Appendix 17-7(d) Mammals around the Project Sites

1. Daurian Hedgehog (*Erinaceus (Hemiechinus) dauricus*)
Japanese name (general): Hari nezumi
Mongolian name: Daguuruin Zaraa

H. auritus, steppe zone from eastern Ukraine to Mongolia in the north and from Libya to western Pakistan in the south, Cyprus;
H. collaris, Pakistan, northwestern India;
H. dauricus, Eastern Gobi Desert region from Lake Baikal to northern China.

Head and body length is approximately 150-280 mm and tail length is 10-55 mm. The spines are usually banded with dark brown and white, and the underparts are generally whitish.

These hedgehogs inhabit subdesert country and steppes over most of their range. In Egypt *H. auritus* is rare in poorly vegetated areas and is commonly found in gardens in association with people. In Egypt this species utilized existing shelter sites and seldom digs its own burrow. During the breeding season the females widen the ends of the burrows to accommodate the young. These hedgehogs are strictly nocturnal and mainly terrestrial. In the Punjab of northern India, *H. auritus* may hibernate up to 3.5 months in winter, and in the mountains of Pakistan hibernation lasts from October to March. The diet includes insects and other invertebrates, small vertebrates, eggs, carrion, fruits, and seeds.

In the Rajasthan Desert, the breeding season is May-October, mainly July-September, and litter size is 1-6. In Pakistan, breeding occurs in spring and summer, gestation reportedly is 35-42 days, and litter size is usually 2-3 in the east and 5-6 in the western mountains. According to Jones, a captive lived for 6 years and 9 months.

Mongolian Red Data Book (1996)

Sites: 65-69km, 92-96km, 110km, 170km, 289km, 315km, 335km

2. Tolai hare (*Lepus tolai*)
Japanese name (general): Nousagi
Mongolian name: Bor tuulay

L.capensis (Cape hare), Iberian Peninsula, southeastern Europe, Palestine to central China, all

nonforested parts of Africa;
L.europaeus (brown hare), most of the Palaearctic region south of the coniferous forest zone, north of Spain and Iran, and east of northeastern China;
L.timidus (blue or mountain hare), tundra and coniferous forest zones from Scandinavia to eastern Siberia, the Alps of Europe, Ireland, Scotland, Sakhalin, Hokkaido;
L.mandshuricus, lower Amur region of extreme southeastern Siberia, Machuria, North Korea;
L.sinensis, Korea, eastern China, northern Viet Nam, Taiwan;
L.brachyurus, Japan;
and so on.

Otherwise, head and body length of *Lepus* is about 400-700 mm, tail length is 35-100 mm, weight is 1,350-7,000 grams. Females are usually larger than males. Nearly all members of the genus have long ears and large hind feet. The feet of hares are well furred, regardless of the climate in which they live. The upper parts of the body are usually brown or grayish brown, and the underparts are paler or white. The tips of the ears are black in some species, and in some the upper side of the tail is black. Some species of *Lepus*, especially those that live in a snowy winter climate, molt into a white winter pelage. The time for such change is governed by the number of hours of daylight. All species that turn white in winter undergo two molts per year. Some species that molt twice, however, do not have a white winter pelage. These species, *L.europaeus*, for example, usually change from a brown summer pelage to a gray winter pelage. Some species apparently molt only once per year.

Most species live in open grassy areas. Much of their range includes areas where vegetation is sparse (probably because of overgrazing by domestic stock), and on the plains they are conspicuous when either running or sitting up to look about. They run rapidly.

Members of the genus *Lepus* do not generally dig or occupy burrows, depending instead on their strong running abilities to escape danger. Most hares spend their inactive hours hidden in vegetation, often in characteristic "forms," which are simple nests or depressions made in the soil, snow, or grass. Hares are mainly nocturnal, but some species are active during twilight. It moves out at night, using a complex system of runways through the grass and undergrowth. To facilitate travel, it clips vegetation from the runways during the summer and packs down the snow during the winter. Hares are active throughout the year. They feed mainly on grasses and herbaceous matter when they are available. At other times they take buds, twigs, and bark.

Northern species of *Lepus* exhibit drastic, cyclic fluctuations in population density, increasing to great abundance and then suddenly declining. Population cycles of predators, most notably

that of *Felis lynx*, follow those of *Lepus*, and eventually a crash in predator numbers, plus regeneration of vegetation, allows a new increase by the hares.

Most species of *Lepus* appear to be solitary except during the mating season. During the most active part of the mating season, male *Lepus* lose their customary caution and are abroad fighting with other males and pursuing females. Fighting consists of boxing with the forefeet and kicking with hind feet. Females may be quite seriously mauled by their overenergetic consorts, which bite and kick them. Hares may utter a high-pitched scream when caught or injured. When seeking the young for nursing, females call the young and are answered. Hares also communicate by thrumming the feet (drumming).

Most species of *Lepus* have lengthy reproductive seasons. Young hares are born in an open place, or at most a shallow depression. The young are well furred at birth, their eyes are open, and they can move about shortly thereafter. The leverets are concealed in dense vegetation and are visited by the female for nursing. The young were hidden in separate places by day, but they came together shortly before the return of the female. Young *Lupus* usually do not breed within their first calendar year of life.

Prohibited Hunting Seasons: from February 16th to October 21st

Sites: 10pk6-10pk8, 17pk9-19pk2, Sukhe-baatar, 30-32km, 54-56km, 65-69km, 92-96km, 110km, 170km, 208-209km, 223km, 235km, 244-245km, 255km, 272km, 285km, 289km, 315km, 335km, 358km, 399km, Tuul river+Dund river, 420-421km

3. Brown Squirrel (*Sciurus vulgaris*)
Japanese name: Ezo risu
Mongolian name: Baraan Kherem

S.anomalus, Caucasus, Asia Minor, Syria, Palestine, western Iran;
S.vulgaris, throughout Europe and northern Asia;
S.lis, Japan;
and so on.

Head and body length is 200-315 mm, tail length is about 200-310 mm, and weight varies from 200 to as much as 1,000 grams. The coloration differs greatly among the many forms. The usual colors of the upper parts are gray, grayish brown, brackish brown, and various shades of red. The underparts vary from white through buff and yellow to orange. There are

often individuals or whole populations that are much darker than normal, and some are black. *S.vulgalis* and *S.aberti* have conspicuous tufts on the ears. There are two molts per year in some, perhaps all, species, but the tail fur is shed only once yearly. The winter coat is generally slightly different in color from the summer coat. The number of teeth is variable; some species have one premolar in each side of the upper jaw, and other species have two. Members of the genus utter sounds when alarmed. A sharp, barklike call repeated rapidly is an alarm warning. It is accompanied by vigorous shaking of the tail.

These squirrels inhabit deciduous, coniferous, and tropical forests, both humid and arid. They spend most of their time in the trees and are extremely agile in traveling along the branches. They come down to the ground to forage for food and to bury nuts and acorns. Feeding shelters are sometimes constructed in trees in the summer. In general, *Sciurus* are diurnal, with peaks of activity in the early morning and late afternoon. *Sciurus* do not hibernate, but in stormy or very cold weather they remain in their nests until it becomes necessary to obtain food. When gray squirrel populations are high and food supplies relatively low, however, mass migrations may occur, involving thousands of animals moving across an extensive area.

The diet usually consists of various nuts, other seeds, fruits, buds, and young tree shoots. Acorns and hickory nuts are especially preferred when available. Nuts are opened by a special levering technique of the lower incisors. After some experience, a squirrel can open a nut in a few seconds. Seeds of conifers are eaten by squirrels that inhabit coniferous forests. Mushrooms, insects, birds' eggs, and small birds may also be taken.

The gray squirrel may spend most of its life in a home range of less than 0.5 ha. *Sciurus* generally are not gregarious, but during the breeding season males may congregate on the home range of a female in estrus and fight one another for the right to mate. After mating the pairs separate. In the Northern Hemisphere mating occurs over an extensive part of the year, but there are usually peaks in winter and from late spring to early summer. In most species that have been investigated, adult females produce two litters each year. The gestation period lasts about 38-39 days in *S.vulgaris*. In *S.vulgaris* 4-10 young have been reported, but usually 5-7 are born. Young *Sciurus* are naked and blind at birth, weigh less than an ounce, and usually remain in the nest for about six weeks. They have some fur after 14 days, and the eyes open at about 30-32 days. When the mother leaves the nest, she covers the young with nest material. The females of this genus usually breed within a year of their birth.

Sciurus normally do no damage to human interests, but at times they gnaw ears of growing corn and the bark of trees. The fur of *Sciurus* generally is not valuable, but some forms of *S.vulgaris* in the Soviet Union have luxuriant winter pelage and are sought for their pelts.

Prohibited Hunting Seasons: February 16th to October 21st.

Sites; 10pk6-10pk8, 17pk9-19pk2, Sukhe-baatar, 30-32km, 170km, 255km, 272km, 285km, 289km, 315km, 335km, 420-421km

4. Siberian Chipmunks (*Eutamias sibiricus*)
Japanese name: Ezo shima risu
Mongolian name: Jirkh

E.sibiricus, Siberia, Mongolia, northern and central China, Korea, Hokkaido

In the various species of *Eutamias*, head and body length is 80-160 mm, tail length is 60-140 mm, and weight is 25-125 grams. The conspicuous characteristic of the pelage is the five black or black-brown longitudinal back stripes separated by four whitish stripes. The remainder of the upper parts is whitish yellow to sandy yellow in color, and the underside is white. The soft, dense fur is slightly woolly in winter. There are two molts each year, one in the spring and a second in the early fall. The summer pelage is brighter than the grayish winter pelage.

Habitats of *Eutamias* include spruce, fir, redwood, and pine forest; sagebrush plains; brush-covered mountains; and dense, temperate zone rainforest. These chipmunks usually reside in burrows and live mostly on the ground, but all species climb trees and bushes at times. They are active during the day and may seek protection in old logs and in crevices among rocks, as well as in their burrows.

These chipmunks gather dry food, which they carry in their cheek pouches and store underground. *E.sibiricus* uses a separate room for storage. The food of *Eutamias* consists of the fruits and seeds of various trees and herbs. The foliage and flowers of some herbs are also eaten, as are the tender buds of woody plants. Mushrooms, insects, bulbs, and birds' eggs are consumed at times.

Brand reported two main categories of vocalization in *Eutamias*: alarm calls, which included a chip, chuck, chippering, and in some cases a trill or whistle; and agonistic or courtship sounds, which tended to be harsh. Mating in *Eutamias* occurs from late February to early July but usually is in April or May. The gestation period is 31 days, and lactation lasts 39-45 days.

Sites; 10pk6-10pk8, 17pk9-19pk2, Sukhe-baatar, 30-32km, 170km, 255km, 272km, 285km, 289km, 315km, 335km

5. Siberian Marmot (*Marmota sibiria*)
Japanese name (general): Maamotto
Mongolian name: Mongol Tarvaga

M.marmota, Alps, Carpathians, and Tatra Mountains of Europe;
M.camtschatica, mountains of northeastern Siberia from Lake Baikal to Kamchatka;
M.menzbieri, Tien Shan Mountains of Uzbek S.S.R. and southeastern Kazakh S.S.R.;
M.bobak, Poland and Rumania to Manchuria and central China;
(*M.sibirica*, southern Siberia, Mongolia, northern China;)
M.boweri, northern Alaska;
M.caudata, mountains of Central Asia;
and so on.

Head and body length is about 300-600 mm, tail length is 100-250 mm, and weight is 3.0-7.5 kg. The color of the fur varies considerably among the different species. The upper parts range from bright brownish yellow, dark brown, and reddish brown to a pattern formed by a mixture of black and white hairs. In some species the underparts differ little in color from the upper parts, but in other species there is considerable variation. The underparts range from whitish to dark brown, yellowish gray, or reddish orange. The texture of the fur varies from thin to long and thick, with degrees of coarseness. Climate probably influences the thickens of the pelage. Apparently there is only one molt per year, in the early summer.

Marmots generally occupy open habitats such as steppes, alpine meadows, pastures, and forest edge. They spend most of their life in burrows, which they excavate in well-drained soil and which have several entrances. These burrows usually are over 1 meter in depth, but hibernation burrows may be 5-7 meters deep. The tunnels may be 10-70 meters in length, or even 113 meters in the case of *M.camtschatica*. Marmots are mainly diurnal and terrestrial, but they occasionally climb into shrubs and trees.

