

APPENDIX 9C

**Additional Bird-Bridge
Survey**

9C. BIRD-BRIDGE INTERACTION IN HONG KONG AND MACAU

9C.1 Introduction

Because of the unique nature of the proposed Shenzhen Western Corridor and limitation of baseline information in Hong Kong, we have expanded our search for literature and field surveys to locations (or expanded?) outside the assessment area of the present EIA study and the boundaries of Hong Kong Special Administrative Region (HKSAR). This will enable a more thorough description/assessment in the main report on the potential impacts of the proposed bridge/crossing on flora and fauna, particularly birds foraging on inter-tidal mudflat.

9C.2 Methods

Flight behaviors and altitudes of birds over four vehicle bridges, three in Hong Kong and one in Macau SAR, were studied in November 2001 and March 2002 (**Table 1**). The three local bridges – Route 3 flyover, the Shatin Road above Shing Mun River Channel (Shatin flyover hereafter) and Tsing Tsuen Bridge – were chosen for study because their heights above the water surface are similar to those proposed for the SWC bridge. In addition, each of these three bridges crosses over water surface where ardeids, dominant bird group recorded in SWC study, occur. Route 3 flyover crosses over inter-tidal mudflat, Shatin flyover over artificial channel and Tsing Tsuen Bridge over harbour. Frequent bird flying activities were also recorded in these three bridges. In contrast, the two cable –stayed bridges in Hong Kong (Tsing Yi - Ting Cau and Tsing Yi – Ma Wan) are of much lower bird flying activities. In November 2001, only 5 Little Egret were recorded during a trial observation in Tsing Yi – Ma Wan bridge. The heights of these two cable-stayed bridges are also different from that of the proposed SWC.

The Lotus Bridge connects Taipa-Coloane Reclamation Areas and Hengqin Island, Zhuhai and spans an intertidal mudflat. This bridge was chosen for study as Black-faced Spoonbills *Platalea minor* are known to feed on nearby inter-tidal mudflat. In addition, both the width (30 m) and height of above intertidal mudflat (14-20 m) of the Lotus Bridge are similar to the proposed SWC bridge.

Birds flying above and below the flyover were identified and counted in morning or afternoon, and evening (**Table 1**). For birds flying above the bridges, the height above the bridge surface was estimated. Bird species observed nesting in the studied bridges were recorded. Video of birds flying across bridges was taken.

Table 1. Studied bridges and survey schedule

Bridges	Clearance above water or mudflat	Dates	Times
Route 3 flyover	15	27 November 2001	1400 – 1530 hrs 1700 – 1830 hrs
		6 December 2001	1100 – 1130 hrs
		20 December 2001	1000 – 1030 hrs
Shatin flyover	15	6 December 2001	1400 – 1530 hrs 1700 – 1830 hrs
		20 December 2001	1400 – 1630 hrs
Tsing Tsuen Bridge	17	19 December 2001	1300 – 1500 hrs 1700 – 1830 hrs
Lotus Bridge	14-20	17 January 2002	1700 – 1830 hrs
		18 January 2002	0830 – 1230 hrs
		27 March 2002	1700 – 1830 hrs
		28 March 2002	0830 – 1230 hrs

Potential effect of bridges on the feeding birds was investigated by comparison between feeding bird abundance on mudflat beneath the shadow of bridges and on mudflat without bridge. Birds feeding on intertidal mudflat near Route 3 flyover and Lotus Bridge in Macau SAR were studied.

Three surveys were carried out at Route 3 between November and December 2001. Previous field notes recorded in that area were also reviewed for additional information. Bird density beneath Route 3 flyover was compared with that on the exposed mudflat of Channel 60 CD (Contract B). Five surveys were carried out along the Taipa-Coloane Reclamation Areas during low tides on 27 and 28 March 2002. Bird densities beneath the Lotus Bridge and on mudflat without bridge were compared. Bird density on the mudflat within 30 m of both sides of the stream flowing out from nearby landfill on the Taipa-Coloane Reclamation Area and cross the mudflat was also estimated to investigate the effect of stream on bird densities on mudflat.

Besides field surveys, local available information on interaction between birds and vehicle bridges was reviewed. Routine structure inspections are carried out for local highway and bridges since the 1970s. Highway Department was consulted for the observation of bird kills on local highways or bridges.

