

Annex C

Detailed Calculations of Operational Noise Levels

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Day-time)

Date: 19 Nov., 2009
Time: 14:16 - 15:31
Location: Wayson Commercial Building (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level at Wayson Commercial Building (with correction for shielding effect at Talon Tower)			
						LAeq	LA10	LA90	LAMax
1	AW139	E	14:21	Approach	67	76	76	75	82
		-		Hovering	23	77	77	82	
		-		Idling	555	73	73	81	
		E	14:32	Take-off	58	76	76	75	80
2	AW139	E	14:49	Approach	68	74	74	74	80
		-		Hovering	21	76	76	79	
		-		Idling	709	73	74	81	
		E	15:02	Take-off	70	76	76	75	83
3	AW139	E	15:19	Approach	92	75	75	74	81
		-		Hovering	22	75	76	84	
		-		Idling	574	74	74	81	
		E	15:30	Take-off	57	76	76	75	81

Remark: * E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.

(B). Measured Background Noise level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	72	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	72	
3	73	

(C). Correction Factor for Distance Attenuation

Distance Attenuation, dB(A)
-0.6

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Noise Level at Talon Tower
						LAMax [®]
1	AW139	E	14:21	Approach	67	81
		-		Hovering	23	81
		-		Idling	555	79
		E	14:32	Take-off	58	79
2	AW139	E	14:49	Approach	68	79
		-		Hovering	21	78
		-		Idling	709	79
		E	15:02	Take-off	70	82
3	AW139	E	15:19	Approach	92	80
		-		Hovering	22	83
		-		Idling	574	80
		E	15:30	Take-off	57	80

Highest Lmax level, dB(A): 83

Remark: ## E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.
 ® Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Evening-time)

Date: 19 Nov., 2009
 Time: 19:00 - 23:00
 Location: Wayson Commercial Building (roof level)
 Weather:
 Condition: Fine

(A). Measured Helicopter Noise Data (with background)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level at Wayson Commercial Building (with correction for shielding effect at Talon Tower)		
						LAeq	LA10	LA90
1	AW139	-	19:00	Approach **	-	0	0	0
		-		Hovering **	-	0	0	0
		-		Idling	-	0	0	0
		E		Take-off	66	73	73	72
2	AW139	W	19:24	Approach	65	77	77	76
		-		Hovering	19	76	77	76
		-		Idling	667	73	73	72
		E		Take-off	70	72	72	72
3	AW139	W	20:02	Approach	69	71	72	71
		-		Hovering	18	73	73	72
		-		Idling	138	73	73	72
		E		Take-off	67	73	73	72
4	AW139	W	20:24	Approach	72	75	75	74
		-		Hovering	18	72	73	71
		-		Idling	186	72	72	71
		E		Take-off	65	73	73	72
5	AW139	W	20:51	Approach	70	75	76	75
		-		Hovering	17	74	75	73
		-		Idling	493	71	72	71
		E		Take-off	60	73	73	72
6	AW139	W	21:20	Approach	68	76	76	75
		-		Hovering	24	72	72	71
		-		Idling	543	71	72	71
		E		Take-off	61	79	80	78
7	AW139	W	21:50	Approach	71	75	76	74
		-		Hovering	20	73	73	72
		-		Idling	475	71	71	71
		E		Take-off	63	75	75	74
8	AW139	W	22:16	Approach	68	75	75	74
		-		Hovering	19	73	74	73
		-		Idling	833	71	71	71
		E		Take-off	64	72	72	71
9	AW139	W	22:48	Approach	68	75	75	74
		-		Hovering	19	74	75	74
		-		Idling	388	71	71	70
		E		Take-off	70	71	72	71

Remark: * E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.
 ** Evening-time Noise measurement was commenced at 19:00. Thus, noise data before this time is not available.