Marmots are deep hibernators and may sleep up to nine months of the year. During the summer they accumulate fat reserves amounting to about 20 percent of the total body weight, which they live on during the dormant period. They may emerge briefly during spells of mild winter weather. The diet of *Marmota* consists largely of green vegetation, especially grasses and forbs, but also includes fruits, grains, legumes, and occasionally insects.

Marmots have a single mating season per year which usually begins shortly after they emerge from winter hibernation. The young are born in a grass-lined nest from April to June, following a gestation period of about 30-32 days. Reported litter size ranges from 1 to 9 but averages 4-5 in *M.monax* and 2-4 in *M.marmota*. The young emerge from underground at about 1 month and are weaned about 2 weeks later. Sexual maturity evidently is usually attained at 2 years in *M.monax* and *M.flaviventris* and at 3 years in *M. caligata* and *M.olympus*. The potential longevity of *M.maramota* is 13-15 years.

Some species of *Marmota* have declined drastically because of environmental disruption. In Europe, *M.marmota* and *M.bobak* disappeared from extensive areas as agriculture spread through their habitats. The latter species now occurs only as far west as the eastern Ukraine. There are introduced populations of *M.marmota* and *M.bobak* in the Caucasus. The species *M.menzbieri*, of Central Asia, is designated as vulnerable by the IUCN and was termed rare by the USSR. Its decline has been caused mainly by intensive pastoral development of montane areas and by excessive hunting.

Prohibited Hunting Seasons: from October 16th to August 10th of the following calendar year.

Sites: 434-435km, 442-443km, 465km

6. Ground Squirrels (*Spermophilus undulatus*)
Mongolian name: Urt Sueuelt Zuram

S.major, Volga River to Mongolia;
S.erythrognys, Altai region of southern Siberia;
S.fulvus, northern Kazakh SSR to northern Iran and Afghanistan;
S.undulatus, southern Siberia, Mongolia;
S.parrii, northeastern Siberia, Alaska, northwestern Canada;
S.dauricus, eastern Mongolia and adjacent parts of Siberia, northern China;
S.alashanicus, Mongolia, northern China;
S.relictus, mountains of Kirghiz and Kazakh SSR;
S.citellus, grasslands from southeastern Germany to the Ukraine;
S.xanthoprymunus, Caucasus to Palestine;
S.suslicus, steppe zone from southern Poland to the Volga River;
S.musicus, Caucasus;

S.pygmaeus, steppe zone from the southern Ukraine to Lake Balkhash in Central Asia; and so on.

Head and body length is 130-406 mm, tail length is 38-254 mm, and weight is 85-1000 grams. Most species are a grizzled brownish or yellowish gray, often with fine light spots on the upper parts; the underparts are whitish or yellowish. A few species are dark brown or blackish. The tail of a ground squirrel is usually relatively short, is well furred, and in some species tends to be reddish in color. The pelage varies from soft and dense to coarse and thin. All species have relatively short legs, as well as large internal cheek pouches in which to carry food. Females have four to seven pairs of mammae.

Ground squirrels inhabit prairies and steppes, tundra, rocky country, open woodlands, abandoned farms, or desert mountain ranges. They are not found in areas with a dense forest cover. Most species construct burrows. All ground squirrels are diurnal.

In the southern parts of their range, ground squirrels may be active nearly throughout the year, though they will remain in their burrows during inclement weather as green food disappears. Species in areas with a severe climate undergo extensive hibernation and live off of accumulated fat reserves while sleeping in their burrows.

Ground squirrels may store food in their burrows, but they seem not to utilize it until awakening in April. The diet consists of seeds, nuts, grains, roots, bulbs, mushrooms, green vegetation, insects and other small invertebrates, and occasionally small vertebrates and birds' eggs.

The various species of ground of ground squirrels have a considerable range of vocalizations, including trills, squeaks, chirps, and buzzes. The most outstanding, however, is a shrill whistle, which functions as an alarm. In some species the whistle seems to warn against the approach of an aerial predator, while a chattering sound indicates the presence of a terrestrial enemy.

Reproductive data for ground squirrels, taken in part from Banfield, are; females are monestrous and normally bear only one litter per year; litter size is 2-15.

Sites: 17pk9-19pk2, 208-209km, 272km, 420-421km, 429km-430km, 434-435km, 442-443km, 465km

7. Voles (*Microtus*)
Japanese name: Hata nezumi
Mongolian name: Ogotno

M.oeconomus, Scandinavia and the Netherlands to eastern Siberia and north-central China, Alaska, northwestern Canada, many northern Pacific continental islands;
M.arvalis, Denmark and northern Spain to central Siberia and Asia Minor, and (probably through introduction) Spitsbergen;
M.mongolicus, Mongolia and adjacent parts of Siberia;
M.maximowiczii, Lake Baikal to upper Amur Basin in southern Siberia;
M.fortis, southeastern Siberia, Mongolia, Manchuria, Korea, eastern China, possibly Sakhalin;
M.gregalis, the Eurasian tundra zone from the White Sea to Bering Strait, southern Siberia, Mongolia, parts of Soviet Central Asia and northern and western China;
and so on.

Head and body length is 83-178 mm and tail length is 15-98 mm. The tail is always shorter than the head and body, usually being less than half as long. The pelage is usually quite long and loose. The general coloration of the upper parts is grayish brown, the darker forms approaching a sooty black and paler forms being tawny, reddish, or yellowish. The underparts range from grayish through pale brown to white. Many species make both burrows and runways. The burrow also contains a food storage chamber which may be nearly 1 meter in length. Surface runways are made by cutting and trampling vegetation and scattering dirt from the connecting underground burrow to make paths 25-50 mm wide. The summer nest may be above ground in a clump of vegetation.

Voles are active throughout the year; they do not hibernate. Although they may move about at any time, most species seem to concentrate their activity at night or in the early morning and late afternoon. Voles are terrestrial, but many species swim and dive well. They are strictly vegetarian and within 24-hour period may consume their own weight in grasses, leaves, twigs, bulbs, tubers, seeds, nuts, or other plant matter. Food may be stored for the winter.

Home range of *Microtus* generally seems to be about 1,000 sq meters or less. Population densities of *Microtus* vary considerably and seem to run in cycles, at least in some areas.

In general the social life of *Microtus* is something of an enigma. A number of species are known to live in what appear to be colonies of hundreds of individuals. The animals therein, however, may be totally uncooperative and extremely aggressive toward one another. There is no evidence of lasting pairs or formal social structure. Perhaps social tolerance in *Microtus*

exists up to a certain point, but aggressiveness increases with density and serves to limit and disperse populations in accordance with available resources.

Microtus appears to be slow-moving, docile, and easily trapped and tamed. When upset, these voles may emit a high-pitched squeak, gnash their teeth, and either flee or freeze, depending upon their location and previous activity. Several species are known to have a variety of well-defined sounds.

Female voles are polyestrous and usually give birth several times per year. A postpartum estrus may occur. Breeding generally takes place throughout the year in southern parts of the range of *Microtus* and from spring to early autumn in the north; under good conditions, however, some winter reproduction may occur even in the north. Reported gestation periods in *Microtus* range from 19 to 25 days.

When their populations are high, voles may becomes serious pests because of their destruction of growing grain, forest plantings and hay. During severe wintering the bark from the roots and lower trunks of trees. Such losses are very heavy when the snow and fallen leaves are mounded around the base of the tree.

Sites: 17pk9-19pk2, 235km, 255km, 272km, 285km, 289km, 335km, 358km, 420-421km, 429-430km, 434-435km, 442-443km, 465km

8. Four- and Five-toed Jerboas (*Allctaga sivirica*)
Mongolian name: Sibir Alagdaaga

A.elater, lower Volga River and eastern Asia Minor to Sinkiang and western Pakistan;
A.sibirica, Caspian Sea to Manchuria;
A.nataliae, Mongolia;
A.bullata, western and southern Mongolia and adjacent parts of China;
and so on.

Head and body length is 90-263 mm, tail length is 142-308 mm, and hind foot length is 46-98 mm. Ognev listed weights of 44-73 grams for *A.elater*, the smallest species in the genus; 95-140 grams of for *A.sibirica*; and 280-420 grams for *A.major*, the largest of all jerboas. The coloration of the upper parts is mixed russet and black to sandy and grayish buff. The underparts are whitish, and there is a white stripe on the hip.

In all species except *A.terradactyla* there are five digits on each hind foot. The two lateral toes are much smaller than the three central digits and do not contribute substantially to the support of the foot. The eyes are large, and the ears are long and slender, being about the same length as the head. There is one small premolar tooth on each side of the upper jaw. Females have eight mammae.

These jerboas inhabit deserts, semideserts, and steppes. At least some species prefer areas of compact soil with a thick cover of vegetation. *Allactaga* also excavate simple temporary shelters, as well as permanent homes that range from the simple to the complex. The small species *A.elater* often digs in wagontracks or other depressions in the ground, and the excavated soil may fill the depression and make it difficult to find the burrow. Unlike those of some other species of *Allataga*, the occupied burrows of *A.elater* are often left unsealed.

Allactaga is primarily nocturnal, but some species are known to emerge from their burrows before sunset to begin foraging. When undisturbed, these jerboas move with a slow bipedal walk, but if startled, they begin leaping in a zigzag pattern, covering a meter or more per jump. *A.elater* has been timed at a speed of 48 km/hr. In the species that occur in the Soviet Union, hibernation generally extends from September or October to about March or April. Most species of *Allactaga* are primarily vegetarian. *A.sibirica* is mainly insectivorous. Observations in Uzbekistan indicate that when *A.elater* initially emerges from hibernation, it feeds mostly on vegetation, but that in May it begins to concentrate on insects.

The breeding season of *A.elater* extends from March to as late as November but there are peak periods of reproductive activity that vary from place to place. There are generally two or three such peaks, corresponding with spring, summer, and fall. Many females evidently have three annual litters. Most other Soviet species also are thought to have lengthy breeding seasons, with several peak periods, and possibly two or three litters per year. There are usually about three to five young at a time, but overall recorded litter size in the Soviet Union is one to eight. The young of *A.elater* remain with the mother for 30-35 days and attain sexual maturity by 3.5 months.

These voles have short, rounded ears that are nearly concealed by the pelage. The foreclaws are somewhat enlarged for digging.

Sites: 420-421km, 434-435km, 442-443km, 465km

9. Gray Wolf (*Canis lupus*)

Japanese name (general): Ookami
Mongolian name: Saaral Tchono

Eurasia except tropical forests of southeastern corner, Egypt and Libya, Alaska, Canada, Greenland, conterminous United States except southeastern quarter and most of California, highlands of Mexico.

This species includes the largest wild individuals in the family Canidae. Head and body length is generally about 1,000-1,600 mm and tail length is 350-560 mm. Overall mean (and extreme) weights are about 40 (20-80) kg for males and 37 (18-55) kg for females. The pelage is long; the upper parts are usually light brown or gray, sprinkled with black, and the underparts and legs are yellow white. Entirely white individuals occur frequently in tundra regions and occasionally elsewhere. Black individuals are also common in some populations.

The gray wolf has the greatest natural range of any living terrestrial mammal other than *Homo sapiens*. It is found in all habitats of the Northern Hemisphere except tropical forests and arid deserts. Dens, used only for the rearing of young, may be in rock crevices, hollow logs, or overturned stumps but are usually in a burrow, either dug by the parents themselves or initially made by another animal and enlarged by the wolves. Several such burrows are sometimes excavated in the same season, perhaps as far apart as 16 km. A den may be used year after year. The animals prefer an elevated site near water. Tunnels are about 2-4 meters long and lead to an enlarged underground chamber with on bedding material. There may be several entrances, each marked by a large mound of excavated soil. After the young are about 8 weeks old, they are moved to a rendezvous site, an area of about 0.5 ha, usually near water and marked by trails, holes, and matted vegetation. Here the young romp and play, and the other members of the pack gather for daily rest during the summer. Such sites are frequently changed, but some may be used for one or two months.

