Appendix-G

List of Totally Protected Wild Animals and Plants in Bhutan

1. List of Totally Protected Wild Animals in Bhutan

1. Asian Elephant: *Elephas maximus*

Body length is 550-640 cm, tail length is 120-50 cm, and shoulder height is 250-300 cm. females weigh an average of 2,270 kg and that large bulls weigh 5,400 kg.

Type Locality : "Zeylonae" [Sri Lanka]
Distribution : Bangladesh, Burma, China, Cambodia, India, Indonesia, Laos, Malaysia, Thailand, Vietnam.
Status : CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) - Appendix I; U.S.ESA (U.S. Endangered Species Act) - Endangered; IUCN (International Union for Conservation of Nature and Natural Resources) Red Data Book - Endangered.

The Asian elephant once ranged from Mesopotamia (now known as Iraq) throughout Asia, south of the Himalayas all the way to Northern China.
Today, Asian elephants are found scattered only in isolated pockets of India, Napal, Sumatra, and Southern Asia.

Elephants are the largest land mammals in the world today. There are two species of elephants : the Asian and the African. When the two are together, it is quite easy to tell them apart. The Asian elephant is usually smaller than the African and has considerably smaller ears but may still reach up to ten feet in height and seven tons in weight.

It also has smoother skin and less prominent tusks. Another difference between the two is the trunk. The African elephant has two "lips" on the end of its trunk to grasp food and other items it needs to pick up, while the Asian elephant relies on only one "lip".

Considered easier to handle and train, Asian elephants are widely used as work animals in India and southeast Asia.

Asian elephants are found primarily in tropical forests and grasslands, seeking refuge in forests by day and feeding in clearings and forest margins by night. An adult Asian may consume between 300 and 350 pounds of vegetation each day. It may also consume soil for its mineral content.

For centuries the Asian elephant has been overhunted for its ivory tusks that are traded to the Far East. The ivory is used for carvings, jewelry, and statues. The main threat to

the Asian elephant is the disappearance its natural habitat due to human development and agriculture. Today, Asian elephants are in even greater danger of extinction because of loss of their natural habitat. Only an estimated 29,000 to 40,000 still remain in the wild.

2. Clouded Leopard: *Neofelis nebulosa*

Head and body length is about 61.6-106.6 cm, tail length is 55-91.2 cm, and weight is usually 16-23 kg.

Type Locality : "Brout from Canton" [China, Guangdong: Guangzhou]
Distribution : Burma, China, Cambodia, India, Indonesia, Malaysia, Nepal, Taiwan, Thailand, and Vietnam.
Status : CITES - Appendix I; U.S.ESA - Endangered; IUCN Red Data Book - Vulnerable.

The clouded leopard has a long body, relatively short legs, and a tail that can be almost equal in length to its head and body combined. They are the most strikingly marked of all cats. Its side pattern consists of some six large, narrow, brown blotches, edged in black, and pale areas separating the blotches. Because of its large upper teeth, which are relatively longer than in any other cat species, the clouded leopard is sometimes referred to as the "modern-day saber-tooth".

The clouded leopard has been persecuted for its coat for many years. Because of the unique pattern, many people desire coats made of this beautiful fur. Unfortunately it takes about 20 to 30 cats to make one full-length coat.

The clouded leopard may be found in the dense forest and scrub of southern and southeastern Asia, where it hunts by night or day, from trees, dropping silently down onto its prey, and seeks medium-sized game of all types. Completely at home in the squirrel. The chief prey of the clouded leopard are monkeys, small deer, and wild boars, which it ambushes from the trees or stalks from the ground. It may also take birds, rodents, or domestic poultry.

3. Golden Langur: *Presbytis geei*

Head and body length is 40-76 cm, tail length is 57-110 cm, and weight is 4.2-14.0 kg.

Type Locality : India, Assam, Goalpara Dist, Jamduar Forest Rest House, East Bank of Sankosh River.
Distribution : Between Sankosh and Manas Rivers, Indo-Bhutan Border (on both sides). Status : IUCN Red Data Book - Rare; U.S.ESA - Endangered; CITES - Appendix I.

4. Musk Deer: *Moschus chrysogaster*

Head and body length is 70-100 cm, tail length is 1.8-60 cm, shoulder height is 50-60 cm, the rump is about 5 cm higher than the shoulder, and weight is 7-17 kg.

Type Locality : Nepal (probably Tibetan Plateau)
Distribution : Himalayas of N Afghanistan, N Pakistan, N India (include. Sikkim), and Nepal; Tibet to C China.
Status : U.S.ESA - Endangered in Afghanistan, Bhutan, China (Yunnan and Tibet), India, Nepal, Pakistan, and Sikkim; CITES - Appendix I in Afghanistan, Bhutan, India, Nepal and Pakistan; otherwise Appendix II.

Musk deer are caught mainly for musk ("musk deer perfume"), present only in the males. Musk is secreted by a saccate gland located between the sex organs and the naval. In the past, musk was used in medicine in Europe and the East. The use of musk as a natural perfume base (used in preparing high quality scents) was discovered later. When this happened, the use of musk in perfume boomed.

The musk deer has long been hunted for its prized "musk pouch". In 1855, around 81,200 sacs were exported from Russia to China through Kyakhta, and a few years later, Japan imported over 100,000 sacs in a single year. The musk deer population diminished greatly, and in 1927, only 5,089 sacs were collected. This lead to the classification of the animal as endangered.

5. Pangolin: *Manis crassicaudata*

Head and body length is approximately 30-88 cm, tail length is 35-88 cm, and weight is 4.5-33 kg. Males are usually larger than females.

Type Locality: India
Distribution : Pakistan, east to west Bengal (India) and Yunnan (China) south to Sri Lanka.

Status : CITIES - Appendix II.

Pangolin is a cross between an anteater and an armadillo. It has layers fat on its body and hard scales. This animal will climb trees to get insects to eat. One of the most unusual parts of this animal is the really long tongue. Most pangolin spend most of their in trees, and some are good swimmers. When a pangolin is threatened, it will roll up into a ball and not even large predators can uncoil them. They lash about dangerously with their tails, which are covered with sharp-edges scales. They may also spray a foul-smelling liquid from anal glands.

Their tongue is extraordinarily long and muscular, arising from the last pair of ribs deep in the animal's chest. This results in a tongue and associated muscles that are longer than the animal's head and body, allowing it to be extruded to an astonishing degree. They lack teeth. Instead, the pyloric part of their stomach is thickened and muscular, with odd keratinous spines projecting into its interior. It usually contains pebbles and seems to be used for "chewing" in much the same way as a bird's gizzard. Pangolins have the ability to close their ears and nostrils as well as eyes, presumably to keep ants out. Their skull is smoothly conical, lacking the ridges and crests found on most mammal crania.
The Pangolin gives live birth. It takes about 5 months before the new baby is born.

6. Pigmy Hog: *Sussylvanicus (Sus salvanius)*

Head and body length is 50-65 cm, tail length is about 3 cm and shoulder height is 25-30 cm.

Type Locality : India, Sikkim Terai.
Distribution : Bhutan, S Nepal, N India (include. Sikkim)
Status : CITES - Appendix I; U.S.ESA and IUCN Red Data Book - Endangered

Pigmy Hog can be found in Manas Wildlife Sanctuary which has own peculiar species of fauna. Manas Wildlife Sanctuary is situated on the banks of river Manas, and 176 km from Guwahati, this sanctuary is the only 'tiger project' of its kind in Assam.

7. Snow Leopard: *Panthera uncia*

Head and body length is 100-130 cm, tail length is 80-100 cm and shoulder height is about 60 cm, and weight is 25-75 kg.

Distribution : Soviet Union, Mongolia, India, Pakistan, Afghanistan, China, Bhutan and Nepal.
Status : CITIES - Appendix I; U.S. ESA, IUCN Red Data Book, and Soviet Union - Endangered.

The snow leopard is found in the high mountains of Central Asia. In summer it occurs commonly in alpine meadows and rocky areas at elevation of 2,700-6,000 meters. In winter it may follow its prey down into the forests below 1,800 meters. It sometimes dens in a rocky cavern or crevice. It is often active by day, especially in the early morning and late afternoon. It is graceful and agile and has been reported to leap as far as 15 meters. The diet includes mountain goats and sheep, deer, boar, marmots, pikas, and domestic livestock.

The snow leopard has been hunted for many years for its beautiful thick coat. Overgrazing of domestic animals in some areas has depleted its natural prey, and other forms of human encroachment are lowering its numbers as well. Estimates of the wild population are difficult because of the remoteness of the snow leopard's range, but most reports agree that there are at least 5,000 animals in the wild. There are over 600 snow leopards in zoos worldwide.

8. Takin: *Budorcas taxicolor*

Head and body length is 100-270 cm, tail length is 8-12 cm and shoulder height is about 70-140 cm, and weight is 150-400 kg.

Type Locality : India, Assam, Mishmi Hills.
Distribution : Bhutan; Sikkim and Mishmi Hills (NE India); N Burma; SE Tibet, Sichuan, Gansu, Shaanxi, and Yunnan (China).
Status : CITIES - Appendix II; IUCN Red Data Book - Rare

The takin prefers dense thickets near the upper limit of tree growth at an elevation of around 1,000-4,250 meters. It makes narrow paths through this thick growth, which it uses regularly in passing to and from grazing areas and salt licks. It is slow and deliberate but can leap nimbly from rock to rock on rough slopes.

There apparently are regular seasonal migrations between alpine areas in summer and forested valleys in winter. In summer, it eats mostly forbs and deciduous leaves from shrubs and trees. The winter diet consists principally of twigs and evergreen leaves

from woody species. They sometimes spends much of the day in dense vegetation and emerges in the late afternoon and early morning to feed.

There normally is single kid, and within 3 days it is able to accompany its mother almost anywhere.

9. Tiger: *Panthera tigris*

Head and body length is 140-280 cm, tail length is 60-95 cm and weight is 180-258 kg (male), 100-160 kg (female).

Type Locality: "Asia".
Distribution : Bangladesh, Bhutan, Burma, China, Laos, India, Indonesia (Sumatra), Korea, Malaysia, Nepal, Thailand, Vietnam, Afghanistan, Pakistan, Iran, and the former USSR.
Status : CITIES - Appendix I; U.S. ESA and IUCN Red Data Book - Endangered.

The tiger is tolerant of a wide range of environmental conditions, its only requirements being adequate cover, water, and prey. It is found in such habitats as tropical rainforests, evergreen forests, mangrove swamps, grasslands, savannahs, and rocky country. An individual may have one or more favored dens within its territory, located in such places as caves, hollow trees, and dense vegetation. The tiger usually does not climb trees but is capable of doing so. It has been reported to cover up to 10 meters in a horizontal leap. It seems to like water and can swim well, easily crossing rivers 6-8 km wide and sometimes swimming up to 29 km.

In Nepal, a specialist determined the usual daily movement to be 10-20 km. To hunt, the tiger depends more on sight and hearing than on smell. It usually carefully stalks its prey, approaching from the side or rear and attempting to get as close as possible. It then leaps upon the quarry and tries simultaneously to throw it down and grab its throat.