(B). Measured Background Noise level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	73	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	72	
3	71	
4	71	
5	70	
6	70	
7	71	
8	71	
9	70	

(C). Correction Factor for Distance Attenuation

Distance Attenuation, dB(A)
-0.6

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Noise Level at Talon Tower
						L _{Aeq} @
1	AW139	-	19:00	Approach **	-	-
		-		Hovering **	-	-
		-		Idling	-	-
		E		Take-off	66	62
2	AW139	W	19:24	Approach	65	74
		-		Hovering	19	74
		-	19:37	Idling	667	64
		E		Take-off	70	58
3	AW139	W	20:02	Approach	69	59
		-		Hovering	18	67
		-	20:06	Idling	138	67
		E		Take-off	67	67
4	AW139	W	20:24	Approach	72	72
		-		Hovering	18	66
		-	20:29	Idling	186	64
		E		Take-off	65	67
5	AW139	W	20:51	Approach	70	73
		-		Hovering	17	72
		-	21:01	Idling	493	65
		E		Take-off	60	68
6	AW139	W	21:20	Approach	68	73
		-		Hovering	24	64
		-	21:31	Idling	543	62
		E		Take-off	61	78
7	AW139	W	21:50	Approach	71	72
		-		Hovering	20	68
		-	21:59	Idling	475	59
		E		Take-off	63	72
8	AW139	W	22:16	Approach	68	72
		-		Hovering	19	69
		-	22:31	Idling	833	57
		E		Take-off	64	65
9	AW139	W	22:48	Approach	68	72
		-		Hovering	19	72
		-	22:56	Idling	388	61
		E		Take-off	70	64

Leq(4-hrs), dB(A): 62

Remark: ## E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.
 @ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Day-time)

Date: 19 Nov., 2009
Time: 16:15 - 17:31
Location: Wing On Centre (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level at Wing On Centre (with correction for shielding effect at The Bauhinia)			
						LAeq	LA10	LA90	LAMax
1	AW139	W	16:20	Approach	35	72	72	71	75
		-		Hovering	23	74	74	77	
		-		Idling	517	71	71	70	
		E	16:29	Take-off	49	71	71	70	74
2	AW139	W	16:49	Approach	49	72	72	71	75
		-		Hovering	34	73	73	77	
		-		Idling	754	71	72	71	
		E	17:03	Take-off	65	73	73	72	80
3	AW139	W	17:15	Approach	77	71	72	70	74
		-		Hovering	25	72	73	72	
		-		Idling	817	69	70	69	
		E	17:30	Take-off	61	71	71	71	79

Remark: * E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.

(B). Measured Background Noise level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	70	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	71	
3	68	

(C). Correction Factor for Distance Attenuation

Distance Attenuation, dB(A)
0.4

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Noise Level at The Bauhinia
						LAMax @
1	AW139	W	16:20	Approach	35	74
		-		Hovering	23	77
		-		Idling	517	75
		E	16:29	Take-off	49	72
2	AW139	W	16:49	Approach	49	74
		-		Hovering	34	76
		-		Idling	754	75
		E	17:03	Take-off	65	80
3	AW139	W	17:15	Approach	77	73
		-		Hovering	25	75
		-		Idling	817	77
		E	17:30	Take-off	61	79

Highest Lmax level, dB(A): 80

Remark: ## E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.

@ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Evening-time)

Date: 19 Nov., 2009
 Time: 19:00 - 23:00
 Location: Wing On Centre (roof level)
 Weather:
 Condition: Fine