Movements are extensive and usually take place at night, but diurnal activity may increase in cold weather. During the summer the pack usually sets out in the early evening and returns to the den or rendezvous site by morning. In winter the animals wander farther and do not necessarily return to a particular location. They tend to move in single file along regular pathways, roads, streams, and ice-covered lakes. The daily distance covered ranges from a few to 200 km. In Finland, the mean daily movement was determined to be 23 km.

The gray wolf usually moves at about 8 km/h but has a running gait of 55-70 km/h. It can cover up to 5 meters in a single bound and can maintain a rapid pursuit for at least 20 minutes. Prey is located by chance encounter, direct scenting, or following a fresh scent trail. Odors

can be detected up to 2.4 km away. A careful stalk may be used to get as close as possible to the prey. If the objective is large and healthy and stands its ground, the pack usually does not risk an attack. Otherwise, a chase begins, usually covering 100-5,000 meters. If the wolves cannot quickly close with the intended victim, they generally give up. There seems to be a continuous process of testing the individual members of the prey population to find those that are easily captured.

The gray wolf is primarily a predator of mammals larger than itself, such as deer, wapiti, moose, caribou, bison, musk-ox, and mountain sheep. Kill rates vary from about one deer per individual wolf every 18 days to one moose per wolf every 45 days. The usual condition is that a pack of several wolves will make a kill, consume a large amount of food, and then make another kill some days later. An adult can eat about 9 kg of meat in one feeding.

There long has been controversy regarding the effects of the wolf on overall prey populations. It was once generally thought, even by some experience zoologists, that the wolf could and did eliminate its prey. Wolf population density varies considerably, being as low as 1 per 520 sq km in parts of Canada. In Alberta, Fuller and Keith found densities of 1 per 73 sq km to 1 per 273 sq km. Home range size depends on food availability, season, and number of wolves. The largest pack range, found in Alaska during winter, was 13,000 sq km, and the smallest, in southeastern Ohio during summer, was 18 sq km. Pack range in the Soviet Union varies from 30 sq km in areas of abundant food and good cover to over 1,000 sq km in deserts and tundra.

The home range of a wolf pack usually corresponds to a defended territory. There is generally little or no overlap between the ranges of neighboring packs. Lone wolves that are continuously pursued by the resident packs and forced to shift about.

Although packs are hostile to one another, the gray wolf is among the most social of carnivores. Groups usually contain 5-8 individuals but have been reported to have as many as 36. Such associations are probably essential for consistent success in the pursuit and overpowering of large prey. The number of wolves in a pack tends to increase with the size of the usual prey, being 7 or less where deer is the only important food, 6-14 where both deer and wapiti are eaten, and 15-20 on Isle Royale, where moose is the primary prey.

A pack is essentially a family group, consisting of an adult pair, which may mate for life, and their offspring of one or more years. The leader is usually a male, often referred to as the alpha male. He initiates activity, guides movements, and takes control at critical times, such as during a hunt. The males and females of a pack may have separate dominance hierarchies, reinforced by aggressive behavior and elaborate displays of greeting and submission by

subordinate members. Generally, only the most dominant pair mate, and elaborate displays of greeting and submission by subordinate members. Generally, only the most dominant pair mate, and they inhibit sexual activity in the others. Social status is rather consistent, and a leader may retain its position for years, but roles can be reversed. Intragroup strife, perhaps resulting from increasing membership or declining food supplies, can result in a division into two packs or the splitting off of individuals. The latter may maintain a loose association with the parental group, sometimes following at a distance and feeding on scraps left behind, or disperse to a new area to seek a mate and begin a new pack.

The gray wolf has a variety of visual, olfactory, and auditory means of communication. Vocalizations include growls, barks, and howls --- continuous sounds usually lasting 3-11 seconds. Different individuals have distinctive howls. Humans can hear howls 16 km away on the open tundra, and wolves probably respond to howls at distances of 9.6-11.2 km. Howling functions to bring packs together and as an immediate, long-distance form of territorial expression.

Territories are also maintained by scent marking, via scratching, defecation, and especially urination. Scent marking differs from ordinary elimination in that there is a regular pattern of deposition at certain repeatedly used points.

Threats and attacks by the dominant members of a pack probably prevent sexual synchronization in subordinates, and thus only the highest-ranking female normally bears a litter during the reproductive season. Mating may occur anytime from January, in low latitudes, to April, in high latitudes. Births take place in the spring. Courtship may extend for days or months, estrus lasts 5-15 days, and the gestation period is usually 62-63 days. Mean litter size is 6 young, and the range is 1-11. The young weigh about 450 grams each at birth and are blind and deaf. Their eyes open after 11-15 days, they emerge from the den at 3 weeks, and they are weaned at around 5 weeks. The mother usually stays near the den for a period, while the father and other pack members hunt and bring food for both her and the pups. The young are commonly fed by regorgitation. At 8-10 weeks the young are shifted to the first in a series of rendezvous sites, each up to 8 km from the other. If in good condition, the young begin to travel with the pack in early autumn. Sexual maturity generally comes at around 22 months, but social restrictions often prevent mating at that time. Potential longevity is at least 16 years.

The wolf is often believed to be a direct threat to people. In Eurasia, attacks are unusual but evidently have occurred, sometimes resulting in death.

CITES Appendices II

Sites: 10pk6-10pk8, Sukhe-baatar, 30-32km, 272km, 285km, 420-421km, 465km

10. Red Fox (*Vulpes vulpes*)
Japanese name: Kitsune
Mongolian name: Shar Uneg

Eurasia except the southeastern tropical zone, northern Africa, most of Canada and the United States

Head and body length is 455-900 mm, tail length is 300-555 mm, and weight is 3-14 kg. Average weights in North America are 4.1-4.5 kg for females and 4.5-5.4 kg for males. The usual weight in central Europe is 8-10 kg. The typical coloration ranges from pale yellowish red to deep reddish brown on the upper parts and is white, ashy, or slaty on the underparts. The lower part of the legs is usually black, and the tail is generally tipped with white or black. Color variants, known as the cross fox and silver fox, represent, respectively, about 25 percent and 10 percent of the species. The cross fox is reddish brown in color and gets its name from the cross formed by one black line down the middle of the back and another across the shoulders. The color of the silver fox, which has the most prized fur of any fox, ranges from strong silver to nearly black. The general color effect depends on the proportion of white or white-tipped to black hairs. An individual with only a few white hairs is sometimes called a black fox.

The red fox rivals the gray wolf for having the greatest natural distribution of any living terrestrial mammal besides *Homo sapiens*. Habitats range from deep forest to arctic tundra, open prairie, and farmland, but the red fox prefers areas of highly diverse vegetation and avoids large homogeneous tracts. Elevational range is sea level to 4,500 meters. Daily rest may be taken in a thicket or any other protected spot, but each individual or family group usually has a main earthen den and one or more emergency burrows within the home range. An especially large den may be constructed during the late winter and subsequently used to give birth and rear the young. Some dens are used for many years by one generation of foxes after another. The preferred site is a sheltered, well-drained slope with loose soil. Often a marmot burrow is taken over and modified. Tunnels are up to 10 m long and lead to a chamber 1-3 m below the surface. There is sometimes only a single entrance, but there may be as many as 19. A system of pathways connects the dens, other resting sites, favored hunting areas, and food storage holes.

The red fox is terrestrial, normally moving by a walk or trot. It has great endurance and can gallop for many kilometers if pursued. It can run at speeds of up to 48 km/h, can leap fences 2 m high, and can swim well. It has keen senses of sight, smell and hearing. Its ability to survive in the close proximity of people, and often to elude human hunters and their dogs, has given it a reputation for cunning and intelligence. Most activity is nocturnal and crepuscular. Individuals cover up to 8 km per night as they move on circuitous routes through the home range. During the autumn, the young born the previous spring disperse from the parental home range. The usual distance traveled at this time is about 40 km for males and 10 km for females; maximum known is 394 km. Once the young animals establish themselves in a new area, they generally remain there for life.

The diet is omnivorous, consisting mostly of rodents, lagomorphs, insects, and fruit. To hunt mice, the red fox stands motionless, listens and watches intently, and then leaps suddenly, bringing its forelegs straight down to pin the prey. Rabbits are stalked and then captured with a rapid dash. Daily consumption is around 0.5-1 kg. Sometimes a hole is dug and excess prey placed therein and covered over, to be eaten at a later time.

The most favorable areas usually support an average of one or two adults per sq km. Home range size varies with habitat conditions and food availability and becomes larger in winter and smallest around the time of the arrival of newborn. The home range is 5-12 sq km in good habitat and 20-50 sq km in poor habitat. A home range is typically occupied by an adult male, one or two adult females, and their young. Males may fight one another during the breeding season. For a period extending from shortly before birth to several weeks thereafter, the female remains in or very near the den. The male then brings her food but does not actually enter the maternal den.

The mating season varies with latitude. In Europe, it is December-January in the south, January-February in central regions, and February-April in the north. Females are monestrous, have an estrus of 1-6 days, and have a gestation period of 49-56, usually 51-53 days. Litter size is 1-13 young but averages about 5 throughout the range of the fox. The young weigh 50-150 grams each at birth, open their eyes after 9-14 days, emerge from the den at 4-5 weeks, and are weaned at 8-10 weeks. They may be moved to a new den at least once. The family remains together until the autumn. Sexual maturity is reached at about 10 months. Potential natural longevity is around 12 years, though few individuals live more than 3-4 years, at least where the species is heavily hunted and trapped.

Prohibited Hunting Seasons: from February 16th to October 21st.

Sites: 10pk6-10pk8, 17pk9-19pk2, 208-209km, 255km, 272km, 285km, 335km, 420-421km, 429-430km, 465km

11. Corsac Fox (*Vulpes corsac*)
Mongolian name: Khiars

Vulpes corsac : dry steppe and subdesert zone from the lower Volga River to Manchuria and Tibet

Head and body length is 500-600 mm and tail length is 250-350 mm. The fur is thick and soft. The general coloration of the upper parts is pale reddish gray, or reddish brown with silvery overtones. The underparts are white or yellow. *Vulpes corsac* is externally similar to *Vulpes vulpes* but has relatively longer legs. Its ears are large, pointed, and very broad at the base.

The corsac fox is a typical inhabitant of steppes and semi-desert. It avoids forests, thickets, plowed fields, and settled areas. It lives in a burrow, often taken over from another mammal, such as a marmot or badger. Self-excavated burrows are simple, usually very shallow, and sometimes are found in groups. Although usually reported to be nocturnal in the wild, *Vulpes corsac* is active by day in captive; it is said to be an excellent climber. It runs with only moderate speed and can be caught by a slow dog, but it has excellent senses of vision, hearing, and smell. Most reports indicate that it is nomadic and does not to keep a fixed home range. It may migrate southward when deep snow and ice make hunting difficult. The diet consists mostly of small rodents but also includes pikas, birds, insects, and plant materials.

This species is more social than other foxes, with several individuals sometimes living together in the same burrow. Small hunting packs are said to form in the winter, though perhaps these represent mated pairs and their grown young of the previous spring. Males fight one another during the breeding season but then remain with the family. Mating occurs from January to March, gestation lasts 50-60 days, and liters usually contain 2-11 young. Females in the Berlin Zoo did not reach sexual maturity until their third year of life.

Prohibited Hunting Seasons: from February 16th to October 21st.

Sites: 10pk6-10pk8, 17pk9-19pk2, 208-209km, 255km, 465km

12. Ermine (*Mustela erminea*)

Japanese name: Okojo
Mongolian name: Tsagaan Ueien

Scandinavia and Ireland to northeastern Siberia and the western Himalayan region, Japan, Alaska and northern Greenland to northern New Mexico and Maryland

Head and body length is 170-325 mm, tail length is 42-120 mm, and weight is 42-325 grams. Old World animals average larger than those of North America, and males average larger than females. Except in certain southern parts of its range, the ermine changes color during three- to five-week molts in April-May and October-November. In summer the back, flanks, and outer sides of the limbs are rich chocolate brown, the tip of the tail is black, and the underparts are white. In winter the entire coat is white, except for the tip of the tail, which remains black. The winter pelage is longer and denser than that of the summer. Females have eight mammae.

