Aug-12					
	Diameter at (mm)			Diameter at (mm)			Diameter at (mm)			Diameter at (mm)			Diameter at (mm)			Diameter at (mm)		
Location	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1B	35.30	44.57	35.30	34.13	44.53	34.26	33.93	44.54	33.87	33.92	44.56	33.60	34.51	44.54	34.03	0.79	0.03	1.27
1G	35.30	44.57	35.30	35.30	44.55	34.70	34.95	44.53	34.31	35.30	44.57	34.46	34.99	44.57	35.19	0.31	0.00	0.11
2C	35.30	44.57	35.30	35.30	44.55	34.39	34.75	44.54	34.53	35.00	44.43	34.64	34.38	44.53	34.59	0.92	0.04	0.71
2F	35.30	44.57	35.30	34.29	44.57	34.77	33.61	44.57	34.59	34.66	44.54	34.52	34.12	44.50	34.16	1.18	0.07	1.14
3D	35.30	44.57	35.30	34.10	44.57	34.84	33.53	44.57	34.42	34.15	44.57	34.84	34.57	44.57	35.00	0.73	0.00	0.30
3E	35.30	44.57	35.30	34.89	44.56	34.10	34.70	44.40	34.10	34.87	44.57	34.79	34.79	44.45	34.39	0.51	0.12	0.91
4D	35.30	44.57	35.30	34.67	44.51	34.76	34.66	44.55	34.63	33.86	44.57	34.77	34.41	44.44	34.62	0.89	0.13	0.68
4E	35.30	44.57	35.30	34.68	44.55	34.88	35.05	44.57	34.49	34.68	44.48	34.89	34.16	44.42	34.72	1.14	0.15	0.58
5C	35.30	44.57	35.30	34.91	44.51	35.30	34.76	44.54	34.57	34.61	44.42	34.55	34.35	44.50	35.00	0.95	0.07	0.30
5F	35.30	44.57	35.30	34.94	43.59	34.74	34.82	44.50	35.01	34.67	44.50	34.58	34.74	44.53	34.45	0.56	0.04	0.85
6B	35.30	44.57	35.30	34.99	44.56	35.10	34.67	44.51	34.87	34.80	44.55	34.42	35.00	44.55	35.03	0.30	0.02	0.27
6G	35.30	44.57	35.30	34.33	44.55	34.26	33.84	44.57	33.97	34.38	44.57	35.30	34.57	44.55	34.59	0.73	0.02	0.71
7A	35.30	44.57	35.30	34.78	44.57	35.09	34.56	44.55	34.73	35.30	44.57	35.04	35.04	44.57	34.74	0.26	0.00	0.56
7H	35.30	44.57	35.30	34.81	44.57	35.10	34.61	44.55	34.31	34.77	44.55	34.48	34.83	44.56	34.49	0.47	0.01	0.81
9C	35.30	44.57	35.30	34.78	44.55	34.77	34.64	44.55	34.70	34.69	44.55	34.77	35.03	44.56	34.96	0.27	0.01	0.34
9F	35.30	44.57	35.30	34.80	44.56	35.00	34.47	44.55	34.67	34.77	44.54	34.74	34.95	44.51	34.94	0.35	0.06	0.36
11D	35.30	44.57	35.30	33.73	44.54	34.92	34.00	44.45	34.80	35.20	44.52	35.30	35.16	44.57	34.85	0.14	0.00	0.45
11E	35.30	44.57	35.30	34.14	44.57	35.11	34.72	44.56	34.16	34.40	44.56	34.54	34.31	44.56	34.64	0.99	0.01	0.66
13B	35.30	44.57	35.30	34.58	44.57	34.93	34.57	44.52	34.71	35.30	44.57	34.58	35.30	44.57	35.11	0.00	0.00	0.19
13G	35.30	44.57	35.30	33.92	44.55	34.38	34.01	44.55	34.61	35.27	44.55	35.08	35.30	44.57	35.30	0.00	0.00	0.00
Average	**35.30**	**44.57**	**35.30**	**34.60**	**44.50**	**34.77**	**34.44**	**44.53**	**34.50**	**34.73**	**44.54**	**34.69**	**34.73**	**44.53**	**34.74**	**0.5745**	**0.0390**	**0.5600**
Average Wear per 1000 engine hours																0.2156	0.0146	0.2101
Minimum diameter for operation																27.67	41.82	27.67
Hours for roller wear to the minimum diameter																32,750	185,662	33,429
Project lifetime (1000hrs)																32,750		
Average operation hour per year (1000hrs)																2,500		
Project lifetime (years)																13.10		