

Xe Bang Fai Cave Trail Alignment Mission (3-6 March 2019)

Author: Terry Bolger

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Introduction: A management and development plan for the Xe Bang Fai Cave was developed and approved in 2018. The cave development plan prescribes that walkways with guardrails be installed in the Balcony Passage and Tham Bing, to facilitate visitor access and help minimize the impacts of tourism on the cave. In addition, a fixed lighting system is prescribed for the Balcony Passage, and possibly for Tham Bing. Laying out the trail alignment in these passages is a prerequisite to designing, costing, and constructing the walkways and lighting systems.

Objective: To determine, layout and survey trail alignments for the Balcony Passage and Tham Bing sections of the Xe Bang Fai Cave. The trail alignment work will provide the basis for designing, costing and constructing walkways and lighting for these sections of the Xe Bang Fai Cave.

Team Members:

1. Terry Bolger, Cave & Karst Specialist
2. Mr Somnuch, Nongping Tourism Service Group
3. Mr Tung, Nongping Tourism Service Group
4. Mr Phan, Nongping Tourism Service Group
5. Mr Jin, Nongping Tourism Service Group
6. Mr Phom, Nongping Tourism Service Group
7. Mr Mae, Nongping Tourism Service Group

Balcony Passage Trail Alignment

Identify and locate cave features for lighting / interpretation: with cave guides from the Nongping Tourism Service Group, 14 cave features along the passage were identified for lighting and interpretation. 'Control points' were temporarily marked on the cave floor at each feature, to be surveyed subsequently. The information collected at each control point included: the distance from the start of the passage (top of the staircase), a description of the feature, and the file names for photos of features at each control point; and is presented in Table 1 below.

Survey of the trail alignment: A survey of the cave trail alignment was made using a hand-held laser survey meter. The survey data are presented in Annex 1, and include distance, bearing and vertical angle for each survey length, and provide an estimated total length of 324 m of trail/walkway to be developed in the Balcony Passage. These survey data now preserve the control point locations and walkway alignment information, without the need to make obvious, marked points along the passage. With the number of tourists visiting this passage, marked points would soon be disturbed or lost. The survey data also provide useful information for the preliminary design and costing of a cave walkway. The walkway alignment still needs to be reviewed 'in-cave' with members of the Hin Nam No Ecotourism Unit.

Photographs of cave features for lighting / interpretation: The cave features at the 14 control points selected for lighting/interpretation were photographed for documentation and reference. The photo filenames corresponding to each cave feature are given in Table 1.

Table 1. Summary of information collected on the control points in the Balcony Passage.

Control Point	Distance into Passage (m)	Description / Features to View	Photo IDs
C0	0	White stalagmites on the right	C0_BP
C1	12	White stalagmites on the right	C1_BP
C2	30	Column on the left	C2_BP
C3	50	Flowstone ahead	C3_BP
C4	70	Flowstone columns on right	C4a_BP , C4b_BP
C5	107	Draperies on left and behind, Stals and chert beds ahead	C5a_BP, C5b_BP, C5c_BP
C6	161	Stalagmites and flowstone on left	C6_BP
C7	197	Draperies on left, column ahead	C7a_BP, C7b_BP
C8	209	Column on left	C8_BP
C9	239	Dragon eggs and paleokarst breccia	C9a_BP, C9b_BP
C10	252	Dragon eggs on left	C10_BP
C11	266	Gour rims to left	C11_BP
C12	284	Overlooking gour rims on left	C12_BP
C13	324	River overlook	C13_BP
C14	140	Draperies and columns on the way out	C14_BP

Tham Bing Trail Alignment

Identify and locate cave features for lighting / interpretation: with cave guides from the Nongping Tourism Service Group, 11 cave features along the passage were identified for lighting / interpretation. 'Control points' were marked on the cave floor at each feature with a dot of pink fingernail polish and a piece of orange flagging tape (Photo 1), to be surveyed subsequently. The information collected at each control point included: the distance from the start of the passage (entrance to Tham Bing), a description of the feature, and the file names for photos of features at each control point; and is presented in Table 2 below.



Photo 1. A marked control point in Tham Bing.

Survey of the trail alignment: A survey of the cave trail alignment was made using a hand-held laser survey meter. The survey data are presented in Annex 2, and include distance, bearing and vertical angle for each survey length, and provide an estimated total length of 565 m of trail/walkway to be developed in Tham Bing. These survey data now preserve the

control point locations and walkway alignment information, in case the marked points along the passage are disturbed or lost. The survey data also provide useful information for the preliminary design and costing of a cave walkway. The walkway alignment still needs to be reviewed 'in-cave' with members of the Hin Nam No Ecotourism Unit.

Photographs of cave features for lighting / interpretation: The cave features at the 11 control points selected for lighting/interpretation were photographed for documentation and reference. The photo filenames corresponding to each cave feature are given in Table 2.