The ermine is found in many habitats, from open tundra to deep forest, but seems to prefer areas with vegetative or rocky cover. It makes its den in a crevice, among tree roots, in a hollow log, or in a burrow taken over from a rodent. It maintains several nests within its range, which are lined with dry vegetation or the fur and feathers of its prey. it is primarily terrestrial but climbs and swims well. It may travel 10-15 km in a night, though the average hunt covers 1.3 km. Activity takes place at any hour but is primarily nocturnal. The ermine is swift, agile, and strong and has keen senses of smell and hearing. Its slender body allows it to enter and move quickly through the burrows of its prey. It generally kills by biting at the base of the skull. It sometimes attacks animals considerably larger than itself, such as adult hares. The diet consists mainly of small rodents and also includes birds, eggs, frogs, and insects. Food may be stored underground for the winter.

Population density fluctuates with prey abundance. Under good conditions there may be an ermine for every 10 ha. Individual hove range is up to about 200 ha, usually 10-40 ha, and is generally larger for males than for females. The ranges of the males included portions of those of the females. Resident animals of both sexes maintained exclusive territories. Boundaries were regularly patrolled and scent-marked, and neighbors usually avoided one another. Adult males were dominant over females and young. Females usually spent their lives in the vicinity of their birthplace, but juvenile males wandered extensively in the spring to find a territory.

Females are polyestrous but produce only one litter per year. Mating occurs in late spring or early summer, but implantation of the fertilized eggs in the uterus is delayed until around the following March, and birth takes place in April or May. Pregnancy thus lasts about 10 months, but embryonic development only a little over 1 month. Litter size is 3-18 young, averaging about 6 in the New World and 8-9 in the Old. The young weigh about 1.5-3 grams at birth, are blind and helpless, and

are covered with fine white hair. They grow rapidly and by 8 weeks are able to hunt with the mother. Females attain sexual maturity at 2-3 months and sometimes can mate in their first summer of life. Males do not reach full size and sexual maturity until 1 year.

Sites: 208-209km

13. Steppe Polecat (*Mustela eversmanni*)
Japanese name: Kenaga itachi
Mongolian name: Oemkhiy Khueren

Steppe zone from Austria to Manchuria and Tibet

Males have a head and body length of 370-562 mm, a tail length of 80-183 mm, and a weight of up to 2,050 grams. Females have a head and body length of 290-520 mm, a tail length of 70-180 mm, and a weight of up to 1,350 grams. There is much variation in color pattern, but generally the body is straw yellow or pale brown, being somewhat darker above than below. There is a dark mask across the face. the chest, limbs, groin area, and terminal third of the tail are dark brown to black. Some individuals bear a striking resemblance to the North American black-footed ferret.

The steppe polecat is found in open grassland and semidesert. It usually expropriates the burrow of a ground squirrel or some other animal and modifies the home for its own use. Some burrow systems, especially those of females, may be occupied for several years and become rather complex. *M.eversmanni* is quick and agile and has keen senses, especially of smell and hearing. It moves by leaps of up to 1 m and constantly changes direction during hunts. It is nocturnal and has been known to cover up to 18 km in the course of a winter night. Local migrations may occur in response to extreme snow depth or food shortage. the diet consists mainly of pikas, voles, marmots, hamsters, and other rodents. Food is sometimes stored for later use.

Mating usually occurs from February to March, and births from April to May. If a litter is lost, however, the female may produce a second later in the year. The gestation period is 38-41 days. The average number of young per litter is about 8-10, and the range is 4-18. The young weigh 4-6 grams each at birth, open their eyes after 1 month, are weaned and start hunting with the mother at 1.5 months, disperse at 3 months, and attain sexual maturity at 9 months.

Sites: 434-435km, 442-443km, 465km

14. Pallas's Cat (*Felis(Otocolobus) manul*)
Japanese name (general): Yama neko
Mongolian name: Manuul

Felis(Otocolobus) manul : Caspian Sea and Iran to southeastern Siberia and Tibet

Head and body length is 500-650 mm, tail length is 210-310 mm, and weight is 2.5-3.5 kg. The general coloration varies from light gray to yellowish buff and russet; the white tips of the hairs produce a frosted silvery appearance. There are two dark streaks across each side of the head and four rings on the dark-tipped tail. The coat is relatively longer and more dense than that of any other wild species of *Felis*. The fur is especially long near the end of the tail, and on the underparts of the body it is almost twice as long as on the back and sides. Such an arrangement provides good insulation for an animal that spends much time lying on frozen ground and snow. The body is massive, the legs are short and stout, the head is short and broad, and the ears are very short, bluntly rounded, and set low and wide apart.

Pallas's cat inhabits steppes, deserts, and rocky country up to elevations of over 4,000 m. It dens in a cave, crevice, or burrow dug by another animal. It is usually nocturnal but is occasionally seen by day. It feeds on pikas and other small mammals. The young are born in Siberia in late April and May, and litter size is five or six.

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Sites: 10pk6-10pk8, 17pk9-19pk2, 434-435km, 442-443km, 465km

15. Eurasian Badger (*Meles meles*)
Japanese name (general): Anaguma
Mongolian name: Dorgo

Originally occurred throughout Europe, including the British Isles and several Mediterranean islands, and in Asia as far as Japan and as far south as Palestine, Iran, Tibet, and southern China.

Head and body length is 560-900 mm, tail length is 115-202 mm, and weight is usually 10-16 kg. The upper parts are grayish, and the underparts and limbs are black. On each side of the face is a dark stripe that extends from the tip of the snout to the ear and encloses the eye; white stripes border the dark stripe. Like other badgers, *Meles* has a stocky body, short limbs,

and a short tail.

The Old World badger is found mainly in forests and densely vegetated areas. It usually lives in a large communal burrow system that covers about 0.25 hectare. There are numerous entrances, passages, and chambers. Nests may be located 10 m from an entrance and 2-3 m below the surface of the ground and have a diameter of 1.5 m. A burrow system may be used for decades or centuries, by one generation of badgers after another; it continually increases in complexity and may eventually cover several hectares. The animals occupying a system may utilize one nest for several months and then suddenly move to another part of the burrow. The living quarters are kept quite clean. Bedding material, in the form of dry grass, brackens, moss, or leaves, is dragged backward into the den. Occasionally this bedding is brought up and strewn around the entrance to air for an hour or so in the early morning. Around the burrows are dung pits, sunning grounds, and areas for play. Well-defined foraging paths may extend outward for 2-3 km distinguished two kinds of burrows: "main sets," with an average of 10.5 entrances; and small "outliers," usually with only a single entrance.

Meles usually does not emerge from its burrow until after sundown. During periods of very cold weather and high snow, it may spend days or weeks in the den. Such intervals of winter sleep extend to several months in northern Europe and up to seven months in Siberia. There is no substantial drop in body temperature, and the badger can be aroused easily, but the animal lives off of fat reserves accumulated in the summer and fall. The omnivorous diet includes almost any available food --- small mammals, birds, reptiles, frogs, mollusks, insects, larvae of bees and wasps, carrion, nuts, acorns, berries, fruits, seeds, tubers, rhizomes, and mushrooms. Earthworms have been found to be of major dietary importance in some areas.

In a study in England, badgers are found to be organized into clans of up to 12 individuals. The minimum distance between the main burrows of clans was 300 m. Most clans used ranges of 50-150 ha, and there was little overlap. The ranges were marked by defecation and secretions from subcaudal glands. Several fights were observed along territorial boundaries. Most clans had more females than males, but one, which used a range of only 21 ha, consisted solely of males (it was suggested that in other parts of the range of *Meles* the bachelors may be nomadic). Individuals moved around alone within the clan range. Adult males always slept in the main sets, but females sometimes slept in the outliers, especially in the summer.

Mating occurs from late winter to midsummer. Development of the fertilized eggs stops at the blastocyst stage, and implantation in the uterus is delayed for about 10 months. The time of implantation seems to be controlled by conditions of light and temperature. Following implantation, embryonic development proceeds for 6-8 weeks, and births occur mainly from

February to March. The total period of pregnancy may thus extend for about 1 year. Females may experience a postpartum estrus. The number of young in a litter is two to six, usually three eyes after about 1 month, nurse for 2.5 months, and usually separate from the female in the autumn. Both males and females apparently attain sexual maturity at the age of 1 year.

Prohibited Hunting Seasons: from November 1st to September 1st of the following calendar year.

Sites: 54-56km

16. Red Deer (*Cervus elaphus*)
Japanese name: Aka shika
Mongolian name: Khaliun Buga

Europe, Asia Minor, Caucasus, Central Asia, southern Siberia, Mongolia, Manchuria, Korea, northern and western China, Himalayan region, northwestern Africa, southern Canada, most of the conterminous United States, northern Mexico.

This is the largest and most phylogenetically advanced species of *Cervus*. Head and body length is 1,650-2,650 mm, tail length is 100-270 mm, height at the shoulder is 750-1,500 mm, and weight is 75-340 kg. Animals in the populations of North America and northeastern Asia are usually larger than those of Europe and southern Asia, and within a given population males average larger than do females. The upper parts are usually some shade of brown, and the underparts are paler. There is a prominent pale-colored patch on the rump and buttocks. The pelage is coarse, and males have a long, dense mane. The well-developed antlers measure up to about 1,750 mm along the beam. There is a supernumerary tine above the brow tine.

The deer utilizes a wide variety of habitats in both lowlands and mountains. In North America it originally was found in dense coniferous forests, open hardwood forests, chaparral, and grasslands. It is usually active during the early morning and late afternoon. In some areas it moves into higher country during the spring and returns to the lowlands in the fall. Populations in eastern North America did not migrate, but those in the western mountains frequently do, the autumn movement generally being to lower elevations to avoid snow cover. Summer ranges cover a much larger area than do winter ranges. In certain areas only a portion of a population migrates. About a fourth of the large herd wintering at the Jackson Hole Refuge in Wyoming remains in the same range all year, while the other animals move out for

distances of up to 97 km. The diet of *C.elaphus* varies and involves both grazing and browsing.

C.elaphus is highly gregarious. Discrete herds are formed, each usually occupying a definite area. For most of the year the sexes stay in separate herds. In a study in Scotland, Clutton-Brock, Guiness and Albon found population densities to vary from 1 per 10 ha to 1 per 120 ha. Females there had home ranges of about 60 ha in summer and 40 ha in winter, whereas males had corresponding ranges of 40 ha and 25 ha. Outside of the mating season the sexes remained apart in groups of usually 4-7 members. Each group had a rank hierarchy maintained by threatening gestures, kicks, and chases. Females began to restrict their range in September and gathered in traditional rutting areas. The males also left their normal ranges and joined the females by early October. The stags then competed for the females through displays involving roars, thrashing, and spraying urine. They fought frequently, and serious injuries were common. The younger and weaker individuals were driven away but sometimes remained in the vicinity and sought to split off females. Males under 4 years old rarely could hold a harem; maximum fighting success came at 7-10 years. Successful stags sometimes gained over 20 females, though seldom did a male actually father more than 4 young per season. Young females generally adopted a home range overlapping that of their mother, while young males left the vicinity at 2-3 years and joined a stag group.

One group of *C.elaphus* occurs in the Tien Shan Mountains of eastern Kazakhstan and Sinkiang, Mongolia, Manchuria, Korea, southern Siberia, and, after a bast hiatus, North America. None of the various subspecies in these regions are now classified by IUCN or the USDI, but most have been adversely affected by human activity, notably unregulated hunting during settlement in the nineteenth and early twentieth centuries.

"Rare" in Gov. Res. 152 Annex 1

Sites: 272km, 442-443km

17. Roe Deer (*Capreolus pygarus*)
Mongolian name: Bor Goeroeoes

C.capreolus, Great Britain and Spain to the Volga River and northern Iran.
C.pygarus, Volga River to southeastern Siberia, Korea, and central China

Head and body length is 950-1,510 mm, tail length is about 20-40 mm, shoulder height is

650-1,000 mm, and weight is 15-50 kg. Coloration varies with the season. In summer the coat is reddish above, the ears are black, and the underparts are white. In winter the general color is buff or dark grayish brown, the throat and rump patch are white, and the face, chest, and legs are tawny. *Capreolus* is small and graceful. the antlers are slightly roughened at the base, only about 230-380 mm long, and seldom more than three-tined. The tail is inconspicuous.