The diet consists mainly of large mammals, such as pigs, deer, antelope, buffalo, and gaur. A tiger can consume up to 40 kg of meat at one time. Although the tiger is an excellent hunter, it fails in at least 90 percent of its attempts to capture animals. In India, individual home range seems usually to be 50-1,000 sq km.

10. Wild Buffalo: *Bubalus bubalis*

Head and body length is 240-300 cm, tail length is 60-100 cm, shoulder height is 150-190 cm, and weight is 700-1,200 kg.

Type Locality : "Asia".
Distribution : Formally India to Indochina; true wild populations survive in Assam and Orissa (India), Nepal, N Thailand, and possibly in Bangladesh, Cambodia and C Vietnam; domesticated in N Africa and S Europe east to Indonesia and in E South America; feral populations in Sri Lanka, Borneo and other parts of SE Asia, New Britain and New Ireland (Bismarck Arch., Papua New Guinea), Australia.
Status : CITIES - Appendix III (Nepal); IUCN Red Data Book - Endangered.

The general coloration is ash gray to black. The spread of the horns, up to 120 cm along the outer edge, exceeds that of any other living bovid. *Bubalus bubalis* is larger, quicker, and more aggressive, and has much more widely spreading horns, than a domestic buffalo.

11. Black-Necked Crane: *Grus nigricollis*

Height 156 cm
Black-necked Cranes is one of the world's most threatened cranes. Over 300 Black-naked Cranes now winter here, but the number is declining. This is partly because of the drainage of their marshy habitat in some places and recent changes in traditional farming methods which have resulted in reduced availability of food for the cranes. Total protection is given to the cranes in Bhutan and wardens at their main wintering areas in the Phobjikha valley (about 10 km southern from Pele-La) and at Bumdiling (near Toshe Yagts). The Black-Naked Crane or Thung Thung as it is called in Bhutan is important in local folklore and there are myths, legends and songs about bird. The cranes are famous for their spectacular and beautiful dances in which they bow, leap into the air and toss vegetation about whilst uttering loud bugling calls.

12. Monal Pheasant: *Lophophorus impejanus*

Length male 70 cm, female 63.5 cm
In summer it is common on rock and grass covered slopes between 3,660 m and 4,570 m, and in winter it moves down to 3,050 m or probably lower, in rock, coniferous and rhododendron forests with grassy glades. The Monal uses its strong bill for digging in search of food and can dig deep in snow if necessary. Seeds, roots, tubers, shoots, berries and insects make up its diet. The male Monal Pheasant is an especially beautiful

pheasant and is famous for his nine iridescent colours. In contrast the female is mainly brown with a whitish rump, heavily barred tail and short crest.

13. Peacock Pheasant: *Polyplectron Bicalcaratum*

Length male 70 cm
They inhabit in bush or forest in the vicinity of a river in Burma, Thailand, Sikkim, Laos, Vietnam, S China and Peninsular Malaysia. The diet consists of grass, shoots, bamboo fruits and insects. They spread their wings and tail like a peacock.

14. Raven: *Corvus corax*

Length 71 cm
The all-black Raven is the largest of the Bhutanese crows and the country's national birds. A fine flier, the Raven often performs spectacular acrobatics in the air, tumbling, nose-diving and even rolling on its back. The Raven is a sociable bird usually found in pairs or small parties which often call to each other. Almost any kind of animal or vegetable matter is eaten. It can be easily distinguished from other crows in flight by wedge-shaped tail. Both sexes are alike. It is fairly common in northern Bhutan at high altitudes above the tree-line.

15. Rufous-Necked Hornbill: *Aceros nipalensis*

Length 122 m
The spectacular Rufous-necked Hornbill is fairly common in Bhutan's primary evergreen forest between 300 m and 1890 m, but outside the country it is rare and declining mainly because of the loss of the tall mature forest trees it requires for nesting and feeding. Like the other three hornbills in Bhutan it mainly eats wild figs and berries. It flies with powerful slow flaps making a loud 'whoosh' with each wing beat. Every now and then it dives with closed wings resulting in deep undulations. In common with other hornbills the female plasters herself inside a tree-hole when incubating her eggs leaving only a narrow slit through which she is fed by her mate. The female has a black head, neck and underparts.

16. Golden Mahseer: *Tor tor*

Golden mahseer is one of the eight species of mahseer which are commonly found in India. Mahseer is one of the important game fishes of India. Golden mahseer is stoutly built and is distinguished by the head being shorter than the depth of the body. This is

the typical mahseer of anglers in north India attaining about 1.5 meters in length. Golden mahseer occurs along the foot-hills of the Himalayas From Kashmir to Assam and in the rivers Narmada and Tapti. Little biological work has been done on golden mahseer of the Himalayas. The biology of mahseer found in Narmada river at Hoshangabad has been studied in detail by Karamchandani et al. (1967). The golden mahseer forms the most predominant fishery in the commercial catches of River Narmada in that region and contributed about 40.99 to 50.7% among the carp group and about 25.45 to 29.62% in the total catches during the year 1958-1966.

The juveniles and adults of golden mahseer have been reported to subsist on food organisms common to both but in varying degrees. The fish is insectivorous in its juvenile stages, but becomes herbivorous in the adult phase. The protrusible and suctorial mouth of the dish and presence of large quantities of sand, mud and debris in the gust are suggestive of bottom feeding habits. The fish attains its first maturity in the size range 273-290 mm. This species has a prolonged breeding season which commences in July-August and continues up to December with peak breeding from July to September.

The younger fish has been observed to breed earlier in the season than the older ones. Ova diameter studies have indicated that an individual golden mahseer breeds in three spurts of spawning at intervals of 2-3 weeks in between two acts, and as soon as the last batch of mature ova are shed the ovary starts maturing and ripening again for spawning in the next season. In Punjab, as a general rule, golden mahseer migrates towards headwaters at the beginning of the South-West monsoon and downstream when rains cease. However, three spawning periods associated with spates have been reported by some authors. Others doubt the existence of any definite season in respect of the Punjab and North Bengal golden mahseer.

17. Spotted deer: *Axis axis*

Head and body length is 100-175 cm, tail length is 12.8-38 cm and shoulder height is 60-100 cm, and weight is 27-110 kg.

Type Locality : India, Bihar, "banks of the Gange".

Distribution : India (include. Sikkim); Sri Lanka; Nepal; introduced to the former Yugoslavia, republics of the former W USSR (still extant?), Andaman Isls, Australia, Hawaiian Isls and Texas (USA), Brazil, Argentina and Uruguay.

During part of the year the upper parts of them are beautifully marked with small white spots. They frequent grasslands and open forest, seldom penetrating into heavy jungles. Normally they rest during the hotter part of the day and move about in the early morning and late afternoon. They may become nocturnal in the summer, or when molested by people. They take readily to water and are said to be good swimmers. Home ranges during about half of the year were approximately 500 ha. for a male and 180 ha foe female.

18. Gaur: *Bos gaurus*

Head and body length is 250-330 cm, tail length is 70-105 cm, shoulder height is 165-220 cm, weight is 650-1,000 kg, and horn length is 60-115 cm.

Type Locality : Bangladesh, NE Chittagong (domesticated stock).
Distribution : India, Nepal, Burma, Thailand, S Tibet and Yunnan (China), S Vietnam, Cambodia, Peninsular Malaysia.
Status : U.S.ESA - Endangered; CITIES - Appendix I; IUCN Red Data Book - Vulnerable.

The gaur is the largest of all wild cattle. It has a glossy dark brown or black coat with cream-colored legs, and thick horns that curve upward. The gaur inhabits forested hills and associated grassy clearing up to elevations of 1,800 meters. It requires water for drinking and bathing but seems not to wallow. It is not excessively wary, but when startled, it crashes off through the jungle at high speed. The gaur was found to be both a grazer and a browser, preferring green grass when it was available but otherwise eating coarse, dry grasses and forbs and leaves.

19. Leopard: *Panthera pardus*

Head and body length id 91-191 cm, tail length is 58-110 cm, and shoulder height is 45-78 cm. Males weigh 37-90 kg, and females, 28-60 kg.

Type Locality : "Indiis", "Egypt"
Distribution : Afghanistan, Algeria, Angola, Arabia, Botswana, Burma, Cameroon, Central Africa Republic, Chad, China, Congo, Egypt, Ethiopia, Gabon, Guinea-Bissau, India, Indonesia (Java), Iran Iraq, Kenya, Korea, Liberia, Laos, Malawi, Malaysia, Mauritania, Morocco, Mozambique, Namibia, Nepal, Niger, Nigeria, Pakistan, Senegal, Sierra Leone, Somalia, South Africa, Sri Lanka, Sudan, Tanzania,

Thailand, Tunisia, Turkey, Uganda, republic of the former USSR, Vietnam, Zaire, Zambia, and Zimbabwe.
Status : CITES - Appendix I; U.S.ESA - Endangered (wxpect in Africa, in the wild, south of, and including Gabon, Congo, Zaire, Uganda and Kenya, where this species is Threatened). IUCN Red Data Book - Threatened.

The leopard can adapt to almost any habit that provides it with sufficient food and cover. It occupies lowland forests, mountains, grasslands, bush country, and deserts.

It may move 25 km in a night, or up to 75 km if disturbed. It generally progresses by a slow, silent walk but can briefly run at speed of over 60 km/hr. It has been reported to leap over 6 meters horizontally and over 3 meters vertically. It climbs with great agility and can descend headfirst. It is a strong swimmer but is not as found of water as is tiger.

The diet is varied but seems to consist mainly of whatever small or medium-sized ungulates are available, such as gazelles, impala. wildebeest, deer, wild goats and pigs, and domestic livestock. Monkey and baboons also are commonly taken. If necessay, the leopard can switch to such prey as robents, rabbits, birds, and even arthropods.

20. Leopard Cat: *Felis bengalensis*

Head and body length is 44.5-107 cm, tail length is 23-44 cm, and weight is 3-7 kg.

Type Locality : "Bengal" [India]
Distribution : Afghanistan, Bangladesh, Burma, Cambodia, China, India, Indonesia, Japan (Tsushima and Irimote Isls), Korea, Laos, Malaysia, Nepal, Pakistan, Phillippine Isls, Taiwan, Thailand, republic of the former USSR and Vietnam.
Status : CITES - Appendix I as *Felis bengalensis* (except for Chinese population); otherwise Appendix II. U.S.ESA - Endangered; IUCN Red Data Book - Endangered as *F. iriomotensis.*

The leopard cat is found in many kinds of forested habitat at both high and low elevations. It dens in hollow trees or small caves or under overhangs or large roots. It is an excellent swimmer and has populated many offshore islands. It apparently hunts on then ground, as well as in trees, and feeds on hares, rodents, young deer, birds, reptiles, and fish. The number of young per litter is one to four, usually two or three.

21. Himalayan Black Bear: *Selenarctos thibetanus*

Head and body length is 120-180 cm, tail length is 6.5-10.6 cm, and males weight is 50-110 kg, and females weight is 65-90 kg.

Type Locality : [India, Assam, Sylhet]
Distribution : Afghanistan, China, India, Indochina, Japan, Korea, Laos, Nepal, Pakistan, Taiwan, Thailand, Russia (SE Primorski Krai), Vietnam.
Status : CITES - Appendix I; U.S.ESA - Endangered as *U.t.gedrosianus*; IUCN Red Data book - Endangered as *U.t.gedrosianus*, otherwise Vulnerable.