Table 2. Summary of information collected on the control points in Tham Bing.

Control Point	Distance into Passage (m)	Description / Features to View	Photo IDs
C0	0	Tham Bing entrance with formations	C0a_TB, C0b_TB
C1	75	Flowstone on left, cave passage ahead	C1a_TB, C1b_TB
C2	140	Stalagmite ahead, entrance behind	C2a_TB, C2b_TB
C3	202	Among draperies and stalagmites	C3a_TB, C3b_TB
C4	217	Rimstone wall and stalagmite ahead	C4a_TB, C4b_TB
C5	254	Flowstone ahead, stalagmite behind	C5a_TB, C5b_TB
C6	297	Looking up flowstone 'steps'	C6_TB
C7	347	Flowstone on left, Stalagmites around	C7a_TB, C7b_TB
C8	385	Surrounded by large stalagmites	C8a_TB, C8b_TB
C9	427	Small gourls ahead, gour walls on left	C9a_TB, C9b_TB
C10	465	Gour walls and large flowstone	C10a_TB, C10b_TB
C11	565	Overlook of river passage	C11_TB

Walkway Design and Materials

The Balcony Passage often floods during the wet season, up to 1 m deep or more in places. Tham Bing also floods in the section near the entrance. Therefore, a walkway that is somewhat elevated above the cave floor (30-40 cm) is recommended for these areas. The walkway surface should be a mesh with about 70% open space. This will facilitate cleaning of the walkway after the wet season. Such walkway surfaces made of plastic or fiberglass reinforced plastic are recommended. A stainless steel frame with guardrails is recommended for the structure of the walkway. Careful assessment, planning and construction monitoring by experts in cave walkway design and installation, and cave resource and heritage management will be required for any walkway development in these passages.

Lighting Design and Materials

In the future, when tourist numbers (or revenue) increase substantially, it may become feasible to install fixed lighting in the Balcony Passage. It is recommended that brighter lighting be used to illuminate the speleothem formations to be highlighted, while low intensity lighting be used to illuminate the walkway for safety purposes.

A specialist cave lighting designer will need to be contracted to design and provide the specifications and costs for any fixed lighting to be installed in the cave. LED lighting fixtures specifically designed for the harsh cave environment are available and should be used. All components of the lighting system should be waterproof. The cave lighting designer will also need to be involved in the installation of the lighting system, as proper installation is as important as having the right equipment specifications.

Fixed lighting is not recommended for Tham Bing due to the large number of bats that roost there, and their sensitivity to light. The fixed lights required to light this large passage would need to be bright, which would disturb the bats and cause declines in the bat populations, and possibly even abandonment of this passage as a roosting site.

Annex 1. Balcony Passage survey data and notes.

Balcony Passage, Xe Bang Fai Cave - Survey of Trail Alignment						
Survey conducted on 03/03/2019 by Terry, Somnuch and Tung, using Disto X2 laser survey meter.						
Survey Station						
From	To	Distance (m)	Bearing (deg)	Vertical (deg)	Notes	Distance into cave (m)
C0	T1	3.96	154.0	-5.4	C0 at top of staircase	4
T1	C1	7.62	208.8	1.7	At top of 3 steps, White stals on R	12
C1	T2	7.58	130.0	-0.4	At corner post, middle of trail	19
T2	C2	10.62	156.0	1.6	Near post, column on L	30
C2	T3	11.40	105.4	2.6	Near corner post	41
T3	C3	8.47	114.2	-0.2	Near corner post, flowstone ahead	50
C3	T4	10.32	84.9	8.9	Top of steps, next to flowstone	60
T4	C4	9.64	114.6	-6.5	At middle of middle column, on R	70
C4	T5	8.02	132.0	1.9	Edge of rock next to corner post	78
T5	T6	11.70	170.0	0.4	At base of steps, next to corner post	89
T6	T7	3.56	218.0	24.1	Top of steps, in middle	93
T7	T8	2.70	165.8	14.4	Top of steps, before descending 4 steps	96
T8	C5	11.15	191.9	-7.2	Draperies on L and behind, stals ahead	107
C5	T9	11.76	171.7	1.0	Dipping chert beds on R	119
T9	T10	10.46	139.6	0.7	Flowstone/Stals on L and R	129
T10	T11 (C14)	11.29	159.2	0.7	Flowstone/Column to L and R (C14 on way out)	140
T11	C6	21.04	196.8	1.1	Calcite on floor on L, near corner post	161
C6	T12	14.68	293.1	-4.2	Draperies on L, near base of steps	176
T12	T13	7.55	277.6	13.7	Top of steps, near post on L	184
T13	C7	13.54	234.9	-9.3	Draperies on L and behind, column ahead	197
C7	C8	11.49	242.3	2.0	Near column, 2.4m from corner post	209
C8	T14	24.17	279.3	-0.3	At top of first rim step up	233
T14	C9	6.05	261.1	-0.4	Paleokarst breccia and dragon eggs on L	239
C9	C10	13.28	288.3	-2.2	Dragon eggs on L, 3m before trail bends L	252
C10	T15	7.92	258.1	3.8	Narrow path (0.5m) above dragon eggs on L	260
T15	C11	6.44	270.4	-0.1	Gour rims to L, next to corner post before steps	266
C11	T16	5.63	313.8	12.7	Top of ramp next to corner post on L	272
T16	C12	12.04	258	1.6	Step near corner post on L, overlooking gour rims	284
C12	T17	7.84	287.9	4.6	At base of last rim step-up	292
T17	T18	19.29	283.2	2.1	At broken rim before overlook	311
T18	C13	12.53	295.6	0.6	River overlook, 1m back from corner post	324
Stations	31				Viewing area from 2m to L and 4.5m to R of C13	