(A). Measured Helicopter Noise Data (with background)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level at Wing On Centre (with correction for shielding effect at The Bauhinia)		
						LAeq	LA10	LA90
1	AW139	-	19:00	Approach **	-	0	0	0
		-		Hovering **	-	0	0	0
		-		Idling **	-	0	0	0
		E		Take-off	66	68	68	68
2	AW139	W	19:24	Approach	65	70	71	70
		-		Hovering	19	73	72	72
		-	19:37	Idling	667	70	71	69
		E		Take-off	70	70	70	70
3	AW139	W	20:02	Approach	69	69	69	68
		-		Hovering	18	68	68	67
		-	20:06	Idling	138	72	73	71
		E		Take-off	67	70	71	69
4	AW139	W	20:24	Approach	72	71	71	70
		-		Hovering	18	71	71	70
		-	20:29	Idling	186	68	68	68
		E		Take-off	65	69	70	69
5	AW139	W	20:51	Approach	70	68	68	67
		-		Hovering	17	72	73	72
		-	21:01	Idling	493	67	67	67
		E		Take-off	60	67	67	66
6	AW139	W	21:20	Approach	68	68	68	67
		-		Hovering	24	72	72	71
		-	21:31	Idling	544	67	67	66
		E		Take-off	60	69	70	69
7	AW139	W	21:50	Approach	71	69	70	69
		-		Hovering	20	71	71	70
		-	21:59	Idling	475	67	67	66
		E		Take-off	63	68	68	67
8	AW139	W	22:16	Approach	68	69	70	68
		-		Hovering	19	73	74	73
		-	22:31	Idling	833	67	67	66
		E		Take-off	64	69	69	68
9	AW139	W	22:48	Approach	68	68	69	68
		-		Hovering	19	72	72	72
		-	22:56	Idling	388	67	67	67
		E		Take-off	70	66	66	65

Remark: * E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.
 ** Evening-time Noise measurement was commenced at 19:00. Thus, noise data before this time is not available.

(B). Measured Background Noise level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	68	
2	68	
3	67	
4	66	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
5	65	
6	65	
7	66	
8	65	
9	65	

(C). Correction Factor for Distance Attenuation

Distance Attenuation, dB(A)
0.4

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Noise Level at The Bauhinia
						L _{Aeq} ®
1	AW139	-	19:00	Approach **	-	-
				Hovering **	-	-
				Idling **	-	-
		E		Take-off	66	59
2	AW139	W	19:24	Approach	65	66
				Hovering	19	71
				Idling	667	66
		E		Take-off	70	66
3	AW139	W	20:02	Approach	69	64
				Hovering	18	60
				Idling	138	71
		E		Take-off	67	68
4	AW139	W	20:24	Approach	72	69
				Hovering	18	70
				Idling	186	65
		E		Take-off	65	67
5	AW139	W	20:51	Approach	70	65
				Hovering	17	72
				Idling	493	63
		E		Take-off	60	61
6	AW139	W	21:20	Approach	68	64
				Hovering	24	71
				Idling	544	62
		E		Take-off	60	67
7	AW139	W	21:50	Approach	71	67
				Hovering	20	69
				Idling	475	55
		E		Take-off	63	62
8	AW139	W	22:16	Approach	68	67
				Hovering	19	73
				Idling	833	62
		E		Take-off	64	66
9	AW139	W	22:48	Approach	68	66
				Hovering	19	72
				Idling	388	64
		E		Take-off	70	60

Leq(4-hrs), dB(A): 60

Remark: ## E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.
 ® Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Day-time)

Date: 20 Nov., 2009
Time: 16:48 - 17:33
Location: Seaview Commercial Building (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level at Seaview Comm. Bldg.			
						LAeq	LA10	LA90	LAMax
1	AW139	EW	16:53	Approach	72	73	74	73	77
		-		Hovering	21	75	75	74	79
		-		Idling	609	72	73	72	80
		EW	17:05	Take-off	67	74	75	74	81
2	AW139	WE	17:21	Approach	59	76	76	75	83
		-		Hovering	16	72	73	72	74
		-		Idling	585	73	73	72	78
		EW	17:32	Take-off	55	72	72	72	75

Remark: * EW - Flight direction from East to West; WE - Flight direction from West to East.