The Asiatic black bear frequents moist deciduous forests and brushy areas, especially in the hills and mountains. It ascends to elevations as high as 3,600 meters in the summer and descends in the winter. This bear is generally nocturnal, sleeping during the day in hollow trees, caves, or rock crevices. It climbs expertly to reach fruit and beehives.

Individuals become fat in late summer and early fall before hibernation, but some populations do not undergo winter sleep, or do so only for brief periods of severe weather. In the Himalayas U. thibetanus hibernates, sometimes in a burrow of its own making, but that in southern Pakistan there is no evidence of hibernation.

22. Red Panda: *Ailurus fulgens*

Head and body length is 51-63.5 cm, tail length is 28-48.5 cm, and weight is usually 3-6 kg.

Type Locality : "Indes orientales"
Distribution : Yunnan and Szechwan (China), N Burma, Sikkim (India), Nepal, Bhutan.
Status : CITIES - Appendix II; IUCN Red Data Book - Insufficiently known.

Red pandas are actually more widely distributed than their larger cousin, the Giant panda. They inhabits mountain forests and bamboo thickets at elevations of 1,800-4,000 meters. They feed on vegetables, grass, fruits, acorns, bamboo leaves, eggs, birds, mice, and roots. In captivity most of them eat fruit, vegetables, and bamboo leaves. Red pandas have an extra "thumb" that functions in much the same way as our thumb. It allows them to grasp branches and hold them while they eat.

Habitat destruction is the main threat to the red panda. China and Nepal have rapidly growing human populations and their need for timber, fuel and grazing land causes widespread losses of forested land that supports bamboo undergrowth. Even in national parks and reserves, livestock grazing and timber extraction are destroying bamboo at an alarming rate. While bamboo flowerings, which cause large areas of bamboo to die, have been a cause of concern, man-made factors are a greater concern for the long-term survival of the species.

Part of the red panda's range overlaps with that of the giant panda, so giant panda conservation programs provide some benefit to the red panda.

23. Serow: *Capricornis sumatraensis*

Head and body length is 140-180 cm, tail length is 8-16 cm, shoulder height is 85-94 cm, and weight is 50-140 kg.

Type Locality : Indonesia, Sumatra
Distribution : N India; Nepal; Sikkim (EN India); Burma; China north to Gansu and Anhui; Thailand; Indochina; Malay Peninsula; Sumatra.
Status : CITES - Appendix I; U.S.ESA - Endangered; IUCN Red Data Book - Endangered as Capricornis, *sumatraensis sumatraensis.*

The upper parts are generally or black, the mane ranges in color from white to black, and the underparts are whitish. Serows inhabit rugged mountains or ridges, covered with thick brush or forest, at elevation of up to 2,700 meters. Their gait is clumsy and not particularly rapid, but they are sure-footed in descending steep, rocky slopes. They are commonly hunted with dogs, and when brought to bay, they defend themselves with their horns in a deadly manner. The diet consists of grass, shoots, and leaves.

2. List of Totally Protected Plants in Bhutan

1 Agar/agaru (Local Name)
Eagle Wood/Indian Aloe Wood (Common Name)
Aquilaria malaccensis (Botanical Name)
Malaysian agalloch. Aloeswood
Family : Daphne
Distribution : East of India, Bengal and Burma in the Himalayan mountains
Growing condition : sandy soil.

2 Yartsa-guenboop (Local Name)
Chinese catapillar (Common Name)
Cordyceps sinensis (Botanical Name)

Altitude : Over 4,000 m above the sea in Bhutan.
This is the famous Drug of Chinese Materia Medica. It is a kind of a mushroom, parasitic on the larva of insect living underground. It is found on the alpine grasslands.

3 Pang-gen metog (Local Name)
Gentiana crassuloides (Botanical Name)

Distribution : S Gansu, W Hubei, SE Qinghai, W Sichuan, S and SE Xizang, NW Yunnan [Bhutan, NW India, Nepal, Sikkim].
Altitude : 2700-4500 m above the sea.
Growing condition : Stream and river banks, grassland slopes, bogs, scrub, forests.

4 Snow down lily (Local Name)
Lloydia yunnanensis (Botanical Name)

Unnane amana
Family : Lily
Distribution : SE China, Bhutan
Altitude : Over 4,000 m above the sea in Bhutan.

5 Tsher-ngeon (local Name)
Blue poppy (Common Name)
Meconopsis grandis (Botanical Name)

Himalayan blue poppy
Family : Poppy
Distribution : From S Nepal to Burma, Mountainous areas of SE China.
Altitude : 3,000-4,500 m above the sea.
Growing condition : Alpine grasslands, meadows, scrub, growing in crowds.

This poppy is a rosette-forming, hairy perennial with elliptic-oblong to lance-shaped, toothed, dark green basal and stem leaves, about 20 cm long. In later spring and early summer, shallowly cup-shaped, deep rich to pale blue flowers, about 12 cm across, are borne singly in the upper leaf axils of the branched stems, on stalks 20-50 cm long.
Height; 1.2-1.5 m. Spread : 60 cm.

6 Kirang-shing (Local Name)
Yew (Common Name)
Taxus baccata (Botanical Name)

Europe Yew
Family : Yew
Distribution : From Middle South of Europe to Bhutan, Burma and SE of China along North Africa, Afghanistan and Himalayan mountains.
Altitude : 2,000-3,500 m above the sea.
Growing condition : Forest along gorge, scrub.

7 Bhreeng-geera-dza (Local Name)
Ginseng (Common Name)
Panax pseudoginseng (Botanical Name)

Family : Araliaceae
Distribution : Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Xizang, Yunnan and Zhejiang in China, Bhutan, India, Japan, Korea, Myanmar, Nepal, Vietnam, Africa, Afghanistan and Himalayan mountains.
Altitude : 2,000-4,800 m above the sea.
Growing condition : Forest bed of moist and heavy rainy areas.

Appendix-H

Tables of Initial Environmental Evaluation

Table 9B.1 Screening and Scoping for No.1 Kurizampa Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property			
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 30m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 30m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- There are about 15 houses (about 100 persons) in the vicinity of the bridge.
- Mahseers (fish, 5 feet in length) are known to exist in the river.
- River color is light brown.

Table 9B.2 Screening and Scoping for No.2 Chamkar Zam Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	U	U	"Chorten" is about 50m from bridge.
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 60m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 60m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- There are about 200 houses (about 2,000 persons) in the vicinity of the bridge.
- There are many schools, hospital, forest office and various juice factories near town to the bridge.

Table 9B.3 Screening and Scoping for No.3 Bjee Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property			
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 40m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 40m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Deer, wild boar and bear, etc. are known to exist in the surrounding areas.
- Trout (fish, 8 inches in length) is known to exist in the river.

Table 9B.4 Screening and Scoping for No.4 Wachy Zam Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property			
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 40m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 40m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Trout (fish, 8 inches in length) is known to exist in the river.
- Six or seven persons are generally living in one house .
- Locals are not fond of fishing because they are Buddhist.

Table 9B.5 Screening and Scooping for No. 5 Mangdichu Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	Y	Y2	One PWD office should be remove.
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	Increase in of landslide is unknown.
10	Topography and Geology	-	-	
11	Soil Erosion	U	U	Topsoil erosion by rainfall after vegetation removal is unknown.
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 10m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 10m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Mahseers (fish, 5 feet in length) and katores (fish, dzongkha language) are known to exist in the river.
- River is muddy at present but it is clean in winter.

Table 9B.6 Screening and Scoping for No.6 Wangdigang Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Deer, leopards, bears and monkeys, etc. are known to exist in the surrounding areas.
- There are many butterflies in the vicinity of the bridge.
- Trout and other local fish are known to exist in the river.

Table 9B.7 Screening and Scoping for No.7 Panjurmani Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Deer are known to exist in the surrounding areas.
- There are no fish in the river.

Table 9B.8 Screening and Scoping for No.8 Ishigangchu Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- There are not fish in the river.
- Left side of bridge is located in the landslide area.

Table 9B.9 Screening and Scoping for No.9 Hesothangkha Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	Y	Y2	Several houses should be removed for new bridge.
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	U	U	Ruin of "Chorten" is about 20m from bridge.
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 10m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 10m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Table 9B.10 Screening and Scoping for No.10 Lawakha Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- There are no fish in the river.
- There are occasionally no water in the river.

Table 9B.11 Screening and Scoping for No.11 Basochu Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	U	U	Increase in of landslide is unknown.
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration			
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Water quantity in the river is controlled by a dam upstream of the bridge.
- Fish are known to exist in the river.
- River becomes muddy in summer because of heavy rain.

Table 9B.12 Screening and Scoping for No.12 Rurichu Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 40m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 40m from bridge. Noise from construction equipment is unknown
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Fish are known to exist in the river.
- River becomes muddy in summer because of heavy rain.

Table 9B.13 Screening and Scoping for No. 13 Baychu Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 30m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 30m from bridge. Noise from construction equipment is unknown
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Information Gathered From the Locals :

- Maize field, orange and mango trees are grown by the farmers in the vicinity of the bridge.

Table 9B.14 Screening and Scoping for No.14 Kamichu Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation			
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Mahseer (fish, 5 feet in length), trout (fish, 8 inches in length) and katore (fish, dzongkha language) are known to exist in the river.
- Deer, wild boar, bear and leopard, etc. are known to exist in the surrounding areas.

Table 9B.15 Screening and Scoping for No.15 Narachu Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	-	-	
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of river bed is unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Three years ago, due to flood, the bridge was submerged under water.

Table 9B.16 Screening and Scoping for No.16 Wakleytar Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	U	U	Increase in of landslide is unknown.
10	Topography and Geology	-	-	
11	Soil Erosion	U	U	Topsoil erosion by rainfall after vegetation removal is unknown.
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :

Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)

- : No environmental impact is expected. EIA is not necessary.

U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- A Police Camp is in the vicinity of the bridge.

Table 9B.17 Screening and Scoping for No.17 Mechikhola Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Only small fish are known to exist in the river.
- River color is light brown.

Table 9B.18 Screening and Scoping for No.18 Burichu Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Deer and bear, etc. are known to exist in the surrounding areas.

Table 9B.19 Screening and Scoping for No.19 Chanchey Bridge

No.	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- There are no fish in the river.

Table 9B.20 Screening and Scoping for No.20 Loringkhola Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	-	-	
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	-	-	
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	-	-	
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- There are no fish in the river.
- River is clean.
- Many leeches were found.

Table 9B.21 Screening and Scoping for No.21 Tangmachu Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	Y	Y2	One shop should be removed for new bridge.
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	Increase in of landslide is unknown.
10	Topography and Geology	-	-	
11	Soil Erosion	U	U	Topsoil erosion by rainfall after vegetation removal is unknown.
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 40m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 40m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Only mahseer (fish, 5 feet in length) is known to exist in the river.