9C.3 Results

Previous local studies on bird kills on highways and bridges

During routine inspections for highway and bridges structures since the 1970s, there were observations of bird kills on noise barriers (Highway Department, pers. comm.). It is more common to have such observations when the noise barriers are newly erected and the transparent panels of the panels are clean, clear and invisible to birds. Since the inspections were unintentional for study of bird kills, there is no data on the frequency of observation. However, this was the only available information in Hong Kong. In fact, if bird kills on highway or bridges were massive, it might have been noticed by local birdwatchers or naturalists

Flight Behavior

Birds flew across the Route 3 flyover actually passed 4 bridges. Most birds recorded flying above the Route 3 flyover were ardeids. However, many non-ardeid species were also recorded, e.g., bulbuls *Pycnonotus spp.*, Crested Myna *Acridotheres cristatellus*. More birds were observed crossing the flyover during evening (86 birds) than during daytime (morning and afternoon) (22 birds) at the Route 3 flyover (**Table 2**). Birds tended to fly below the flyover during daytime, and above the bridge during evening. The lower flying height during daytime may be related to movement between feeding habitats (exposed mudflats) while the higher flying height in evening may be related to birds returning to roosts. Birds flew at an average height 12 ± 4.02 m (standard deviation) above the Route 3 flyover, higher than the top of any vehicle on the flyover. Only a few birds flew below 6 m above the flyover surface (**Chart 1**). In addition, birds made sharp turns above the flyover to avoid approaching vehicles.

Table 2. Number of Birds Flying Across Route 3 Flyover

	Above	Below	Total
Daytime	5	17	22
Evening	83	3	86

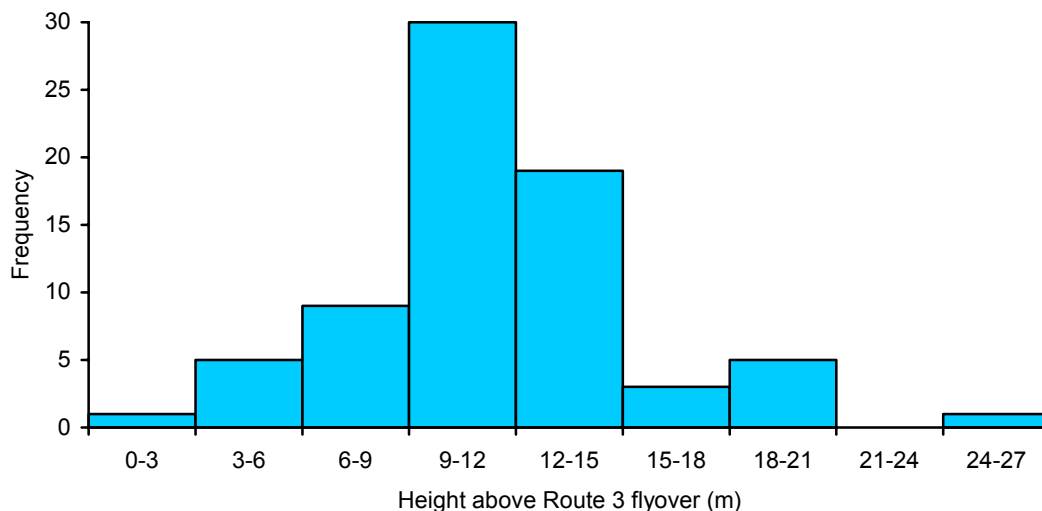


Chart 1 Flight Heights of Birds Flying above The Route 3 Flyover

All birds recorded flying above the Shatin flyover were ardeids. More birds were observed crossing the flyover during afternoon (33 birds) than during evening (3 birds) (Table 3). Birds flew at an average height 9.9 ± 3.17 m (standard deviation) above the Shatin flyover, higher than the top of any vehicle on the flyover. Only a few birds flew lower than 6 m above the flyover surface (Chart 2). Birds reacted to the bridge by gaining altitude to fly over the bridge.