(B). Measured Background Noise level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	72	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	72	

(C). Correction Factor for Distance Attenuation

Distance Attenuation, dB(A)
0.9

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Noise Level at Ka On Bldg.
						LAMax [®]
1	AW139	EW	16:53	Approach	72	76
		-		Hovering	21	79
		-		Idling	609	80
		EW	17:05	Take-off	67	81
2	AW139	WE	17:21	Approach	59	83
		-		Hovering	16	71
		-		Idling	585	78
		EW	17:32	Take-off	55	72

Highest Lmax level, dB(A): **83**

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.
[®] Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Evening-time)

Date: 20 Nov., 2009
 Time: 19:00 - 23:00
 Location: Seaview Commercial Building (roof level)
 Weather
 Condition: Fine

(A). Measured Helicopter Noise Data (with background)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level at Seaview Comm. Bldg.		
						LAeq	LA10	LA90
1	AW139	-	19:02	Approach **	0	0	0	0
		-		Hovering **	0	0	0	0
		-		Idling	153	72	72	71
		W		Take-off	69	72	73	72
2	AW139	E	19:27	Approach	63	72	72	71
		-		Hovering	25	73	73	72
		-		Idling	389	71	72	71
		W		Take-off	70	73	74	72
3	AW139	W	20:29	Approach	65	75	75	74
		-		Hovering	24	72	73	71
		-		Idling	439	70	71	70
		W		Take-off	74	72	72	71
4	AW139	W	20:50	Approach	56	76	76	75
		-		Hovering	17	74	75	73
		-		Idling	426	70	70	69
		W		Take-off	69	72	73	71
5	AW139	W	21:25	Approach	61	75	76	74
		-		Hovering	16	72	73	72
		-		Idling	418	70	71	70
		W		Take-off	71	73	74	73
6	AW139	W	21:50	Approach	61	76	76	75
		-		Hovering	23	72	72	71
		-		Idling	274	70	70	69
		E		Take-off	67	71	71	70
7	AW139	W	22:24	Approach	74	74	75	74
		-		Hovering	18	75	75	74
		-		Idling	547	71	71	70
		W		Take-off	72	70	70	70
8	AW139	W	22:50	Approach	58	75	76	75
		-		Hovering	23	75	75	74
		-		Idling	331	71	71	70
		E		Take-off	72	71	71	70

Remark: * E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.
 ** Evening-time Noise measurement was commenced at 19:00. Thus, noise data before this time is not available.

(B). Measured Background Noise level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	72	Road traffic noise, and noise due to airplane passing-by, and Turboprop arrival/ departure at HK-Macau Ferry Terminal
2	71	
3	70	
4	69	
5	69	
6	70	
7	70	
8	70	

(C). Correction Factor for Distance Attenuation

Distance Attenuation, dB(A)
0.9

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Noise Level at Ka On Bldg.
						L _{Aeq} @
1	AW139	-	19:02	Approach **		
				Hovering **		
				Idling	153	62
		W		Take-off	69	64
2	AW139	E	19:27	Approach	63	63
				Hovering	25	67
				Idling	389	62
		W		Take-off	70	69
3	AW139	W	20:29	Approach	65	73
				Hovering	24	68
				Idling	439	55
		W		Take-off	74	67
4	AW139	W	20:50	Approach	56	76
				Hovering	17	73
				Idling	426	60
		W		Take-off	69	69
5	AW139	W	21:25	Approach	61	75
				Hovering	16	70
				Idling	418	64
		W		Take-off	71	72
6	AW139	W	21:50	Approach	61	75
				Hovering	23	68
				Idling	274	59
		E		Take-off	67	66
7	AW139	W	22:24	Approach	74	73
				Hovering	18	74
				Idling	547	64
		W		Take-off	72	61
8	AW139	W	22:50	Approach	58	75
				Hovering	23	74
				Idling	331	60
		E		Take-off	72	65

Leq(4-hrs), dB(A): 62

Remark: ## E - Flight approaches from or departs to the East; W - Flight approaches from or departs to the West.
 @ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.
 ** Evening-time Noise measurement was commenced at 19:00. Thus, noise data before this time is not available.