Table 9B.22 Screening and Scoping for No.22 Sunkosh Bridge

No	Environmental Item	Screening	Scoping	Reason
1	Resettlement	Y	Y2	About three houses should be removed for new bridge.
2	Economic Activities	-	-	
3	Traffic and Public Facilities	-	-	
4	Split of Communities	-	-	
5	Cultural Property	-	-	
6	Water Rights and Rights of Common	-	-	
7	Public Health Condition	U	U	Generation of garbage and the increase of vermin are unknown in construction phase.
8	Waste	U	U	Generation of construction and demolition waste, debris and logs are unknown.
9	Hazards (Risk)	-	-	
10	Topography and Geology	-	-	
11	Soil Erosion	-	-	
12	Groundwater	-	-	
13	Hydrological Situation	-	-	
14	Coastal Zone	-	-	
15	Fauna and Flora	U	U	Existence of the protected plant in Bhutan and the state of aquatic life are unknown.
16	Meteorology	-	-	
17	Landscape	-	-	
18	Air Pollution	U	U	Human settlement, about 20m from bridge. Exhaust gas from construction equipment is unknown.
19	Water Pollution	U	U	Disturbance of sediments by construction of abutment and the erosion caused by the change of vegetation and topography are unknown.
20	Soil Contamination	-	-	
21	Noise and Vibration	U	U	Human settlement, about 20m from bridge. Noise from construction equipment is unknown.
22	Land Subsidence	-	-	
23	Offensive Odour	-	-	
24	Highway Runoff Pollution	-	-	
25	Highway Spills	-	-	
26	Monitoring and Maintenance	U	U	Monitoring for assessing the actual environmental impacts and the long-term maintenance of the project are unknown.

Note :
Y: Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)
- : No environmental impact is expected. EIA is not necessary.
U: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

Other Information Gathered From the Locals :

- Only trout (fish, 8 inches in length) is known to exist in the river.
- Monkeys, wild boar and many birds are known to exist in the surrounding areas.

Appendix-I

TOR for EIA for the National Highway Bridge Construction

དཔལ་ལྡན་འབྲུག་གཞུང་།

National Environment Commission
Royal Government of Bhutan
THIMPHU/BHUTAN

Tele. No. : 23384
Fax No. : 23385

NEC/EIA/ROADS/ 174 · 9 March 98

Subject: TOR for EIA for the National Highway Bridge Construction

Dear Phuntsho Wangdi,

Please find the enclosed a copy of the revised Terms of Reference for the EIA for the National Highway Bridge Construction in the Kingdom of Bhutan. The National Environment Commission would highly appreciate if the EIA report is prepared as per the EIA guidelines and the TOR. On completion of the EIA report we would appreciate if you could send the first draft copy before finalising the document.

Thanking you for your cooperation and look forward to working together.

Yours sincerely,

Paljor J. Dorji
Deputy Minister, NEC

Phuntsho Wangdi
Executive Engineer
Division of Roads
Ministry of Communication

Term of Reference:
EIA for the National Highway Bridge Construction in the Kingdom of Bhutan

1. Background

As a land-locked country, Bhutan's socioeconomic development depends largely on an efficient and reliable road network. However, the lack of a well developed transport network in Bhutan has been identified as one of the major constraints to the development of more remote areas of the country. Road infrastructure development has therefore been given priority in all the past five year plans.

The national highway network in Bhutan provides links between districts (Dzonghags) and their capitals, and between the district capitals themselves. Some of the national highways carry international traffic to India, such as National Highway No.2 (Thimphu-Phuntsholing), National Highway No.3 (Trashigang-Samdrup Jongkhar), National Highway No.4 (Trongsa-Gelephu) and National Highway No.5 (Wangdue Phodrang-Gelephu). These highways are narrow with winding horizontal alignments having many hairpin bends, and prone to landslides and sinking.

The construction and maintenance of roads is technically difficult due to the fragility of the ground and the risk of landslides during the monsoon period. The terrain in which roads are positioned require that they be aligned along the base of mountainous valleys and cut into hillside, making road construction more demanding in terms of technology and finances and therefore costlier than those in the plains.

The road network had been given due importance during the Seventh Five Year Plan (1991-1996). The seventh plan objective was to construct and maintain the road network and bridges in order to facilitate efficient movement of cargo and passengers. A sufficient road network in Bhutan is a prerequisite for the socioeconomic development of the country.

Most of the bridges on the national highways were constructed as temporary structures (Bailey bridges with stone masonry substructures) and have passed their design life. Within a few years they will not be suitable for use by any transport leave alone heavy vehicles.

In the Eighth Five Year Plan (1997-2002) the programs of highway improvement and permanent bridge construction are continuously given high priority.

In taking account of these conditions, the Royal Government of Bhutan (RGOB) through the Public Works Division (PWD), intends to implement the Study on National Highway Bridge Replacement Project (Study). RGOB requested to the Government of Japan to conduct the Study. At present the Study is being implemented by the Japan International Cooperation Agency Study Team (JICA Study Team). The object of the Study is to carry out a feasibility study on the selected 5 bridges from among 22 bridges in order to facilitate efficient movement of goods and passengers on the National Highways.

RGOB has given the mandate to the National Environment Commission (NEC) to review and assess the need for environmental impact assessment (EIA) in relation to development projects and to scope the EIA. Bhutan's fragile mountainous environment with its rich biological diversity and its unique culture and religious background makes it imperative to carry out EIAs for all major development projects in order to make it possible to mitigate adverse environmental impacts, such as soil erosion and landslides. Therefore, general Environmental Impact Assessment Guideline for Bhutan was issued by the NEC in 1993, and according to these, EIA is required prior to any binding decision in relation to major development projects.

The main purposes of the EIA are to reveal negative environmental consequences of the project to decision-makers and other interested parties, and to provide environmental background information that makes it possible to design, construct and operate the bridge in an environmentally sound way. The EIA takes place concurrently with technical and economic feasibility studies to make it possible to incorporate environmental considerations equally with technical and economic aspects. Thus, EIA is considered a flexible and transparent tool for ensuring environmentally sound development.

PWD will be responsible for the execution of the EIA, whereas the EIA report will be prepared by the JICA Study Team.

The EIA should address the proposed bridge replacement project.

A JICA survey team visited the project areas on September 1997. An initial environmental examination (IEE) was made on the basis hereof. The main findings at

the five bridge sites from the IEE are summarized below:

The Result of IEE for 5 Bridges.

Bridge Name / Environmental Item	No.1 Kurizampa	No.2 Chamkar Zam	No.3 Bjee	No.4 Wachy Zam	No.5 Mangdichu
Resettlement	-	-	-	-	Y2
Cultural Property	-	U	-	-	-
Public Health Condition	U	U	U	U	U
Waste	U	U	U	U	U
Soil Erosion	-	-	-	-	U
Fauna and Flora	U	U	U	U	U
Air Pollution	U	U	U	U	U
Water Pollution	U	U	U	U	U
Noise and Vibration	U	U	U	U	U
Monitoring and Maintenance	U	U	U	U	U

Note :

Y : Environmental impact is expected. (Y1: Serious impact is expected. Y2: Minor impact is expected.)

- : No environmental impact is expected. EIA is not necessary.

U : Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses.).

These Terms of Reference (ToR) for the National Highway Bridge Construction Project are based on the finding from the IEE.

2. Project Objectives

The goal of the bridge replacement project which is to construct permanent bridges from the existing old temporary bridges, is formulated by PWD so as to improve and maintain sound transport conditions and socioeconomic status of the Kingdom of Bhutan.

3. Project Description

The following five (5) bridges selected have been studied for feasibility.

3.1 No.1 Kurizampa Bridge

Existing Conditions:	Location	:	Kurichu River, Mongar Dzongkhag
	Class of road	:	National Highway Route No.1
	Superstructure	:	Bailey TSR
	Bridge length	:	42.7 m
	Completed in	:	1971
	Present limited load capacity	:	5 ton
Estimated traffic volume for the year 2020		:	169 vehicles per day
Proposed Bridge:	Superstructure	:	Steel Truss
	Bridge length	:	54 m
	Design Live Load	:	Class A Loading
	Distance to the present bridge	:	8 m

3.2 No.2 Chamkhar Zam Bridge

Existing Conditions:	Location	:	Chamkarchu River, Bumthang Dzongkhag
	Class of road	:	National Highway Route No.1
	Superstructure	:	Bailey DS
	Bridge length	:	33.7 m
	Completed in	:	1973
	Present limited load capacity	:	5 ton
Estimated traffic volume for the year 2020		:	169 vehicles per day
Proposed Bridge:	Superstructure	:	Steel Truss
	Bridge length	:	43 m
	Design Live Load	:	Class A Loading
	Distance to the present bridge	:	8 m

3.3 No.3 Bjee Bridge

Existing Conditions:	Location	:	Mangdichu River, Trongsa Dzongkhag
	Class of road	:	National Highway Route No.1
	Superstructure	:	Bailey TSR
	Bridge length	:	42.7 m
	Completed in	:	1969
	Present limited load capacity	:	9 ton
Estimated traffic volume for the year 2020		:	388 vehicles per day
Proposed Bridge:	Superstructure	:	Steel Truss

Bridge length : 50 m
Design Live Load : Class A Loading
Distance to the present bridge : 8 m

3.4 No.4 Wachy Zam Bridge

Existing Conditions:
Location : Dangchu River, Wongdue Dzongkhag
Class of road : National Highway Route No.1
Superstructure : Bailey DSR
Bridge length : 33.7 m
Completed in : 1969
Present limited load capacity : 18 ton
Estimated traffic volume for the year 2020 : 388 vehicles per day
Proposed Bridge:
Superstructure : Steel Truss
Bridge length : 43 m
Design Live Load : Class A Loading
Distance to the present bridge : 8 m

3.5 No.5 Mangdichu Bridge

Existing Conditions:
Location : Mangdichu River, Zhemgang Dzongkhag
Class of road : National Highway Route No.4
Superstructure : Bailey Suspension
Bridge length : 97.4 m
Completed in : 1965
Present limited load capacity : 4 ton
Estimated traffic volume for the year 2020 : 76 vehicles per day
Proposed Bridge:
Superstructure : Steel Lohse
Bridge length : 100 m
Design Live Load : Class A Loading
Distance to the present bridge : 40 m

4. Project Benefits

The project benefits are identified by PWD as follows:

The density of existing trunk road network in Bhutan is very coarse. Accordingly, when a main section of the network is closed for a moment by disaster, traffic accident, etc.

the road users are compelled to make a large detour. In case of the collapse of present Bailey bridges which have already crossed their life spans and limited at low load capacity, the same situation occur, and road users will suffer many disadvantages. The implementation of this projects will be able to avoid such a critical situation.

National Highway No.1 on which four bridges will be replaced is only one connecting road from west and to east areas of the country and it is a very important "Life Line" in the Kingdom of Bhutan. Four bridges on the National Highway No.1 still remain as temporary bridges with limited low load capacity compared with other permanent bridges on the Highway. There are constraints of freight movement and access to markets on account of the load capacity limitation of existing bridges, and therefore the economic activities and industrial developments in the whole country, especially in the central region, are constrained. When these four bridges are replaced by new permanent bridges, the traffic characteristics between west and east will be extremely improved.

National Highway No.4 on which one bridge will be replaced is a very important road as "Productivity Road". This bridge still remain as temporary bridge with very limited load capacity (4 ton) as compared with other permanent bridges on the Highway. When this bridge is replaced by a new permanent bridge, the traffic characteristics will be extremely improved as same as above mentioned 4 bridges.

Local residents will be provided with safe and reliable accessibility to educational facilities in and around the project bridges, and the ability of health service teams to provide timely service will be improved by the availability of reliable transport. This will be even more so when a team must respond to an emergency such as road traffic accidents or when a critically ill patient must be moved to a higher level care center.