Table 3. Number of Birds Flying across Shatin Flyover

	Above	Below	Total
Daytime	25	8	33
Evening	0	3	3

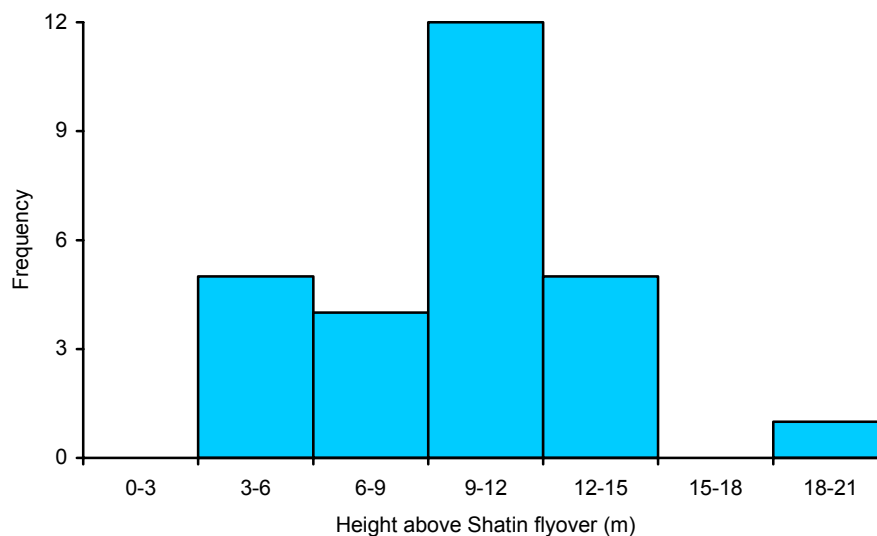


Chart 2. Heights of Birds Flying above The Shatin Flyover

Most birds recorded flying across the Tsing Tsuen Bridge were ardeids. Other non-ardeid species such as Black-eared Kite *Milvus lineatus* and Feral Pigeon *Columba livia* were observed flying across the bridge. More birds were observed flying during afternoon (130 birds) than during evening (17 birds) (**Table 4**). Only 4 birds flew above the bridge, and the height ranged between 10 and 25 m (median height = 12 m) above the Tsing Tsuen Bridge. Birds were only observed flying above the bridge in evening.

Table 4. Number of birds flying across Tsing Tsuen Bridge

	Above	Below	Total
Daytime	0	130	130
Evening	4	13	17

Ardieds, spoonbills and some passerines (e.g., bulbuls) were observed flying across the Lotus Bridge. More birds were observed flying over than below the bridge (**Table 5**). Birds flew at an average height 11.8 ± 3.6 m (standard deviation) above the Lotus Bridge, higher than the top of any vehicle on the flyover. Only a few birds flew below 9 m above the flyover surface (**Chart 3**). Birds reacted to the bridge either by gaining altitude to fly over the bridge, or by simply flying beneath the bridge deck.

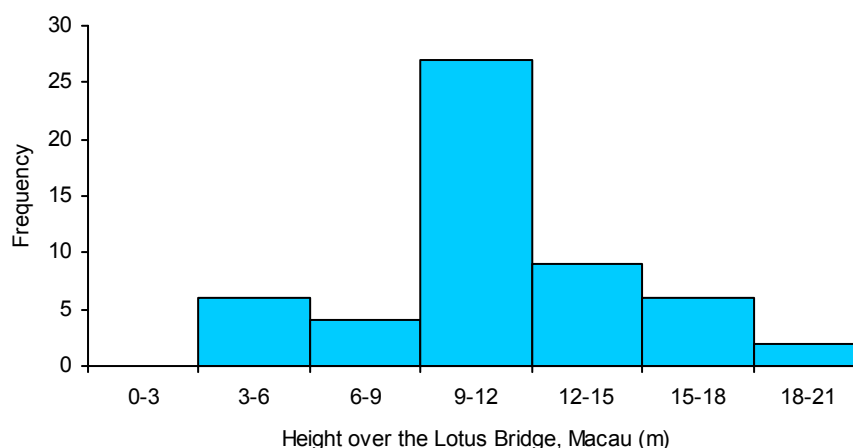


Chart 3. Heights of birds flying above the Lotus Bridge, Macau

Table 5 Number of birds flying across Lotus Bridge, Macau

	Above	Below	Total
Daytime	37	19	56
Evening	73	28	101

In Macau bird kills from collision have been found at the foot of a coastal monument named “Gateway of Understanding” near Nam Van Lake, Macau (Leung Va, pers. comm.). The monument consists of two narrow vertical towers with polished stone facing. Birds are reported to collide with the tower during adverse weather conditions. This observation supports conclusions reached during extensive literature review for this project of bird collisions with man-made structures.