Annex 2. Tham Bing survey data and notes.

Tham Bing, Xe Bang Fai Cave - Survey of Trail Alignment						
Survey conducted on 05/03/2019 by Terry, Phom and Phan						
using Disto X2 laser survey meter. Surveyed from river overlook back to the entrance						
Survey Station						
From	To	Distance (m)	Bearing (deg)	Vertical (deg)	Notes	Distance into cave (m)
C11	T1	13.30	325.7	-0.3	C11: Gour rim at river overlook, on R side (looking into river)	13
T1	T2	14.08	288.1	1.8	Near to back edge of gours	27
T2	T3	18.01	342.4	12.6	Top of rockpile, 1.4m from flowstone wall on R	45
T3	T4	9.24	314.6	6.2	Top of rockpile, near far edge of flowstone on wall	55
T4	T5	19.28	306.5	-14.3	Sediment floor at bottom of rockpile	74
T5	T6	5.30	263.5	-20.0	Crystal floor at bottom of flowstone	79
T6	C10	20.67	194.5	3.0	Top of rim, view of rim walls and large flowstone	100
C10	T7	21.66	257.3	-0.9	On crystal floor	122
T7	C9	16.27	257.2	-0.7	Top of rock on crystal floor, rims on L, gours ahead	138
C9	T8	24.62	301.4	2.3	On rocks, small stalagmite on R	162
T8	T9	11.45	319.4	0.6	Large splattermite 2m behind	174
T9	C8	6.12	286.7	-7.1	In middle of stals, broken stal on L, splattermite ahead	180
C8	T10	9.46	250.4	2.2	On rocks, big stal 4m to L	189
T10	T11	9.98	336.1	14.1	Broken stals on L and R	199
T11	T12	8.01	280.4	16.6	On rocks	207
T12	C7	10.34	302.8	3.3	At base of white flowstone, stals ahead and behind	218
C7	T13	13.38	214.6	14.2	On rocks	231
T13	T14	12.83	208.1	8.2	At 'T' junction (L and R)	244
T14	T15	8.65	272.1	-2.8	Top of flowstone slope	253
T15	C6	14.93	261.6	-22.8	Base of flowstone on floor, looking up flowstone 'steps'	268
C6	T16	12.12	316.7	5.8	-	280
T16	T17	15.36	272.3	-1.8	Near L wall, between rocks	295
T17	C5	16.36	292.3	0.2	Flowstone wall ahead, large stalagmite behind	311
C5	T18	18.52	304.6	0.1	Between 2 rocks, on sediment floor	330
T18	C4	17.61	320.9	-2.7	Rock 4m from gour wall, wall and stal ahead	348
C4	C3	15.12	296.1	0.0	Rock on floor, between stals and draperies	363
C3	T19	15.82	285.0	-0.5	Next to rock, 2.5m from R wall	378
T19	T20	18.12	208.2	0.5	On floor, 3m before large stal	397
T20	T21	9.53	224.9	-0.2	Large stal 2m away on R	406
T21	C2	18.59	255.6	-3.2	On rock on floor, large stal ahead, entrance behind	425
C2	T22	24.39	247.6	-0.9	On floor, 5m from flowstone on R wall	449
T22	T23	24.94	261.5	1.1	Just before climb up entrance slope	474
T23	C1	15.76	194.8	31.7	On entrance slope, flowstone on L, cave ahead	490
C1	T24	10.19	221.7	28.0	On entrance slope	500
T24	T25	7.70	217.5	30.4	On entrance slope	508
T25	T26	16.76	253.0	35.9	On entrance slope	524
T26	T27	15.83	249.8	36.0	On rock near top of slope	540
T27	T28	8.55	354.5	15.1	On rock, flat spot beneath the dripline	549
T28	T29	8.66	240.1	24.5	On rock, just under the dripline	558
T29	T30	4.74	235.6	30.3	On rock on L	562
T30	C0	3.18	244.7	24.8	Top of entrance slope, view of entrance	565
Stations	41					