5. Scope of Work

The ToR for the National Highway Bridge Replacement Project has been prepared to meet the needs for an EIA and mitigation plan which are in agreement with Environmental Impact Assessment Guidelines for Bhutan, 1993.

The impact assessment should identify, describe and assess potentially significant adverse environmental impacts of the project and accessory activities imposed by the project, such as extraction of materials from borrow pit and quarry sites, generation of construction and demolition waste, and set-up and removal of labor's camps. The impact assessment should cover the construction period only because this project

concerns replacement from the existing temporary to permanent one, and the proposed location is very close to the present bridge and it's scale is planned as almost same as the present one.

The mitigation plan should identify a set of responses to potentially adverse environmental impacts; determine requirements for ensuring that those responses are made in an effective and timely manner and describe the means of meeting those requirements. Emphasis should be given to responsibility of agencies charged with implementing, mitigation and monitoring, that is who is going to do the work and pay for it?

5.1 Identification and Assessment of Impacts

Identification, description and assessment of environmental impacts should be based on observations from field investigations covering land use, topography, flora and fauna in the study area that may contain environmental issues relating to the project. The field observations should be supplemented with various baseline data (maps, scientific literature etc.), for example from the interviews of locals. The assessment should include, but not necessarily be limited to, the following aspects:

1. extraction of construction materials, including blasting
2. noise and vibrations generated by construction equipment
3. noise from blastings
4. construction waste and siltation of rivers, including possible obstruction of breeding activities and extinction of aquatic species due to change of habitat conditions
5. waterway constrictions
6. topsoil erosion by rainfall after vegetation removal
7. labour camps
8. resettlement due to land occupancy (transfer of rights of residence / land ownership), where relevant
9. damage to or loss of the value of religious or historical places/monuments, where relevant

5.2 Mitigation Plan

Based on the findings of the above evaluation, a mitigation plan should be prepared, if necessary. The mitigation plan should describe in detail mitigation action needed, estimate their costs, staffing needs, and timing for corrective measures and actions.

Roles and responsibilities in relation to the actions needed should be specified in detail.

The mitigation plan should specifically include:

a) Technical Mitigation Measures

Technical measures that are, or could be, incorporated into project design and construction phases to eliminate or reduce adverse environmental impacts should be identified and described in general terms. The level of detail of the technical description should be approximately that of a preliminary design. The following aspects should be specifically addressed:

1. need for blasting
2. drainage system alongside the construction yard.
3. slop protection work such as establishment of native shrubs/trees or rip-rap for further prevention of soil erosion from new slope caused by the project.
4. land tenure, land use rights and land values.
5. borrow pit, quarries and disposal sites.

b) Environmental Management Plan for the Construction Phase

A draft environmental management plan for construction activities should be prepared with the purpose of incorporation of environmental terms and conditions into the bridge construction Tender Documents. The management plan should cover aspects of bridge construction, and responsibilities should be assigned, including responsibilities for mitigation operations, supervision, emergency response procedures, financing and reporting. Special attention should be paid to the following issues:

1. occupational health and safety issues, including labor's camps and work sites.
2. waste management, discharge water from labor camps, housing and services for labors.
3. response action in case of accidents or unforeseen events.

c) Maintenance Plan

A draft maintenance plan - or a code of maintenance practice - should be prepared. The plan/code of practice should describe maintenance procedures and assign responsibilities in relation to regular maintenance, emergency response action, supervision, financing, monitoring and reporting. Institutional capacity for implementing the plan should be reviewed and training needs assessed.

d) Environmental Monitoring

A monitoring program covering the construction phase should be prepared, including assignment of responsibilities and an implementation schedule. The monitoring program should make sure, that the proposed monitoring plan are implemented by agencies or companies that are in charge of bridge construction.

e) Estimated Costs

The costs and/or savings from the proposed mitigation plan should be estimated.

6. Report Form

The EIA report should include a non-technical executive summary and a technical part supplemented with relevant annexes.

6.1 Executive Summary

The EIA report should include a precise, non-technical description of significant findings and recommendations.

6.2 Technical EIA Report

The technical component of the EIA report should include the following sections:

a) Project Description

The project description should be at a level of detail that provides adequate background information for comparison and ranking of project alternatives. At a minimum, the project description should include the following information:

1. location of the bridge
2. length and width of the bridge
3. brief summary of topography, geology and land use at the proposed bridge site.
4. technical design of the bridge.
5. accessory constructions and activities (quarries, disposal of excess material, temporary bridge, workers' camps etc.).

b) Baseline Information

This section should contain a description of the existing environment situation based on field investigations complemented with available books, maps, etc. Documentation from the field investigation should be presented here or be put into an annex of the report.

c) Assessment of Impacts

This section should describe and assess significant potential environmental impacts of the proposed project.

d) Mitigation Plan

This section should present a mitigation plan with findings and recommendations based on the impact assessment.

7. Reporting and Timing

A draft report should be prepared by the PWD and reviewed by the NEC and possibly by other relevant institutions to be selected by the NEC. Six copies of the draft final report should be submitted to the NEC for comments. The NEC will submit its comments to the PWD within two weeks after receipt of the draft final report. Ten copies of the final report should be submitted to the NEC not later than three weeks after receipt of comments from the NEC on the draft final report.

8. Background Information

8.1 Background Information from PWD:

The Eighth Five Year Plan (1997-2002), Ministry of Planning

8.2 Background Information from NEC:

1. Environmental Impact Assessment Guideline for Bhutan, National Environment Commission, 1993
2. Draft Sectoral EIA guidelines for Bhutan, May 1997

Appendix-J

Construction Plan/Cost Estimate

Appendix-J Construction Plan / Cost Estimate

J.1 General Construction Conditions

J.1.1 Cement

The cement factories are listed as follows:

- Name of Enterprise : Penden Cement Authority Limited (PCAL)
  Location : Gomtu, Samtse District
  Production Capacity : 800 tons per day
- Name of Enterprise : Dungsum Cement Plant (DCP), Under construction
  Location : Nanglam, Samdrup Jongkar District
  Production Capacity : 1,500 tons per day when completed
- Name of Enterprise : Lhaki Cement Private Limited (LCPL)
  Location : Gomtu, Samtse District
  Production Capacity : 50 tons per day
- Name of Enterprise : Namgail Cement Company Limited
  Location : Pasakha, Chhukha District
  Production Capacity : Less than 50 tons per day (No sale record in 1996)

J.1.2 Procedure for Recruitment of Non-National Workforce

The employment of non-nationals is carried out in accordance with the Rules and regulations of the Ministry of Home Affairs, i.e. CHA/19(20)-13/94/650. The followings are the extracts.

(1) Applicants
   - Labour recruiting agency or the concerned employer in Bhutan
   - The Department / Ministry / Commission.

(2) Eligibility of Non-National Workforce.
   - Only single person or bachelor of the age 20 to 50 and free from diseases.
   - Having skills or experience in the field of work for which labor is required.
   - Possessing valid identity documents or certificate of nationality.

(3) Approving Authority (Ministry of Home Affairs)
   - And Committee composed of officials of Ministry of Home Affairs, Royal Civil Service Commission, Ministry of Trade, Industry and Power, Division of Registration

(4) Priority to be considered by the Committee
   - Royal Government projects / Government of India aided projects / Internationally aided projects.
   - Industry / construction sectors.
   - When Bhutanese nationals are not available.

(5) Ceiling and Restrictions
   - Not more than 30,000 non-nationals at any one time.
   - Only skilled persons and technicians not available within Bhutan.

J.1.3 Labor Law

The labour law refers to the regulations, i.e. CHA/19(20)-13/94/650. The followings are the extracts.

1) All contingency staff / persons engaged on Consolidated Pay or Daily Wage basis, should be employed within category depending on their experience and grades of skill.
2) The level of wage rate is applicable throughout the kingdom, and the government approved wage rate is valid until further orders.
3) Working duration shall be 8 hours a day with one hour lunch break.
4) Person paid on consolidated and daily wage will not be entitled to daily allowances.
5) Worker will be eligible for companion under Workmen's Compensation rules.
6) Medical coverage will be given as far as practical free of charge within the country.
7) Rations shall be made available on payment at the site where ever possible.
8) Material for temporary site living accommodation may be provided free of cost.
9) Transportation costs shall be borne-by the concerned employer
10) All workers on consolidated pay are entitled for one day paid leave for every 6 working day and 15 days paid leave in a year.
11) Employers should ensure overtime payment for the additional hours of work at one and a half times the rates.

J.1.4 Local Construction Contractors

The outline of class A contractor which is expected to be employed as sub- contractor for this project is described below ;

- Minimum Work Experience : 8 years except in the special case of Direct Entry
- Minimum Turnover : Nu. 8 millions per year

- Minimum Technical Manpower for Civil Works ;
  Manager (National) : 1, Civil engineer (degree) per contract : 1
  Civil engineer (diploma) per contract : 1, Accountant (National) : 1
- Minimum Construction Equipment ;
  Concrete mixer : 2 nos., Vibrator : 2 nos., Steel form works : 400m2
- Contract Limit : Bid for 5 different contracts at a time worth above Nu. 3 million each

J.1.5 Concrete Strength and Mix Proportion

It is important to study the relation between concrete strength and mix proportion using local materials for the following reasons ;

- Local mix proportion is carried out based on the Indian specified mix shown in Table J-1.
- PWD laboratory has no record of mix and design of mix proportion
- Different quality of stones and sand at each quarry site.

Hence, the mix proportion for concrete should be carried out according to the availability of materials at site prior to commencement of construction.

Table J-1 Mix Proportion

Classification	Mini. Strength at 28 Days (kg/cm^2)	Mix Ratio (by weight)		
		Cement	Sand	Aggregate
M10	100	1	3	6
M15	150	1	2	4
M20	200	1	1.5	3
M25	250	1	1	2

J.2 Construction Conditions at Site

The survey results of each bridge site are shown in Table J-2 and J-3.