The mean/median heights of birds flying above the Route 3 flyover, Tsing Tsuen Bridge and Lotus Bridge were similar. The mean height of birds flying above the Shatin flyover was not much different from those of these 3 bridges. Birds behaved similarly in all the studied bridges. No bird collision was observed in any of the four studied bridges. Flying birds avoided collision with the bridges either by gaining altitude or simply flying beneath the bridge decks.

There were differences in diurnal flight frequency in the studied bridges: higher flight activities during evening at Route 3 flyover and Lotus Bridge and higher in afternoon in Shatin flyover and Tsing Tsuen Bridge. However, this probably may be due to differences in habitats around each bridge. All studied bridges were well-lit, therefore birds flew close to deck surface after sunset could be observed. Apart from the Night Heron in Shatin, no bird was observed flying across any of the studied bridges after sunset. The Lotus Bridge was open for operation in 2000, and yet no dead bird suspected to be killed by collision with the bridge has been reported.

Feeding behavior

Numbers of ardeids observed feeding on exposed mudflats in Channel 60 CD (Contract B) of the Kam Tin River beneath the Route 3 flyover are shown in Table 6. The underside of the Route 3 flyover is approximately 15 m above the mudflat, similar to the height of the proposed bridge. This suggests that birds would feed on the mudflat beneath the proposed bridge.

The area under the shadow of the three bridges above Channel 60 CD (Contract B) is 1.8 ha. The mean feeding ardeid density on mudflat under the shadow of bridges was higher than that on mudflat downstream of Channel 60 CD (Contract B) in winter 2000/2001 and winter 2001/2002 (Table 6).

Table 6. Feeding bird densities (birds ha⁻¹) under Route 3 flyover and exposed mudflat in Channel 60 CD (Contract B) (Ecosystems Ltd. unpubl. data)

	Under Route 3 flyover	Mudflat on Channel 60 CD (Contract B)
winter 2000/2001	42.2	2.2
winter 2001/2002	6.9	1.7

Most birds recorded flying above the Lotus Bridge in Macau were ardeids. Black-faced Spoonbills *Platalea minor* and European Spoonbills *P. leucorodia* were recorded in the vicinity of the bridge, but were concentrated at a shallow man-made freshwater marsh within 50 m from the bridge. Ardeids and spoonbills were feeding in a stream coming out from a landfill.

Bird density on mudflat below the Lotus Bridge was lower than the average on the rest of inter-tidal mudflat along Taipa-Coloane Reclamation Areas (without bridge) (Table 7). However, the lower bird density below Lotus Bridge could be largely due to the presence of large amount of scrap construction materials and a variety of rubbish, and should not be totally attributed to the presence of a bridge. This is because large number of ardeids has been observed feeding on exposed mudflat under the Route 3 flyover in Hong Kong. Therefore, it is assume that ardeids will not avoid feeding under bridges.

Table 7. Bird densities on inter-tidal mudflat along Taipa-Coloane Reclamation Areas

	Mudflat	Below Lotus Bridge	Stream
Bird density (birds ha ⁻¹)	4.8	1.6	84.2

Average bird density on mudflat with the stream was much higher than on mudflat without a stream (Table 7). All spoonbills observed on the mudflat along Taipa-Coloane Reclamation Areas were foraging in this stream. The high bird density was likely to be due to higher food availability in the stream.

Nesting

Despite of the apparent traffic disturbance, some bird species have been observed nesting in holes of drainage systems below the Route 3 flyover. These were the Blue Rock-thrush *Monticola solitarius*, Crested Myna and Tree Sparrow *Passer montanus*.

9C.4 Summary

Observations in studies of birds and bridges are summarized as follows:

- 1) Long-term inspections on local highways and bridges reveal no massive bird kills.
- 2) Birds can avoid bridges and vehicles moving on bridges, and do not collide with bridges.
- 3) Bridges do not completely exclude birds from feeding underneath.
- 4) Based on point (2) and (3) above, bridges are neither barrier to bird flights nor cause of fragmentation of inter-tidal bird habitats.

9C.5 Reference

Ecosystems Ltd. 2002. *Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin Ecological Monitoring – Avifauna Use of Abandoned Channels and Constructed Channels: Winter 2001/2002*. Prepared for Territory Development Department.