Roe deer are found in forests, sparsely wooded valleys, open fields, and agricultural areas, usually at elevations not exceeding 2,400 m. They are found in almost any area that furnishes a reasonable amount of cover and are able to live in parklike places among dense human populations. In the early morning and late evening, they emerge from cover and may seek open grassland, where they graze. Most populations are sedentary, remaining in relative small area throughout the year, but in the Soviet Union there are reported to be migrations of up to 300 km to traditional wintering sites with shallow snow cover. *Capreolus* is shy, but curious, and has well-developed senses. It is an excellent swimmer. The diet consists of grass, herbs, and cultivated crops.

Roe deer lives alone or in small groups, but aggregations of up to 100 animals frequently form at favorable feeding sites, especially during the fall and winter or in the course of migrations. Groups are unstable in membership, but the individuals in a given area have a dominance hierarchy. During the spring and summer, when the animals live alone or in doe-fawn pairs, adults of both sexes establish defended territories. If two animals of the same sex meet at such times, they may fight. Reported size of territories is 7-25 ha for males and 3-180 for females; these areas compose only a portion of the total home range. Unlike most deer, male *Capreolus* usually escort only one female. They will savagely fight any intruding male. During the mating season, males often chase females in circles, leaving a track referred to as a "witch circle". Such chases also occur in other seasons, sometimes between individuals of the same sex. The row deer utters a barking sound when disturbed. Females emit a screeching sound during the breeding season and to call fawns.

Mating usually occurs in July and August, and implantation of the fertilized egg in the uterus is subsequently delayed about 4 months. A few females, however, do not mate until November or December, do not experience delayed implantation, and have a total gestation of about 5.5 months. Births occur in the spring. When about to bear its young, the doe chases away the offspring of the previous season and then retires to the forest, returning in about 10 days with the new family. the number of young per birth is usually two, occasionally one or three. Twins are born and suckled, not at the same spot, but usually 10-20 meters apart. The fawns have three longitudinal rows of white spots. Sexual maturity is attained at about 1 year and 4 months. *Capreolus* is delicate in captivity. The average life span of 11 specimens in the

London Zoo was 40 months, and the maximum was 7 years. Normal longevity in the wild is 10-12 years, and the maximum may be 17 years.

Prohibited Hunting Seasons: from December 1st to September 1st of the following calender year.

Sites: 10pk6-10pk8, 17pk9-19pk2, 272km, 285km, 420-421km

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Appendix 17-8 Aquatic Biota

Natural variation in time and space is superimposed upon environmental change induced by human activities in catchment basins. Flows in all of the larger and most of the smaller rivers in the temperate latitudes of the world now are regulated by dams and diversions. Reduced volume and altered seasonality of flow radically change the natural habitat template, eliminating native species and allowing invasion of nonnatives.

Stream regulation by dams, diversions, and revetments: uncouples longitudinal, lateral, and vertical dimensions.
- Lotic reaches replaced by reservoirs: loss of up-downstream continuity
- Migration barrier; flood and nutrient sink; stimulates biophysical constancy in downstream environments
- Channel reconfiguration and simplification: loss of lateral connections
- Removal of woody debris, isolation of riparian and hyporheic components of floodplains
- Transcatchment water diversion: abnormal coupling of catchments
- Dewatering of channels; immigration of exotic species, import of pollutants.

Water pollution: alters flux rates of materials, uncouples food webs
- Deposition of pollutants from airshed into catchment
- Eutrophication, acidification
- Accelerated erosion related to deforestation and roading
- Sedimentation of stream bottoms, eutrophication

Food web manipulation : induces strong interactions that alter food webs
- Harvest of fishes and invertebrates
- Biomass and bioproduction shifts
- Introduction of exotic species
- Cascading trophic effects

Temperature is one of the most important variables in the biospehere. Temperature affects movement of molecules, fluid dyanmics, saturation constants of dissolved gases in water, metabolic rates of organisms, and a vast array of other factors that directly or indirectly affect life on earth. Typically, the greatest source of heat in fresh water is solar radiation. This is particularly true for lakes, large rivers, or streams that are exposed to direct sunlight over most of this surface. Many small streams, however, have dense canopy cover under the riparian forest that shades the stream surface. In very heavily shaded streams, transfer of heat from the air and flows from ground water are more important than direct solar radiation in

governing stream temperatures.

Light is a critical variable in most ecosystems. In streams, as in all aquatic environments, solar radiation is necessary for photosynthesis by attached algae. It is also the medium through which all visual behavior (e.g., predation by fish) is expressed. Because streams are so closely linked with the surrounding terrestrial landscape, stream light regimes are highly influenced by terrestrial objects such as trees or geologic features. Shade created by an overhanging tree canopy restricts primary production in many streams in undisturbed forests. The longitudinal downstream change in light regime and its consequences for stream bioenergetics is an integral part of stream ecosystems. In regions where streamside vegetation is not well-developed, shade from steep banks or canyon walls can be important. Light attenuation by dissolved organic matter or suspended organic and inorganic particles can reduce light penetration in larger streams, particularly those that carry high suspended sediment loads.

Dissolved oxygen (DO) greatly affects aquatic life as well as biogeochemical process. In most unpolluted streams and rivers, DO concentration remain well above 80 % saturation. Solubility of oxygen increases nonlinearly as temperature decreases and decreases with decreasing atmospheric pressure associated with different elevations or barometric change of weather. Organic pollution , such as that associated with municipal sewage treatment discharge or industrial wastes, may significantly reduce DO concentrations in entire stream reaches as microbial processes consume the oxygen from the water; this is generally referred to as biochemical oxygen demand (BOD). In unpolluted running waters, oxygen concentration may also change dramatically between habitats. Microbial activity within leaf packs and debris dams may reduce oxygen concentrations at the microhabitat levels. Streams and rivers that support luxuriant algal growth may experience broad daily ranges in DO as photosynthesis increases oxygen concentration during the day and respiration reduces oxygen concentration at night.

For many watershed, the movement of sediment into stream systems generally occurs by two major processes: surface erosion and mass wasting. Surface erosion by water is perhaps most common in arid areas, agricultural areas, or where watersheds have relatively little vegetation or organic matter (litter) on the soil surface. When bare soils occur, rainfall can detach inorganic soil particles and transport them to a channel network by overland flow; additional sediment can be entrained by surface runoff as sheet and rill erosion. Mass wasting, or landslides, represent the en mass movement of soil, rock, and organic debris downslope by gravity. Various types of mass failures can occur including rockfalls, debris avalanches, debris flows, slumps, soil creep, and others. Each type of failure can deliver a wide variety of

particle sizes to a stream system. Landslides and other forms of mass failures usually are the predominate form of erosion in areas with relatively steep terrain. Furthermore, where soil, rock, or previously deposited alluvium are being eroded by a stream or river system, these materials can represent another important source of sediment to aquatic systems.

The amount of sediment that moves into a stream network from hillslopes or other land surfaces or is eroded by fluvial systems can vary greatly among watersheds because of the numerous factors involved in erosional processes. These factors include climate (precipitation and temperature regimes), topography (terrain steepness, aspect), vegetation (type and density of vegetation), soils (particle sizes and erodibility), and geology (characteristics of parent material and bedrock). In addition, human perturbations and management practices that affect watershed and stream systems can greatly augment natural rates of erosion and sediment yield.

Heterotrophic microorganisms in streams include bacteria, protists, and fungi, which are important components of the microbial communities associated with submerged surfaces such as rocks, leaves, and wood as well as with interstitial water of benthic sediments and in the overlying water. One important role of benthic bacterial communities is in the assimilation of dissolved materials from the overlying water. The ecological importance of these processes is that they result in the transfer of organic carbon associated with dissolved organic matter (DOM) from the overlying streamwater to surfaces, where it can then be partially or wholly metabolized by benthic, heterotrophic microbial communities. Therefore, benthic microbial communities function to retain and transform DOM, which is an important source of organic matter and energy.

The algae are an ubiquitous group of photosynthetic organisms responsible for the majority of photosynthesis in most sunlit streams. Benthic algae are dominant members or the periphyton community and live on submerged substrata in the photic zone of most aquatic ecosystems including both marine environments and freshwater. As organisms at the base of the food web, they are at the interface of the physical-chemical environment and the biological community. Photosynthesis by benthic algae provides food for algivores. In many stream habitats, the contribution of organic carbon to the food web from algal photosynthesis is considerable. Benthic algae may enter the food web through direct consumption from the substrata by benthic invertebrates such as snails or insects or through capture of drifting benthic algae by filter-feeders that strain the water column.

Freshwater macroinvertebrates are ubiquitous; even the most polluted or environmentally extreme lotic environments usually contain some representatives of this diverse and

ecologically important group of organisms. In many lotic environments, the macroinvertebrate community consists of several hundred species from numerous phyla including arthropods (insects, mites, scuds, and crayfish), mollusks (snails, limpets, mussels, and clams), annelids (segmented worms), nematodes (roundworms), and platyhelminthes (flatworms). Most stream macroinvertebrate species are associated with surfaces of the channel bottoms (e.g., bedrock, cobble, roots, and sediments) or other stable surfaces (e.g., fallen trees, snags, roots, and submerged or emerged aquatic vegetation) rather than being routinely free-swimming. Because of their propensity for bottom habitats, most stream macroinvertebrates are referred to as being benthic, or collectively as the macrozoobenthos.

Geology, climate, and other landscape features directly affect hydrologic patterns, the movement and storage of inorganic and organic materials. Nutrients and the downstream transport of solutes are affected by channel and substratum complexity, the interactions of ground- and surface waters, and by the stream biota itself. Interactions between the stream channel, hyporheic zone, and riparian floodplains likewise are important features in the structure and function of the entire stream corridor. These and many other factors affect the microhabitat structure of the stream and the distribution and abundance of stream macro-invertebrates.

The fish community is an assemblage of species inhabiting a prescribed area. The community is an important unit of study because community interactions influence the stability and flow of materials and energy through the ecosystem. Changes in the community arise from natural invasion caused by changes in climate, breakdown of geographical barrier, and human introduction. The number and kinds of species found locally can be ascribed to several ecological mechanisms: dispersal, physiological tolerances, biological interactions among species, and periodic environmental disturbances. Colonists disperse during seasonal migrations from the available species pool. some of these migration are short, measured in tens of meters. Other migrations are extensive, extending over many kilometers. The limitations to dispersal are often dictated by physical tolerances to habitat quality (e.g., temperature, pH, dissolved oxygen, current, availability of substrata or cover). Biotic interactions such as predation, competition, mutualism, parasitism, and disease are also important in shaping communities, especially in stable and predictable environments. Periodic, recurrent disturbances such as flash floods or droughts can cause local, short-term changes in community structure. The effects of flooding in particular are especially harsh on young-of-the-year fishes. The serenity of these disturbances can be ameliorated when the habitat is complex, because habitat complexity confers refuge. In summary, biological interactions may be very important community structuring agents in physically stable and complex streams, whereas the ability to disperse and colonize may be dominant factors in streams subject to

harsh recurrent disturbances.

In general, species richness increases as a function of habitat volume and habitat complexity. Larger watersheds or catchment basins will have more species, all other things being equal. First, when environmental gradients such as stream power or temperature change gradually, fish communities slowly change through the addition of species downstream. Second, when transitions are abrupt, the stream's fish fauna segregates into distinct zonal communities (e.g., trout zone, minnow zone) or faunal subunits.