Table J-2 Construction Conditions at Site (1/2)

Bridge No. Bridge Name	Restriction to Construction Work	Land Aquisition & Compensation of Properties
No.1 Kurizampa	*The water is deep even in the dry season. *To maintain the vertical clearance for the existing traffic flow, when the cable erection method is planned. *There are no rocks for cable anchor for temporary work on the slope of the access road on the left bank.	*Not required
No.2 Chamkar	*The depth of water on the right riverbed is shallow in the dry season. *A large volume of fill materials are required.	*Not required
No.3 Bjee	*The depth of water on the right riverbed is shallow in the dry season. *To maintain the vertical clearance for the existing traffic flow, when the cable erection method is planned. *Large volume of rock excavation is required to detour the existing traffic flow and improvement of access road.	*Water table counter of Power Division (Automatical Logger) located on the left bank
No.4 Wachy Zam	*The depth of water on the downstream riverbed is shallow in the dry season. *A large volume of fill materials are required *Large volume of rock excavation is required to detour the existing traffic flow and improvement of access road. *The land acquisition of farmland is difficult, but the rental for temporary work is negotiable.	*Paddy fieldlocated on the right bank *The land aquition process takes more than 6 months
No.5 Mangdichu	*The depth of water on the downstream riverbed is shallow in the dry season. *To secure the chorten located on the highway towards Zhemgang side. *Large volume of rock excavation is required to detour the existing traffic flow and improvement of access road.	*Electric cable and poles provided by Mirco Hydel Project *Police check house located on the right bank *PWD properties such as staff quarters, storage, workshops and etc.located on the left bank. *Hut and wire cable for measuring water velocity located on the downstream

Note :

1. At present, the alignment and the construction method is not yet fixed.

Table J-3 Construction Conditions at Site (2/2)

Bridge No. Bridge Name	Local Procurment Material Source					Consruction Yard Public Utilites
	Stone / Sand	Fill Material	Cement	Timber	Fuel	
No.1 Kurizampa	Quarry site located at 5km from Site or Dealer at Mongar	No requirment or small volume	Dealer at Mongar (25km from the Site)	Sawmill at Limithang (4km from the Site)	Dealer at Mongar (25km from the Site)	Limithang PWD area (1km from the Site) Electricity is available No telephone facilities
No.2 Chamkar	To crush stones collected from sandbar around the Site	Goverment land along road (2km from the Site)	Dealer at Trongsa (68km from the Site)	Adjacent sawmill to the Site	Dealer at Jakar (1km from the Site)	Adjacent open area to the Site Electricity & telephone facilities are available
No.3 Bjee	To utilize adjacent old quarry site	No requirment or small volume	Dealer at Trongsa (6km from the Site)	Sawmill at Jakar (68km from the Site)	Dealer at Trongsa (6km from the Site)	Adjacent quarry site at the Site No electricity No telephone facilities
No.4 Wachy Zam	Quarry site located at the mountain side (5km from the Site or 27km to Nobding)	Goverment land along road (5km from the Site)	Dealer at W/Phodrang (13km from the Site)	Dealer at W/Phodrang (13km from the Site)	Dealer at W/Phodrang (13km from the Site)	Adjacent farmland or open area to the Site No electricity No telephone facilities
No.5 Mangdichu	To crush stones collected from adjacent branch river near the Site	No requirment or small volume	Dealer at Zemgang (35km from the Site)	Adjacent sawmill to the Site	Dealer at Zemgang (35km from the Site)	Adjacent Tingtibi PWD area or open area at the Site Electricity is available No telephone facilities

Notes :

1. Sand is purchased from dealer, when quarry cannot produce large quantity of sand.
2. In Limithang and Tingtibi, the electric supply is often interrupted.

J.3 Transportation of Materials and Equipment

J.3.1 Transportation Conditions of Imported Materials and Equipment

(1) Customs Clearance

There are trading companies in Thimphu, Phuentsoling and Calcutta which some carriers deal with transportation of international goods into the country.
If the documents (Import License) are in order, clearance time for customs is as below;

- India : 1 day
- Overseas : 7 days at Calcutta Port

(2) Type of Vehicle and Carrying Capacity

The type of vehicle and maximum carrying capacity are limited as follows ;

- Tata Truck : 5 m (L) x 2.1 m (W) x 2.1 m (H), Maximum weight 13MT
- STD Trailer : 12 m (L) x 2.4 m (W) x 2.4 m (H), Maximum weight 24MT
- Low Bed Trailer : 6 m (L) x 3 m (W) x 3 m (H), Maximum weight 30MT
- Special Low Bed Trailer : 8 m (L) x 3.75 m (W) x 3.75 m (H), Maximum weight 40MT

J.3.2 Transportation Conditions from Phuenthsholing to Each Bridge Site

(1) Transportation Route and Time Required

The recommended transportation routes from Phuenthsholing to the each bridge site and the time required, considering the controlled road conditions shown in Fig. J-1 and Table J-4 are as below ;

1) Bridge No.1 Kurizampa
   Route : Phuentsholing Hashimara Rangia - S/Jongkar Trashigang Mongar - Site (639 Km)
   Time : 4 or 5 days for Tata truck / 7 days for Trailer
2) Bridge No.2 Chamkar
   Route : Phuentsholing Semtoka - W/Phodrang Trongsa Jakar - Site (431 Km)
   Time : 3 or 4 days for Tata truck / 5 days for Trailer

3) Bridge No.3 Bjee
   Route : Phuentsholing Semtoka - W/Phodrang - Site (355 Km)
   Time : 3 days for Tata truck / 4 days for Trailer
4) Bride No.4 Wachy Zam
   Route : Phuentsholing Semtoka - W/Phodrang - Site (246 Km)
   Time : 2 days for Tata truck / 3 or 4 days for Trailer
5) Bridge No.5 Mangdichu
   Route : Phuentsholing Hashimara Samtalbari Gelephu - Site (291 Km)
   Time : 3 days for Tata truck / 4 or 5 days for Trailer

The road conditions on some spots of the above routes are not so good. The followings are especially limited by the conditions.

- Bjee bridge : Limited load capacity 5 ton (TSR Bailey type completed in 1969)
- Pelela pass : Snow area & No pavement due to severe landslide
- Aie bridge : Original load capacity 9 ton (Bailey Suspension type completed in 1963) (Refer to Fig. J - 1 and Table J - 4)

(2) Type of Vehicle and Carrying Capacity

The type of vehicle and maximum carrying capacity are limited as follows ;
- Tata Truck : 5 m (L) x 2.1 m (W) x 2.1 m (H), Maximum weight 8 ton
- Trailer : 6 m (L) x 2.5 m (W) x 2.7 m (H), Maximum weight 16 ton

The trailer has 1 front axle and 2 rear axles, namely it is called ten wheelers.
Maximum possible length of material for transportation by Trailer is as below ;
- Length & Maximum weight of materials : 9 m (5 MT), 8 m (9 MT), 7 m (11 MT)