References

1. F.Richard Hauer and Gary A. Lamberti, Methods in Stream Ecology (1996), Academic Press, San Diego

Chapter 20
APPENDIX

Ap Table 20-1-1 Time Value of Passengers

	Item	Details
1	Passengers on the railways 1)	Daily (1995) 3200 persons, (2005) 4300 persons Daily (2010) 4800 persons, (2010) 5400 persons
2	GDP per capita 2)	
	-1 Mongolia GDP in 1995	391,103.4 mn Tug in current prices, and the price esc. 1.378 was
	Mongolia GDP'95 in 1996 prices	used to show in 96 prices. =391103*1.378=538,940 tug mn in 96 prices
	-2 Pop 1995 esti.	2,330,000
	-3 GDP/person of 1995 in 1996	538940 / 2330,000 = 235,037 tug per capita
	-4 GDP/person/hr	235037/(365*8)= 80.50 Tug/person/hr in 96 prices
	in $us $1.00=Tug 550 in 96	80.5 / 550 = $0.150 /hr
3	GDP/ person of international passengers 3)	China registered a growth of 10% p.a. in real GDP in 1993-96, while Russia reduced it at -4% in the same period. By considering in those changes the averaged GDP/person 95 is tabulated as:
	Russia 1994	$us 2460 3). So '95 is estimated by $2460*0.96= $us 2362
	China 1995	$us 530 3). So '95 is $530
	the average 1995	1/2* (2362+583)=1/2* 2945=1473 1473 / (365*8)= $0.50 /hr
		The above figure of 0.50 in 1995 was thought to be
4	the weighted average of Mongolian & international of 1995 in prices'96	equal in the value in 1996. 0.15* 0.67 +0.50*0.33= $ 0.266/ hr

Source: 1) From Fig. 5-6-1 and Ap Table 5-8-23
2) From State Statistical Yearbook (STOM, 1996)
3) World Social Indicators of Development, 1996 (World Bank, 1996)

Remarks:

Damage occurrence

The average close hours per damage is shown below. Average train number per day is in Ap Table 6-19. Damages in 'S' is assumed to occur with wait hrs per train at '1/2' of the scale M. It means the 'S' will wait hrs of 5.3 hrs and the closure time was estimated at 8.3 hrs. The followings are those calculations.

Scale	Av. Close Hrs	Av. Train Wait Hrs
L	24.0	13.5
M	18.0	10.5
S	8.3	5.3

Passenger trains: 8 trains per day 1995
L: closed hrs 24.0 interval 24/8=3hrs in average and trains wait in order as
24, 21, 18, 15, 12, 9, 6, 3 which means 108/8 = 13.5 av. wait hrs
M: closed hrs 18.0 interval 3 hrs, and trais wait in order as
18, 15, 12, 9, 6, 3, which means 63/6 = 10.5 av. wait hrs
For S , a half of wait hrs of M is assumed. It is 5.3 hrs.
The closed hr. is tabulated at 8.3 hrs (8.3, 5.3, 2.3)

Ap Table 20-1-2 Time Value of Passengers

Yr	Stage		1	Time Cost				
	Passengers per day	Scale	Wait hrs Train Av	Time cost Hr/pass	Occur Damages	Ini. Cost $us	Cost 1)	Sum of stages
'05	4300	L	13.5	0.334	0.38	7368	14736	
	4300	M	10.5	0.334	0.97	14628	29256	
	4300	S	5.3	0.334	1.35	10276	20552	
	Total/yr				2.7	32271	64542	64542
'10	5-10	Every year traffic growth			1.02			
		time value growth			1.023	40327	80654	
'20	10-20	Every year traffic growth			1.01			
		time value			1.025	58000	116000	
	Stage		2	Time Cost				
	Pass/day		Wait hrs	Time cost	Occurence	Cost		
'10	4800	L	13.5	0.3741	0.14	3393		
	4800	M	10.5	0.3741	0.36	6788		
	4800	S	5.3	0.3741	0.5	4758		
	Total/yr				1	14939	29878	110532
'20	10-20	Every year traffic growth			1.01			
		time value growth			1.025	21581	43163	
	Stage		3	Time Cost				
	Pass/day		Wait hrs	Time cost	Occurence	Cost		
'20	5400	L	13.5	0.4696	0.39	14094		
	5400	M	10.5	0.4696	1.01	28390		
	5400	S	5.3	0.4696	1.4	19863		
	Total/yr				2.8	62347	124694	283857

Ap. Table 20-1-3 Road Vehicle Costs

(Unit Cost, 1996 in $ on paved road at v=50km/h.)

		Wagon Box Asian 12 prs	Cost/000km	Bus Asian 40 prs	Cost/000km	Truck Russ/Asian 8 tons	Cost/000km
veh	Cost CIF $	11300		22600		20340	
	Life	10		12		15	
	km/Yr	30000	37.67	40000	47.08	40000	33.90
Tyre	1 set Cost $	226		450		610	
	Life/Yr km	30000	7.53	30000	15.00	30000	20.34
Fuel	Diesel Aug'96	Fc 151 Tug/l	Taxes 42.6 Tu/l, Ecost 108.4Tug/l				
	Km/l	6		5		4	
	$/1000km	1000/6=a		1000/5=a		=1000/4=a	
		a*108.4/550	32.85	a*108.4/550	39.42	a*108.4/550	49.27
Oil lub.	10% of fiel		3.29		3.94		4.93
Maintenance in lab & mat. equiv to 60% of fuel			19.71		23.65		29.56
Capital cost i=12% on 1/2 of CIF veh		678	22. 60	1356	33. 90	1220.4	30. 51
Driver wage $50*12=$600/yr		=600/30	20.00		22.50		22.50
Overhead 10%			14.36		18.55		19.10
Paved rd							
Total economic cost $ in '96/1000km			158.01		204.05		210.11
Road 50% paved & 50% gravel							
VOC on gravel is assumed at +30% in cost							
Consequently, VOC in project area is 1)			181.71		234.65		241.63

Source: Customs Office and others, August 1996

Notes: The VOC should be understood the cost at the border and compatible in neighbouring countries since domestic market is influenced by administrative maneauvering. A comparison is made to see the relative difference among the types of vehicles. Due to the inflation in those years cost comparison of the same type may need further researches.

VOC in other studies (cost in us$ /1000 km) is shown under

	Wagon 12-14 seats	Bus 30-40 seats	Truck 8-12 ton ld	
This study	158.01	204.05	210.11	
	(1.00)	(1.29)	(1.33)	
Road Master	108.3	161.8	188.6	Road Master Plan (ICT & Swk
Plan	(1.00)	(1.49)	(1.74)	1994)
ADB Rd 2nd	116	141.1	168.84	ADB 2nd Provincial Hiwy
project	(1.00)	(1.21)	(1.45)	Project Pakistan (PCI & others, 1995)

Ap Table 20-1-4 Estimated Road Transport Cost 450km

A. Passengers

Stage	Detail Volume/da	Damages per Yr.	Veh. type	%	Load/veh	% disrupt hr	Req. Veh	Share in Veh. type	Yr
1	4300 L	0.38	Bus	55	30	13. 5/24	17	0.56	5
	4300		Wag	45	10		41		
	4300 M	0.97	Bus	55	30	10. 5/24	33	0.44	
	4300		Wag	45	10		82		
	Total		Bus				50	1.00	
			Wag				123		
2	4800 L	0.14	Bus	55	30	13. 5/24	7	0.56	10
	4800		Wag	45	10		17		
	4800 M	0.36	Bus	55	30	10. 5/24	14	0.44	
	4800		Wag	45	10		34		
	Total		Bus				21	1.00	
			Wag				51		
3	5400 L	0.39	Bus	55	30	13. 5/24	22	0.56	20
	5400		Wag	45	10		53		
	5400 M	1.01	Bus	55	30	10. 5/24	44	0.44	
	5400		Wag	45	10		107		
	Total		Bus				65	1.00	
			Wag				161		

Cost of Road Vehicle Transport; Passengers

Stage	Number of vehicles	Road km	VOC $/km	trips	Cost by Veh	Cost by stage	Ratio on & off *1.2	Annual cost 1)	yr
1	50	450	0.23465	2	10624				
	123	450	0.18171	2	20193	30817	36981	62784	05
	Increase 05-10 is (1.02)^5=1.104:				1.104			69314	10
	Increase 10-20 is (1.01)^10=1.104:				1.104			76524	20
2	21	450	0.23465	2	4391				
	51	450	0.18171	2	8345	12736	15283	22030	10
	Increase 10-20 is (1.01)^10=1.104:				1.104	16873		24320	20
3	65	450	0.23465	2	13825				
	161	450	0.18171	2	26278	40103	48124	81704	20

B. Cargoes

Stage	Detail Volume/da	Damages per Yr.	veh.	%	Load/veh	Req. Veh	Vehicles total
1	7924 L	0.38	Truck	100	8	212	
	7924 M	0.97	Truck	100	8	420	632
2	9340 L	0.14	Truck	100	8	92	
	9340 M	0.36	Truck	100	8	184	276
3	10836 L	0.39	Truck	100	8	297	
	10836 M	1.01	Truck	100	8	599	896

Cost of Road Vehicle Transport; Cargoes $us

Stage	Number of vehicles	Road km	VOC $/km	trips rt	Cost by Veh	Cost by stage	Ratio on off *1.2	Annual cost 1)	
1	212	450	0.241633	2	46043				
	420	450	0.241633	2	91412	137455	164946	319624	05
	Increase 05-10 is (1.04)^5=1.217:				1.217	200739		389488	10
	Increase 10-20 is (1.01)^10=1.104:				1.104	429995		430808	20
2	92	450	0.241633	2	19994				
	184	450	0.241633	2	39989	59983	71980	147877	10
	Increase 10-20 is (1.01)^10=1.104:				1.104			467471	10
3	297	450	0.241633	2	64620				
	599	450	0.241633	2	130160	194780	233736	233736	20
					1.105				

C. Total Cost in $us of 1996 prices

Stage	Item Asuumed shift to road vehicle transport	Passenger Cost	Cargoes Cost	Total Cost 1)		Yr
1	Cost in 2005	62784	329892	382408	*	05
	Cost in 2010	69314	401478	458802	*	10
	Cost in 2020	76524	443231	507332	*	20
2	Cost in 2010	22030	147877	169907		10
	Cost in 2020	24320	163257	187577		20
3	Cost in 2020	81704	467471	549175		20

Note : 1) Including the mobilization of vehicles

Appendix Table 20-1-5 Road Transport Cost

Year	a Road Cost 1)	b Train Net Revenue 2)	c = a-b Net Road Transp. C.
2005	392,676	10,268	382,408
2010	470,792	11,990	458,802
2020	519,755	12,423	507,332

Notes: 1) calculated using data in Ap Table 20-1-4

2) Revenue and cost of MR were estimated for 450km as under in $us'000

Year	Revenue	Op cost	Net Revenue
1996	19178		
2005	26876	16620	10256
2010	31050	19073	11977
2020	35199	22790	12409

Calculation could be made in the followings to find the train operation cost, which should be deducted from the road cost in the benefit estimate.

$10256*L 0.28 /365 * 0.38 *13.5/24.0=1682

$10256*M 072 /365 * 0.97 *10.5/24.0=8586

total $us in 2005 10268

In the similar way, the net lost revenue is estimated at 11990 and 12423 for '10 and '20 respectively.

Ap Table 20-1-6 Economic Cost and Benefits, 1999-2034
Short Term Urgent Projects

Case Basic ($us 1996 prices)

No.	Year	Project Cost	Benefits Damage Rep	Pass Time	Road Veh	Total	Net Benefits
0	1999	452000		0	0		-452000
1	2000	408000	34740	2517	14914	52171	-355829
2	2001	271000	65917	4776	28298	98991	-172009
3	2002	3591000	88186	6390	37858	132434	-3458566
4	2003	3449000	377686	27366	162141	567193	-2881807
5	2004	2925000	655606	47503	281452	984561	-1940439
6	2005		890769	64542	382408	1337719	1337719
7	2006		890769	67485	396595	1354849	1354849
8	2007		890769	70562	411309	1372640	1372640
9	2008		890769	73780	426569	1391118	1391118
10	2009		890769	77144	442394	1410308	1410308
11	2010		890769	80654	458802	1430225	1430225
12	2011		890769	83638	463479	1437886	1437886
13	2012		890769	86733	468204	1445706	1445706
14	2013		890769	89942	472977	1453688	1453688
15	2014		890769	93270	477798	1461837	1461837
16	2015		1068923	96721	482669	1648312	1648312
17	2016		1068923	100299	487589	1656811	1656811
18	2017		1068923	104011	492560	1665493	1665493
19	2018		1068923	107859	497581	1674362	1674362
20	2019		1068923	111850	502653	1683426	1683426
21	2020		1068923	116000	507332	1692255	1692255
22	2021		1068923	116000	507332	1692255	1692255
23	2022		1068923	116000	507332	1692255	1692255
24	2023		1068923	116000	507332	1692255	1692255
25	2024		1068923	116000	507332	1692255	1692255
26	2025		1247077	116000	507332	1870409	1870409
27	2026		1247077	116000	507332	1870409	1870409
28	2027		1247077	116000	507332	1870409	1870409
29	2028		1247077	116000	507332	1870409	1870409
30	2029		1247077	116000	507332	1870409	1870409
31	2030		1247077	116000	507332	1870409	1870409
32	2031		1247077	116000	507332	1870409	1870409
33	2032		1247077	116000	507332	1870409	1870409
34	2033		1247077	116000	507332	1870409	1870409
35	2034	-7767200	1247077	116000	507332	1870409	9637609
	Total		33,289,819	3,137,042	14,998,230	51,425,091	48,096,291
Economic Rate of Return				EIRR =			0.1305

11096000

Ap Table 20-1-7 Economic Cost and Benefits, 1999-2034

Short Term Urgent Projects

Sensitivity Tests ($us 1996 prices)

No.	Year	Net Benefits						
		Basic	Casel	Case II	Case III	Case IV	Case V	Case VI
0	1999	-452000	-497200	-542400	-452000	-452000	-497200	-542400
1	2000	-355829	-396629	-437429	-361046	-366263	-401846	-447863
2	2001	-172009	-199109	-226209	-181908	-191807	-209008	-246007
3	2002	-3458566	-3817666	-4176766	-3471809	-3485053	-3830909	-4203253
4	2003	-2881807	-3226707	-3571607	-2938526	-2995246	-3283426	-3685046
5	2004	-1940439	-2232939	-2525439	-2038895	-2137351	-2331395	-2722351
6	2005	1337719	1337719	1337719	1203947	1070175	1203947	1070175
7	2006	1354849	1354849	1354849	1219365	1083880	1219365	1083880
8	2007	1372640	1372640	1372640	1235376	1098112	1235376	1098112
9	2008	1391118	1391118	1391118	1252006	1112894	1252006	1112894
10	2009	1410308	1410308	1410308	1269277	1128246	1269277	1128246
11	2010	1430225	1430225	1430225	1287203	1144180	1287203	1144180
12	2011	1437886	1437886	1437886	1294098	1150309	1294098	1150309
13	2012	1445706	1445706	1445706	1301135	1156564	1301135	1156564
14	2013	1453688	1453688	1453688	1308319	1162950	1308319	1162950
15	2014	1461837	1461837	1461837	1315653	1169470	1315653	1169470
16	2015	1648312	1648312	1648312	1483481	1318650	1483481	1318650
17	2016	1656811	1656811	1656811	1491130	1325449	1491130	1325449
18	2017	1665493	1665493	1665493	1498944	1332394	1498944	1332394
19	2018	1674362	1674362	1674362	1506926	1339490	1506926	1339490
20	2019	1683426	1683426	1683426	1515083	1346740	1515083	1346740
21	2020	1692255	1692255	1692255	1523029	1353804	1523029	1353804
22	2021	1692255	1692255	1692255	1523029	1353804	1523029	1353804
23	2022	1692255	1692255	1692255	1523029	1353804	1523029	1353804
24	2023	1692255	1692255	1692255	1523029	1353804	1523029	1353804
25	2024	1692255	1692255	1692255	1523029	1353804	1523029	1353804
26	2025	1870409	1870409	1870409	1683368	1496327	1683368	1496327
27	2026	1870409	1870409	1870409	1683368	1496327	1683368	1496327
28	2027	1870409	1870409	1870409	1683368	1496327	1683368	1496327
29	2028	1870409	1870409	1870409	1683368	1496327	1683368	1496327
30	2029	1870409	1870409	1870409	1683368	1496327	1683368	1496327
31	2030	1870409	1870409	1870409	1683368	1496327	1683368	1496327
32	2031	1870409	1870409	1870409	1683368	1496327	1683368	1496327
33	2032	1870409	1870409	1870409	1683368	1496327	1683368	1496327
34	2033	1870409	1870409	1870409	1683368	1496327	1683368	1496327
35	2034	9637609	10414329	11191049	9450568	9263527	10227288	10816967
	Total	48096291	47265823.72	47430531	33503214	37811273	47559865	37145513
	EIRR	0.1305	0.1192	0.1097	0.1181	0.1054	0.1077	0.0882

APPENDIX 20-2-1(1)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

BASE CASE

(UNIT: THOUSAND US$)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PROFIT & LOSS STATEMENT																				
TOTAL REVENUE		0	3	5	7	32	57	81	83	86	88	91	93	94	96	97	98	99	101	102
OPERATING COST		0	2	3	4	20	35	50	51	53	54	56	57	58	59	61	62	63	64	65
SAVINGS OF REHABILITATION COST		0	38	71	95	410	713	970	970	970	970	970	970	970	970	970	970	1,164	1,164	1,164
DEPRECIATION		0	5	9	12	52	90	122	122	122	122	122	122	122	122	122	122	122	122	122
OPERATING PROFIT		0	34	64	86	371	645	878	879	880	881	882	883	884	884	884	884	1,078	1,078	1,078
INTEREST PAYMENT		0	0	0	0	0	0	202	202	202	202	195	185	175	165	155	145	136	126	116
NET PROFIT		0	34	64	86	371	645	676	677	678	679	688	699	709	719	729	739	943	953	963
CUMULATIVE NET PROFIT		0	34	98	184	555	1,200	1,876	2,553	3,232	3,911	4,599	5,298	6,006	6,725	7,454	8,192	9,135	10,087	11,050
FINANCE PROGRAM																				
FINANCE IN FOREIGN CURRENCY																				
BORROWING		405	394	213	2,848	2,787	2,137	0	0	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT		0	0	0	0	0	0	0	0	0	0	429	429	429	429	429	429	429	429	429
LOAN BALANCE		405	799	1,012	3,860	6,648	8,784	8,784	8,784	8,784	8,784	8,356	7,927	7,499	7,070	6,642	6,213	5,785	5,356	4,928
INTEREST		0	0	0	0	0	0	202	202	202	202	195	185	175	165	155	145	136	126	116
INTEREST DURING CONSTRUCTION		9	18	23	87	149	197	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCE IN LOCAL CURRENCY																				
CASH SHORT		79	13	38	1,123	767	573	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH SURPLUS		0	0	0	0	0	0	798	799	800	194	0	0	0	0	0	0	0	0	0
BALANCE		79	92	130	1,253	2,019	2,592	1,794	994	194	0	0	0	0	0	0	0	0	0	0
INVESTMENT																				
CIVIL WORKS	F/C	396	376	190	2,761	2,614	1,937	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	79	51	111	1,221	1,164	1,307	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR	F/C	0	0	0	0	24	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	0	0	0	0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0
F/C TOTAL		396	376	190	2,761	2,638	1,939	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C TOTAL		79	51	111	1,221	1,189	1,308	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL		475	427	301	3,982	3,827	3,247	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH FLOW STATEMENT																				
CASH FLOW FOR FIRR		-475	-389	-228	-3,884	-3,404	-2,512	1,000	1,001	1,002	1,004	1,005	1,006	1,006	1,006	1,006	1,006	1,200	1,200	1,200
OPERATING PROFIT		0	34	64	86	371	645	878	879	880	881	882	883	884	884	884	884	1,078	1,078	1,078
DEPRECIATION		0	5	9	12	52	90	122	122	122	122	122	122	122	122	122	122	122	122	122
INVESTMENT(-)		475	427	301	3,982	3,827	3,247	0	0	0	0	0	0	0	0	0	0	0	0	0
SALVAGE VALUE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRR (ROI)		8.67%																		

APPENDIX 20-2-1(2)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

BASE CASE

(UNIT: THOUSAND US$)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	TOTAL
PROFIT & LOSS STATEMENT																		
TOTAL REVENUE	103	104	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	3,103
OPERATING COST	66	67	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	1,976
SAVINGS OF REHABILITATION COST	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	36,235
DEPRECIATION	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	3,830
OPERATING PROFIT	1,078	1,079	1,079	1,079	1,079	1,079	1,079	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	33,532
INTEREST PAYMENT	106	96	86	76	67	57	47	37	27	17	7	1	0	0	0	0	0	2,830
NET PROFIT	973	983	992	1,002	1,012	1,022	1,032	1,236	1,246	1,255	1,265	1,271	1,273	1,273	1,273	1,273	1,273	30,703
CUMULATIVE NET PROFIT	12,022	13,005	13,997	15,000	16,012	17,034	18,066	19,302	20,547	21,803	23,068	24,339	25,612	26,885	28,157	29,430	30,703	
FINANCE PROGRAM																		
FINANCE IN FOREIGN CURRENCY																		
BORROWING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,784
REPAYMENT	429	429	429	429	429	429	429	429	429	429	429	214	0	0	0	0	0	8,784
LOAN BALANCE	4,499	4,071	3,642	3,214	2,785	2,357	1,928	1,500	1,071	643	214	0	0	0	0	0	0	
INTEREST	106	96	86	76	67	57	47	37	27	17	7	1	0	0	0	0	0	2,830
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	484
FINANCE IN LOCAL CURRENCY																		
CASH SHORT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,592
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,592
BALANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
INVESTMENT																		
CIVIL WORKS F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,275
CIVIL WORKS L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,333
BRIDGE REPAIR F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
BRIDGE REPAIR L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
F/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,301
L/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,959
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,260
CASH FLOW STATEMENT																		
CASH FLOW FOR FIRR	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,395	1,395	1,395	1,395	1,395	1,395	1,395	1,395	1,395	9,799	33,507
OPERATING PROFIT	1,078	1,079	1,079	1,079	1,079	1,079	1,079	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	1,273	33,532
DEPRECIATION	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	3,830
INVESTMENT(-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,260
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,404	8,404
FIRR (ROI)																		

APPENDIX 20-2-2(1) **THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS**

SENSITIVITY ANALYSIS CASE 1

(UNIT: THOUSAND US$)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PROFIT & LOSS STATEMENT																			
TOTAL REVENUE	0	3	5	7	32	57	81	83	86	88	91	93	94	96	97	98	99	101	102
OPERATING COST	0	2	3	4	20	35	50	51	53	54	56	57	58	59	61	62	63	64	65
SAVINGS OF REHABILITATION COST	0	38	71	95	410	713	970	970	970	970	970	970	970	970	970	970	1,164	1,164	1,164
DEPRECIATION	0	5	10	13	57	99	134	134	134	134	134	134	134	134	134	134	134	134	134
OPERATING PROFIT	0	33	63	85	365	636	866	867	868	869	870	871	871	872	872	872	1,066	1,066	1,066
INTEREST PAYMENT	0	0	0	0	0	0	222	222	222	222	214	203	192	182	171	160	149	138	127
NET PROFIT	0	33	63	85	365	636	644	645	646	647	656	668	679	690	701	712	917	928	939
CUMULATIVE NET PROFIT	0	33	97	182	547	1,183	1,827	2,472	3,118	3,765	4,421	5,089	5,768	6,458	7,159	7,871	8,787	9,715	10,654
FINANCE PROGRAM																			
FINANCE IN FOREIGN CURRENCY																			
BORROWING	446	433	234	3,133	3,066	2,351	0	0	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0	0	0	0	471	471	471	471	471	471	471	471	471
LOAN BALANCE	446	879	1,114	4,246	7,312	9,663	9,663	9,663	9,663	9,663	9,191	8,720	8,249	7,777	7,306	6,835	6,363	5,892	5,421
INTEREST	0	0	0	0	0	0	222	222	222	222	214	203	192	182	171	160	149	138	127
INTEREST DURING CONSTRUCTION	10	20	25	96	164	217	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCE IN LOCAL CURRENCY																			
CASH SHORT	87	18	49	1,245	885	704	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH SURPLUS	0	0	0	0	0	0	778	779	780	650	0	0	0	0	0	0	0	0	0
BALANCE	87	105	154	1,399	2,284	2,988	2,210	1,431	650	0	0	0	0	0	0	0	0	0	0
INVESTMENT																			
CIVIL WORKS F/C	436	414	209	3,037	2,875	2,131	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C	87	56	122	1,343	1,280	1,438	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR F/C	0	0	0	0	26	2	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C	0	0	0	0	28	1	0	0	0	0	0	0	0	0	0	0	0	0	0
F/C TOTAL	436	414	209	3,037	2,901	2,133	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C TOTAL	87	56	122	1,343	1,308	1,438	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL	523	470	331	4,381	4,209	3,572	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH FLOW STATEMENT																			
CASH FLOW FOR FIRR	-523	-431	-258	-4,283	-3,787	-2,837	1,000	1,001	1,002	1,004	1,005	1,006	1,006	1,006	1,006	1,006	1,200	1,200	1,200
OPERATING PROFIT	0	33	63	85	365	636	866	867	868	869	870	871	871	872	872	872	1,066	1,066	1,066
DEPRECIATION	0	5	10	13	57	99	134	134	134	134	134	134	134	134	134	134	134	134	134
INVESTMENT(-)	523	470	331	4,381	4,209	3,572	0	0	0	0	0	0	0	0	0	0	0	0	0
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRR (ROI)	7.88%																		