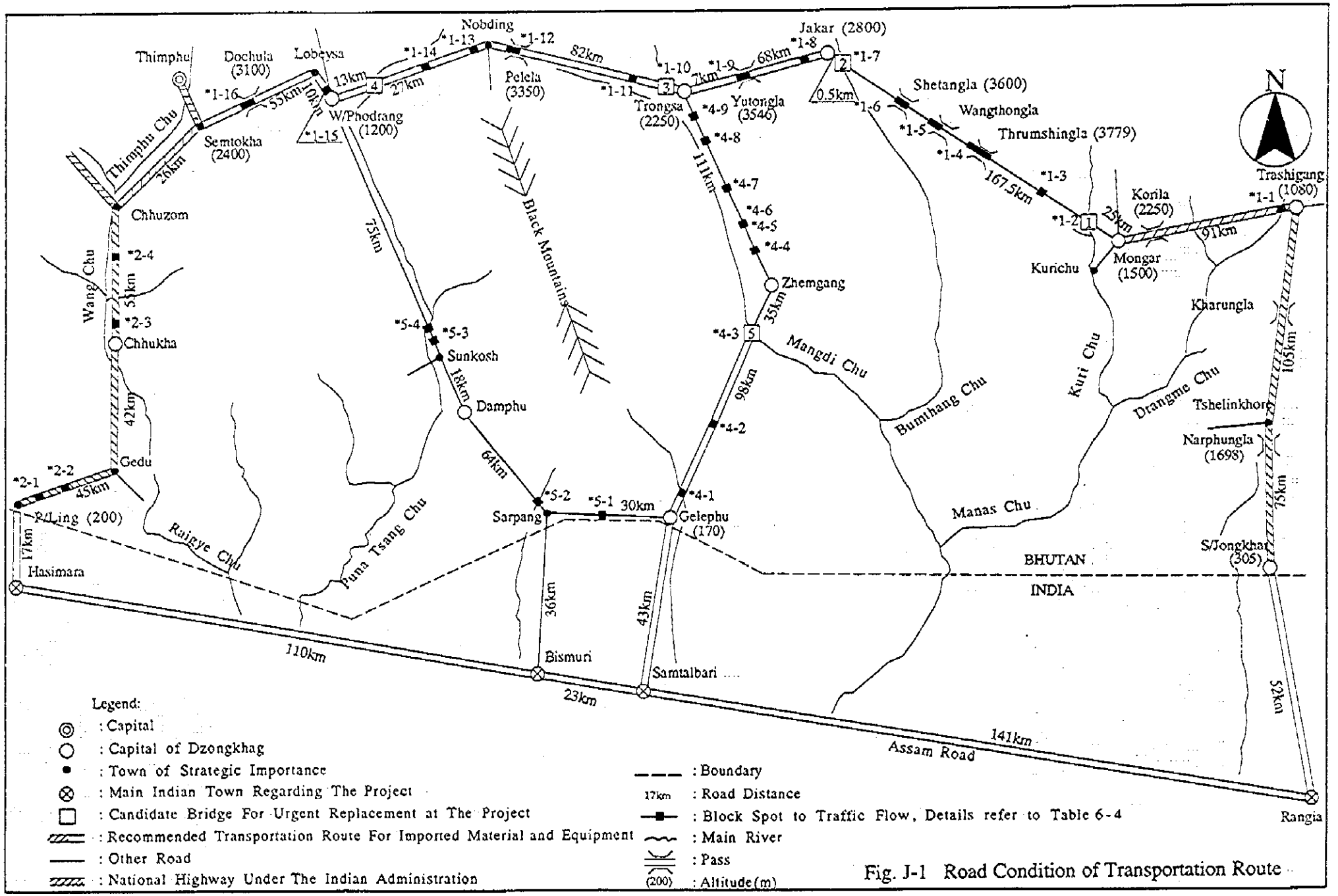

Fig. J-1 Road Condition of Transportation Route

Table J-4 Road Condition of Transportation Routes

Spot No.	Location (Km)	Distance (Km)	Existing Road Condition	Condition	Past Record of Road Blocks & Other Comments (*)
1 - 1	10	0.8	Original load capacity of Chazam bridge:15 ton,Completed in 1965	Not good	
1 - 2	116	0.05	Limited load capacity of Kurizampa bridge:5 ton	Bad	*Study by Japan
1 - 3	159 - 163	4.0	Critical section prone to dangerous rock and landslides	- do -	Major block some years ago
1 - 4	192 - 209	17.0	Thrumshingla pass: Snow area & No pavement in certain places	- do -	Road blocked by snow for 46 days in 1995/1996
1 - 5	216 & 226 - 232	0.2 & 6.0	Wangthongla pass: No pavement due toland slide & Snow area	- do -	
1 - 6	246 - 253	7.0	Shevtang pass: Snow area	Not good	
1 - 7	284	0.04	Limited load capacity of Chamkar Zam bridge:5 ton	Bad	*Study by Japan
1 - 8	291 - 297	6.0	Pass: Snow area	Not good	
1 - 9	322 - 330 &328	8.0 & 0.3	Yutongla pass: Snow area & No pavement due to landslide	- do -	Snow block on average 1 week a year
1 - 10	359	0.05	Limited load capacity of Bjee bridge:9 ton	Bad	*Study by Japan
1 - 11	327 - 390	3.0	Pass: Snow area	Not good	
1 - 12	420 - 428 & 432	8.0 & 0.3	Pelela pass: Snow area & No pavement due to severe landslide	Bad	Snow block on average 1 week a year
1 - 13	443	0.1	No pavement due to landslide on the mountainside	Not good	
1 - 14	458	0.3	- do -	- do -	
1 - 15	482	0.1	Original load capacity of Wangdue Zam bridge:15ton,Completed in 1969	- do -	*Study by Switzerland
1 - 16	529 - 534	5.0	Dochula pass: Snow area	- do -	Snow block on average 1 week a year
2 - 1	12	0.3	No pavement due to landslide on the mountainside	Fair	
2 - 2	18 - 24	0.3,0.3,0.1,0.5,0.5	No pavement in certain places due to landslide on the mountainside	- do -	
2 - 3	94	0.2	No pavement due to landslide on the riverside	- do -	
2 - 4	120 - 124 & 121	4.0 & 0.1	Snow area & Landslide area on the mountainside	- do -	
4 - 1	11	0.1	Original load capacity of Aie bridge:9 ton,Completed in 1963	Bad	*Study by India
4 - 2	37	0.04	Original load capacity of Rongkhola bridge:15ton,Completed in 1963	Not good	
4 - 3	98	0.1	Limited load capacity of Mangdichu bridge:4 ton	Bad	*Study by Japan
4 - 4	156	0.04	Original load capacity of Wangdigang bridge:15ton,Completed in1969	Not good	
4 - 5	168	0.5	No pavment due to landslide & severe rough surface	Bad	
4 - 6	169	0.01	Temporary bridge after the former was damaged by flood	- do -	
4 - 7	191	0.2	No pavement due to landslide on the riverside	Not good	
4 - 8	218	0.1	- do -	- do -	
4 - 9	233	0.3	No pavement due to landslide on the mountainside	- do -	
5 - 1	15 - Gelephu	-	No bridge: Crossing the riverbed	Bad	
5 - 2	4 - Sarpang	0.04	Original load capacity of Sarpangkhola bridge:18 ton,Completed in 1965	Not good	*Study by India
5 - 3	Wangdue - 59	0.02	Limited load capacity of Mechikhola bridge:8 ton	Bad	
5 - 4	Wangdue - 54	0.08	Limited load capacity of Waklevtar bridge:12ton	Not good	

J.4 Cost Survey

J.4.1 Prices of Materials

Table J-5 Prices of Materials

Unit : Nu

Description		Unit	BSR			Market
	Standard		PL	GP	SJ	Thimphu
Cement	Portland	Tonne	2,600.00	3,036.45	3,374.00	2,878.60
Deformed Bar	415Mpa	Tonne	17,500.00	17,630.00	17,770.00	18,500.00
Rolled Section	Angle (250MPa)	Tonne	15,000.00	15,930.00	16,110.00	19,000.00
-do-	Channel (250MPa)	Tonne	17,000.00	17,930.00	18,110.00	20,500.00
-do-	H section	Tonne	-	-	-	22,000.00
-do-	I section	Tonne	-	-	-	21,000.00
Welded Mesh	75mm*25mm	Sq.m	120.00	122.24	123.13	123.00
Gabion Net	100*100*8-Gauge	Sq.m	81.25	82.20	82.94	-
Stone	Boulder	Cu.m	199.70	199.70	199.70	320.00
River Gravel	20mm to 10mm	Cu.m	167.99	168.74	169.19	280.00
Sand		Cu.m	215.75	215.75	215.75	459.00
Crushed Rock	40mm	Cu.m	279.24	279.24	279.24	-
-do-	20mm	Cu.m	366.11	366.11	366.11	-
Timber	Class A	Cu.m	2,989.00	2,989.00	2,989.00	-
Plywood	T=4mm	Sq.m	69.00	71.80	73.21	100.00
Bitumen	80/100	Tonne	6,795.00	7,231.45	7,569.00	9,300.00
Petrol		Liter	-	-	-	23.62
Diesel		Liter	8.25	8.25	8.25	11.18
Explosives	Gelatine	Tonne	-	-	-	77,440.00
-do-	Detonator	Piece	-	-	-	2.32
-do-	Fuse Coil	Coil	-	-	-	2.80

Notes :

1. BSR prices are based on 1996/1997. PWD considers 10 % as cost escalation annually.
2. The abbreviation of areas using BSR are as below ;
   PL (Phuentsholing) : Phuentsholing, Thimphu, Lobesa
   GP (Gelephu) : Gelephu, Zhemgang, Panbang, Daga
   SJ (S/Jongkhar) : S/Jongkar, Limithang, Trashigang
2. Market prices based on October 1997.
3. Royalty for earth, boulder, sand and gravel is Nu 40 per truck according to BSR. For Paro Valley Agricultural Development Project, the royaly was Nu 80 per Tata truck (4.6 Cum).
4. The treatment of explosives requires permission from the Ministry of Home Affairs.

Table J-6 Price & Price Index of Cement

Dzongkhag	Related Bridge Name (Bridge No.)	Rate Nu/50Kg	Cost Index	Remarks
Phuentsholing	-	118.68	1.00	
Thimphu	-	143.93	1.21	
Wangdue Phodrang	Wachy Zam (No.4)	155.36	1.31	
Trongsa	Bjee (No.3)	167.08	1.41	
Bumthang	Chamkar Zam (No.2)	-	-	Not Available
Mongar	Kurizampa (No.1)	181.90	1.53	
Zhemgang	Mangdichu (No.5)	155.44	1.31	

Notes :

1. Price of cement produced by Penden Cement Authority Ltd.came into effect from Octobe 17, 1997.
2. The price of cement at Samtse at Nu 118.66 was found the lowest in comparison with the regions because of the less transportation cost.

Table J-7 Price & Price Index of Fuel

Unite : Nu

Dzongkhag	Related Bridge Name (Bridge No.)	Diesel		Petrol	
		Price Nu / Liter	Price Index	Price Nu / Liter	Price Index
Phuentsholing	-	10.47	1.00	22.68	1.00
Thimphu	-	11.18	1.07	23.62	1.04
Wangdue Phodrang	Wachy Zam (No.4)	11.36	1.09	23.80	1.05
Trongsa	Bjee (No.3)	11.41	1.09	23.78	1.05
Bumthang	Chamkar Zam (No.2)	11.62	1.11	23.98	1.06
Mongar	Kurizampa (No.1)	11.67	1.11	23.03	1.02
Zhemgang	Mangdichu (No.5)	11.08	1.06	23.44	1.03

Notes :

1. Price of fuel came into effect from September 1, 1997.
2. The price at Phuentsholing was found the lowest in comparison with the other regions, because of the less transportation cost.

J.4.2 Machinery and Plant Daily Hire Charges

Table J-8 Machinery and Plant Daily Hire Charges (1/2)

Unit : Nu

Description	Type	Hire Charge			
		BSR	A	B	C
Bulldozer	Cat D4E	-	9,000	-	-
- do -	Cat D4H (80HP)	6,099	9,000	9,500	-
- do -	Cat D6D (165HP)	8,133	12,000	12,500	-
- do -	Cat D7G (180HP)	10,113	15,000	18,000	12,136
- do -	Dresser TD8 (110HP)	5,629	-	15,000	6,756
- do -	Dresser TD12E (160HP)	9,380	-	18,000	11,256
- do -	Dresser TD20 (210HP)	11,406	-	18,000	13,687
Excavator	PC640,Hyd.	3,387	-	5,500	-
- do -	IH640,Hyd.	7,694	-	12,000	-
- do -	Cat E225 (80HP)	-	12,000	-	-
- do -	Cat E240C (110HP)	-	12,000	-	-
- do -	Case Poclain	-	9,000	-	-
- do -	PC60 (0.60M3)	-	-	-	-
Wheel Loader	Cat 416	3,668	-	5,000	-
- do -	Cat 510B / 515B	4,547	-	6,500	-
- do -	Cat 910	5,285	7,000	8,000	-
- do -	Cat 918F	-	9,000	-	-
- do -	Cat 916	5,959	-	9,000	-
- do -	Cat 926 (1.65M3)	6,230	-	10,500	7,476
- do -	Cat 930 (1.60M3)	6,636	-	5,500	7,964
Motor Grader	130G2 or MG330	6,010	-	-	-
- do -	A400E	6,154	-	-	-
- do -	Dresser A450E (108HP)	-	12,000	-	-
Road Roller	VR752	801	-	-	-
- do -	R91	857	-	-	-
- do -	E785	1,108	-	-	-
- do -	810 or DC011	1,199	-	-	-
- do -	CS551 or Sakai SV91	7,133	8,000	-	-
- do -	Avelling Jossep (10ton)	-	-	-	1,500
- do -	Sakai (Phunematic 12ton)	-	-	-	3,000
Road Broom	TD84	602	-	-	-
- do -	Pacific PTO with Tractor	-	-	-	800
Vibration Roller	Vibrocon (SR-750W, 2ton)	-	-	-	350
Small Roller		-	600	-	-
Plate Compactor		-	400	-	-
Tamping Rammer		-	400	-	-
Hot Mix Plant	Sptmix	4,210	-	-	-
Bitumen Sprayer	Leyland 50D (6000Liters)	-	-	-	8,000

Table J-9 Machinery and Plant Daily Hire Charges (2/2)

Unit : Nu

Description	Type	Hire Charge			
		BSR	A	B	C
Tipper	Comet 1AIC03/3	1,538	-	-	-
- do -	Canter PE444E	1,692	-	-	-
- do -	Tata 1210SK32	1,706	2,500	2,500	2,000
- do -	Hino FF172KD	2,264	-	-	-
- do -	Nissan CPB12EDRT	2,306	-	-	-
Truck	Tata (8ton)	-	2,000	-	-
- do -	DCM Toyota (5ton)	-	-	-	1,500
Tractor	3610 with Trailer	676	-	1,500	1,000
- do -	2ton	-	1,000	900	800
Tanker Fuel	1210SE	1,649	-	-	-
- do -	Nissan (6,000Literes)	-	-	-	3,430
Tanker F/Water	CPB12ERT	2,859	-	3,000	-
Crane	Kato KR-250	14,842	-	-	-
Trailer	Isuzu	15,236	-	-	-
Stone Crusher	16"*10"	1,873	-	2,500	-
- do -	B12	3,276	-	2,500	-
- do -	AJ2010R	3,835	-	5,500	-
- do -	Ringleson (40M3/Day)	-	2,500	-	-
- do -	Sisco (40M3/Day)	-	2,000	-	-
- do -	Portable	-	-	-	2,500
Stone Granulator	16"*16"	1,874	-	-	-
Concrete Mixer	3/5Cu.Ft.	222	-	500	-
- do -	7/5Cu.Ft.	369	150	100	500
- do -	10/7Cu.Ft.	436	300	1,500	-
- do -	14/10Cu.Ft.	-	600	-	-
ConcreteVibrator	M/C5	94	400	125	350
Air Compressor	Atlascopco VT/250	615	2,000	1,500	-
- do -	Atlascopco VT/6	728	2,600	1,800	874
- do -	TDS250	867	-	2,000	-
- do -	CPS400	1,034	-	2,000	1,241
- do -	CP125HP	-	2,600	-	-
Welding Set	With Generator	-	1,250	-	-
Pinjor Drill	FJ2020R	311	-	500	-
Water Pump		193	400	250	-
Jack Hammer		-	400	-	200

Notes :

1.Hire charges are based on 1997/1998.

2.Hire charges are excluding the cost of fuel, but including operator/driver/other consumables.

3.BSR : Bhutan Schedule of Rates (Guideline for Construction Equipment Hire)

4.A : Bhutan Engineering Co. Pvt. Ltd.

5.B : Gaseb Construction Co.

6.C : Singye Construction Co.

J.4.3 Monthly Salary of Permanent Staff

Table J-10 Monthly Salary of Permanent Staff

Unit : Nu

Job Classification	Government Staff		Priv Sector	
	Grade	Monthly Salary	Recruiting Source	Monthly Salary
Civil Engineer	Grade 5	12,700	Bhutanese / Indian	16,500
-do-	Grade 7	9,800	- do -	12,700
Mechanic	Grade 7	9,800	- do -	12,700
Electrician	Grade 7	9,800	- do -	12,700
Surveyor	Grade12	5,900	- do -	7,700
Survey Helper	Grade15	4,500	Bhutanese	5,900
Drafstman	Grade12	5,900	- do -	7,700
Accountant	Grade15	4,500	Bhutanese / Indian	7,700
Clerk	Grade15	4,500	Bhutanese	5,900
Secretary	Grade13	5,300	- do -	6,900
Typist	Grade14	5,000	- do -	6,500
Office Boy		-	- do -	2,200
Maid		-	- do -	2,200
Cook		-	- do -	2,200
Driver		-	- do -	3,500
Storekeeper		-	- do -	4,500
Watchman		-	- do -	2,500

Notes :

1. Salaries of Government staffs are based on 1997. The salary were up around 20 % from 1996.
2. Staffs are paid the housing allowance, 30 % of the salary.
   Furthermore, there are some cases where construction company staff are paid project allowance. In the case of Tala Hydro Project, the project allowance is 35 % of the salary.
3. Construction companies require an indirect cost of 25 % of the salary for recruitment, medical insurance, transportation and so on.
4. Overtime charge per hour is 150 % of hourly cost of the basic salary.

J.4.4 Labour Daily Wage

Table J-11 Labour Daily Wage

Unit : Nu

Job Classification		Daily Wage			
	Recruiting Source	BSR	A	B	C
Foreman	Indian / Bhutanese	106	190	170	240
Operator	Bhutanese	106	250	285	320
Mason	Indian / Bhutanese	91	140	145	140
Carpenter	- do -	106	150	145	110
Plasterer	- do -	91	150	130	110
Rigger	Indian	106	115	155	95
Steel Worker	- do -	91	140	130	130
Welder	- do -	91	150	150	140
Fitter	Indian / Bhutanese	91	150	145	140
Painter	- do -	106	140	145	140
Roadman	- do -	-	90	130	95
Skilled Labour	- do -	-	90	130	95
Common Labour	Indian / Bhutanese	60	75	95	85

Notes :

1. Daily wages are based on 1977/1988. The yearly escalation is forecasted at 25 %.
2. Working conditions : Working times 8 hours per day & Working days of 25 days per month.
3. Construction companies require an indirect cost of 25 % of the wage for recruitment, site accommodation, medical insurance and so on.
4. Overtime charge per hour is 150 % of hourly cost of the basic wage.
5. Prices of BSR are monthly basis, considering 25 working days and without certain allowance.
6. A : Bhutan Engineering Co. Pvt. Ltd.
7. B : Gaseb construction Co.
   The mentioned wages are including extra one hour charge, because the basic working time is 7 hours.
8. C : Singye Construction Co.
   Wages are including food allowance (Nu500 per month)
   Wage of operator is more adding the working allowance (Nu20 per hour)

J.4.5 Other Market Prices

Table J-12 Price of Office Furnishings, Stationery, Survey Instruments Small Working Tools, Vehicles and etc. (1/2)

Description	Type	Unit	Market Price		Remarks
			Nu.	US$ / Yen	
Desk	Particle Board	No.	3,800		Jattu Furniture Thimphu
Chair	Revolving Chair	No.	4,000		- do -
Meeting Table	For 8 persons (8'*4')	No.	6,000		- do -
Meeting Chair	Stacking	No	2,350		- do -
Reception Set	Sofa + Center Table	No.	8,900		- do -
Cloth Locker	Medium Size	No.	2,300		- do -
Bookshelf	With glass	No.	4,900		- do -
Drawing Drawer	For A1 Paper	No.	5,500		- do -
Cupboard		No.	2,500		- do -
Refrigerator	165Liter	No.	12,000		
Stove	Blower Heater	No.	2,000		Singye General Stores
- do -	Kerosene	No.	8,000		- do -
- do -	Wood	No.			
Gas Stove	(Best Quality)	No.	2,700		
Drawing Instrumer	A3,Board,Rodring Set	No.	5,150		German Made
Telephone Set		No.	6,300		With Subscription Charge
Facsimile Set	Cannon(Tel+Fax),B4	No.		US$ 850	CIF Thimphu (Galing Enter.)
Copy Machine	Cannon(Selex,Big)	No.		US$ 7,900	- do -
Computer	Desktop+Printer	No.	35,478 or 55,503		Peljorkhang
Camera		No.			
Copy Paper	A4, 500 Sheets	No.	230		Soe-Nam Palden
Drawing Paper	A1	Piece	35		- do -
Roll Film	Fuji/Kodak	No.	150		- do -
Film Developing		Roll	25		Pel Wong
Film Print		Piece	5		- do -
File Case	(Best Quality)	No.	250		Soe-Nam Palden
Copy Charge	A4	Piece	2		- do -
- do -	A1	Piece	55		Galing Enterprise
Transreceiver		Set	-		Not Available
Transit		No.	-		- do -
Level		No.	-		- do -
Survey Staff	5m	No.	-		- do -
Survey Pole		No.	-		- do -
Measure Tape	50m	No.	575		Singye General Stores
- do -	5m, Steel	No.	175		- do -
Paint	1 Liter, For Wood	No.	125		- do -

Table J-13 Price of Office Furnishings, Stationery, Survey Instruments Small Working Tools, Vehicles and etc. (2/2)

Description	Type	Unit	Market Price		Remarks
			Nu.	US$ / Yen	
Bending Instrumen	For Steel Bar	No.	-		Not Available
Cutting Machine	- do -	No.	-		- do -
Electric Saw		No.	-		- do -
Welding Machine		No.	-		- do -
Concrete Vibrator	Big Size	No.	25,000		Singye General Stores
Concrete Mixer	Big Size	No.	275,000		- do -
Water Pump	10Hp	No.	75,000		- do -
Generator	10 Kw	No.	175,000		- do -
Wheel Barrow		No.	2,000		- do -
Wire Rope Sling	D16mm, 3-5m/kg	m	145		- do -
Rope	Nylon	Kg	85		- do -
Barbed Wire		Kg	30		- do -
Search Light	USA made,4cell	No.	3,500		- do -
Electric Torch	Halogen, 1000w	No.	2,000		- do -
Shovel	Tata made	No.	150		- do -
Pickaxe	Tata made	No.	175		- do -
Sledgehammer	6.5kg	No.	500		- do -
Hammer	Steel	No	150		- do -
Saw	Wood	No.	175		- do -
Helmet		No.	900		
Propane	Gas Cylinder	No.	1,050		
Kerosene		Liter	4		
Firewood		Truck	2,800		Capacity of Truck: 6ton
Electric Charge	Residential Area	Kwh	0.6		Nu300-500/month/house
- do -	Commercial Area	Kwh	0.8		
Water Charge		Cu.m	1.3		Thimphu
Telephone Charge	Overseas 3minutes	No.	480		To Japan
- do -	Local 3minutes	No.	5		
DHL	10kg,Japan	No.		US$ 120	US$250/25kg
Lodging Charge	Second Class Hotel	Day	1,000		
Rental House	3 Bed Rooms	Month	15,000		Thimphu
Rental Office		Month	15,000		Thimphu
Motor Vehicle	Toyota Land Cruiser	No.		J 3,073,000	STCB, CIF Calctta
- do -	Toyota Pickup(Hilux)	No.		J 1,859,000	- do -
Microbus	Toyota 15 persons	No.		J 1,718,000	- do -
Bike	Rajdoot, Indian Made	No.	40,000		STCB
Vehicle Hire Charg	With Fuel & Driver	Day		US$ 60	
- do -	For Long Distance	Day		US$ 70	
Concrete Test	Compressive Strength	Set	150		3 Nos/Set, PWD Laboratory

J.4.6 Transportation Cost

The transportation costs are surveyed as follows;

- Steel bar etc. by Tata truck : Nu. 3.75/MT/Km (Minimum charge 8 MT)
- Heavy equipment etc. by the trailer : Nu. 11.00/MT/Km (Minimum charge 14 MT) or Nu. 6.50/FT/Km (Minimum charge 35 FT)

Notes: MT: Metric ton FT: Freight Ton

J.4.7 Land Acquisition and Compensation

The land acquisition and compensation will be caused by the re-alignment of road as the result of selecting a location of new bridge. The procedures and rates are prescribed in the revision of 'the Land Act. 1979' enacted in 1996, i.e. Ka (10)-19/96.

(1) Land Acquisition

The rates of land acquisition except the urban areas are same throughout the country, and the rate of each landuse is as below;

- Paddy field : Nu. 35,000 per acre
- Dry land : Nu. 20,000 per acre
- Grazing land : Nu. 5,000 per acre
- Forest related : Nu. 200 per acre

The area of land acquisition will be calculated in the coming study phase, considering the existing right-of-way for this project a total width of 100 ft. (=30 m), i.e. 50 ft. from the road center on both sides.

(2) Compensation

The properties compensation consists of houses and fruit trees. As a result of site reconnaissance, no fruit trees exist at the proposed bridge sites for compensation except for a few houses at Bridge No. 5 site. Though the exact cost of house compensation is derived from the estimation by a qualified engineer of the PWD based on the BSR, the cost of these houses is roughly estimated around Nu. 200,000 per house.

(3) Rental Land

The Project requires the rental land as construction yard at Bjee and Wachy Zam bridge site. The rental charge of each site is surveyed as follows;

1) Bjee Bridge Site

Location	:	Adjacent old quarry site to the site
Rental charge	:	Nu. 24,000 per year
Source	:	PWD Trongsa Office

2) Wachy Zam Bridge Site

Location	:	Paddy field located on the right bank
Rental charge	:	Paddy yield (1 ton/acre) x Cost of rice (Nu. 18/kg) x Area x Year
Source	:	PWD Lobesa Office and District Agriculture Officer (DAO) at Wangdue Phodrang

J.4.8 Taxation

Sales tax and contractors tax mentioned below are levied on this project in line with the 'Taxation Policy 1992'. However, International Assisted Projects are exempted from payment of these taxes.

(1) Sales Tax

The rates of sales tax for principal construction materials and equipment are as follow;

- Diesel : 3 %
- Petrol, Cement, Sand & Boulder, Reinforcing steel bar, Pre-fabricated bridge parts, Bitumen, Timber, Heavy earth moving equipment, Tractor : 5 %
- Pipes : 10 %
- Goods vehicles : 15 %
- Light motor vehicles : 20 %

(2) Contractors and Consultants Taxes

The contractors and consultants taxes are applicable on the bill amount. The rate is 2 % for national licensed contractors and 3 % for foreign contractors.

J.4.9 Price Movement

The consumer price index for the years 1980 - 1994 based on the average growth rate of 9.1 %, 11.2 % and 9.8 % for food, non-food and total respectively. Hence PWD considers 10 % as cost escalation annually.