APPENDIX 20-2-2(2)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE I

(UNIT: THOUSAND US$)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	TOTAL
PROFIT & LOSS STATEMENT																		
TOTAL REVENUE	103	104	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	3,103
OPERATING COST	66	67	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	1,976
SAVINGS OF REHABILITATION COST	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	36,235
DEPRECIATION	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	4,213
OPERATING PROFIT	1,066	1,066	1,067	1,067	1,067	1,067	1,067	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	33,149
INTEREST PAYMENT	117	106	95	84	73	62	51	41	30	19	8	1	0	0	0	0	0	3,113
NET PROFIT	950	961	972	982	993	1,004	1,015	1,220	1,231	1,241	1,252	1,259	1,260	1,260	1,260	1,260	1,260	30,037
CUMULATIVE NET PROFIT	11,604	12,564	13,536	14,519	15,512	16,516	17,531	18,751	19,982	21,223	22,475	23,734	24,995	26,255	27,516	28,776	30,037	
FINANCE PROGRAM																		
FINANCE IN FOREIGN CURRENCY																		
BORROWING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,663
REPAYMENT	471	471	471	471	471	471	471	471	471	471	471	236	0	0	0	0	0	9,663
LOAN BALANCE	4,949	4,478	4,007	3,535	3,064	2,592	2,121	1,650	1,178	707	236	0	0	0	0	0	0	
INTEREST	117	106	95	84	73	62	51	41	30	19	8	1	0	0	0	0	0	3,113
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	532
FINANCE IN LOCAL CURRENCY																		
CASH SHORT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,988
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,988
BALANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
INVESTMENT																		
CIVIL WORKS F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,103
CIVIL WORKS L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,327
BRIDGE REPAIR F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
BRIDGE REPAIR L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
F/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,131
L/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,355
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,486
CASH FLOW STATEMENT																		
CASH FLOW FOR FIRR	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,395	1,395	1,395	1,395	1,395	1,395	1,395	1,395	1,395	10,640	33,121
OPERATING PROFIT	1,066	1,066	1,067	1,067	1,067	1,067	1,067	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	33,149
DEPRECIATION	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	4,213
INVESTMENT(-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,486
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,245	9,245
FIRR (ROI)																		

APPENDIX 20-2-3(1)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE II

(UNIT: THOUSAND US$)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PROFIT & LOSS STATEMENT																				
TOTAL REVENUE		0	3	5	7	32	57	81	83	86	88	91	93	94	96	97	98	99	101	102
OPERATING COST		0	2	3	4	20	35	50	51	53	54	56	57	58	59	61	62	63	64	65
SAVINGS OF REHABILITATION COST		0	38	71	95	410	713	970	970	970	970	970	970	970	970	970	970	1,164	1,164	1,164
DEPRECIATION		0	6	11	14	62	108	147	147	147	147	147	147	147	147	147	147	147	147	147
OPERATING PROFIT		0	33	63	84	360	627	854	855	856	857	858	859	859	859	859	860	1,054	1,054	1,054
INTEREST PAYMENT		0	0	0	0	0	0	242	242	242	242	234	222	210	198	186	174	163	151	139
NET PROFIT		0	33	63	84	360	627	611	613	614	615	624	637	649	661	673	685	891	903	915
CUMULATIVE NET PROFIT		0	33	95	179	539	1,166	1,778	2,390	3,004	3,618	4,243	4,880	5,529	6,191	6,864	7,549	8,440	9,343	10,258
FINANCE PROGRAM																				
FINANCE IN FOREIGN CURRENCY																				
BORROWING		486	473	256	3,418	3,345	2,564	0	0	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT		0	0	0	0	0	0	0	0	0	0	514	514	514	514	514	514	514	514	514
LOAN BALANCE		486	959	1,215	4,632	7,977	10,541	10,541	10,541	10,541	10,541	10,027	9,513	8,999	8,484	7,970	7,456	6,942	6,428	5,913
INTEREST		0	0	0	0	0	0	242	242	242	242	234	222	210	198	186	174	163	151	139
INTEREST DURING CONSTRUCTION		11	22	27	104	179	237	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCE IN LOCAL CURRENCY																				
CASH SHORT		95	23	60	1,367	1,004	834	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH SURPLUS		0	0	0	0	0	0	758	759	760	761	257	89	0	0	0	0	0	0	0
BALANCE		95	118	178	1,545	2,549	3,384	2,626	1,867	1,107	346	89	0	0	0	0	0	0	0	0
INVESTMENT																				
CIVIL WORKS	F/C	475	451	228	3,314	3,137	2,325	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	95	61	133	1,465	1,396	1,569	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR	F/C	0	0	0	0	28	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	0	0	0	0	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0
F/C TOTAL		475	451	228	3,314	3,165	2,327	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C TOTAL		95	61	133	1,465	1,427	1,569	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL		571	513	362	4,779	4,592	3,896	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH FLOW STATEMENT																				
CASH FLOW FOR FIRR		-571	-474	-288	-4,681	-4,169	-3,162	1,000	1,001	1,002	1,004	1,005	1,006	1,006	1,006	1,006	1,006	1,200	1,200	1,200
OPERATING PROFIT		0	33	63	84	360	627	854	855	856	857	858	859	859	859	859	860	1,054	1,054	1,054
DEPRECIATION		0	6	11	14	62	108	147	147	147	147	147	147	147	147	147	147	147	147	147
INVESTMENT(-)		571	513	362	4,779	4,592	3,896	0	0	0	0	0	0	0	0	0	0	0	0	0
SALVAGE VALUE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRR (ROI)		7.21%																		

APPENDIX 20-2-3(2) **THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS**

SENSITIVITY ANALYSIS CASE II

(UNIT: THOUSAND US$)

		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	TOTAL
PROFIT & LOSS STATEMENT																			
TOTAL REVENUE		103	104	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	2,103
OPERATING COST		66	67	68	68	68	68	68	68	68	68	68	68	68	68	68	68	68	1,976
SAVINGS OF REHABILITATION COST		1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	36,235
DEPRECIATION		147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	4,596
OPERATING PROFIT		1,054	1,054	1,054	1,054	1,054	1,054	1,054	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	32,766
INTEREST PAYMENT		127	115	103	92	80	68	56	44	33	21	9	1	0	0	0	0	0	3,396
NET PROFIT		927	939	951	963	974	986	998	1,204	1,216	1,228	1,239	1,247	1,248	1,248	1,248	1,248	1,248	29,371
CUMULATIVE NET PROFIT		11,185	12,124	13,075	14,037	15,012	15,998	16,996	18,200	19,416	20,643	21,883	23,130	24,378	25,626	26,874	28,122	29,371	
FINANCE PROGRAM																			
FINANCE IN FOREIGN CURRENCY																			
BORROWING		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10,541
REPAYMENT		514	514	514	514	514	514	514	514	514	514	514	257	0	0	0	0	0	10,541
LOAN BALANCE		5,399	4,885	4,371	3,857	3,342	2,828	2,314	1,800	1,286	771	257	0	0	0	0	0	0	
INTEREST		127	115	103	92	80	68	56	44	33	21	9	1	0	0	0	0	0	3,396
INTEREST DURING CONSTRUCTION		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	580
FINANCE IN LOCAL CURRENCY																			
CASH SHORT		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,384
CASH SURPLUS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,384
BALANCE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
INVESTMENT																			
CIVIL WORKS	F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,930
	L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,720
BRIDGE REPAIR	F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
	L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
F/C TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,961
L/C TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,751
GRAND TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14,712
CASH FLOW STATEMENT																			
CASH FLOW FOR FIRR		1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,395	1,395	1,395	1,395	1,395	1,395	1,395	1,395	1,395	11,480	32,736
OPERATING PROFIT		1,054	1,054	1,054	1,054	1,054	1,054	1,054	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	32,766
DEPRECIATION		147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	4,596
INVESTMENT(-)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14,712
SALVAGE VALUE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10,085	10,085
FIRR (ROI)																			

APPENDIX 20-2-4(1)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE III

(UNIT: THOUSAND US$)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PROFIT & LOSS STATEMENT																			
TOTAL REVENUE	0	2	5	6	29	52	73	75	77	79	82	84	85	86	87	88	89	91	92
OPERATING COST	0	1	3	4	18	32	45	46	48	49	50	51	52	53	54	55	56	57	59
SAVINGS OF REHABILITATION COST	0	34	64	86	369	642	873	873	873	873	873	873	873	873	873	873	1,047	1,047	1,047
DEPRECIATION	0	5	9	12	52	90	122	122	122	122	122	122	122	122	122	122	122	122	122
OPERATING PROFIT	0	30	57	76	328	572	778	779	780	781	782	783	783	783	783	783	958	958	958
INTEREST PAYMENT	0	0	0	0	0	0	202	202	202	202	195	185	175	165	155	145	136	126	116
NET PROFIT	0	30	57	76	328	572	576	577	578	579	587	598	608	618	628	638	823	833	842
CUMULATIVE NET PROFIT	0	30	87	163	491	1,063	1,639	2,216	2,795	3,374	3,961	4,559	5,167	5,785	6,413	7,051	7,874	8,707	9,549
FINANCE PROGRAM																			
FINANCE IN FOREIGN CURRENCY																			
BORROWING	405	394	213	2,848	2,787	2,137	0	0	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT	0	0	0	0	0	0	0	0	0	0	429	429	429	429	429	429	429	429	429
LOAN BALANCE	405	799	1,012	3,860	6,648	8,784	8,784	8,784	8,784	8,784	8,356	7,927	7,499	7,070	6,642	6,213	5,785	5,356	4,928
INTEREST	0	0	0	0	0	0	202	202	202	202	195	185	175	165	155	145	136	126	116
INTEREST DURING CONSTRUCTION	9	18	23	87	149	197	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCE IN LOCAL CURRENCY																			
CASH SHORT	79	16	45	1,133	809	646	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH SURPLUS	0	0	0	0	0	0	698	699	700	631	0	0	0	0	0	0	0	0	0
BALANCE	79	96	141	1,274	2,082	2,729	2,030	1,331	631	0	0	0	0	0	0	0	0	0	0
INVESTMENT																			
CIVIL WORKS F/C	396	376	190	2,761	2,614	1,937	0	0	0	0	0	0	0	0	0	0	0	0	0
CIVIL WORKS L/C	79	51	111	1,221	1,164	1,307	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR F/C	0	0	0	0	24	2	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR L/C	0	0	0	0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0
F/C TOTAL	396	376	190	2,761	2,638	1,939	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C TOTAL	79	51	111	1,221	1,189	1,308	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL	475	427	301	3,982	3,827	3,247	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH FLOW STATEMENT																			
CASH FLOW FOR FIRR	-475	-393	-235	-3,894	-3,446	-2,586	900	901	902	903	904	905	905	905	905	905	1,080	1,080	1,080
OPERATING PROFIT	0	30	57	76	328	572	778	779	780	781	782	783	783	783	783	783	958	958	958
DEPRECIATION	0	5	9	12	52	90	122	122	122	122	122	122	122	122	122	122	122	122	122
INVESTMENT(-)	475	427	301	3,982	3,827	3,247	0	0	0	0	0	0	0	0	0	0	0	0	0
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRR (ROI)	7.80%																		

APPENDIX 20-2-4(2)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE III

(UNIT: THOUSAND US$)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	TOTAL
PROFIT & LOSS STATEMENT																		
TOTAL REVENUE	93	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	2,793
OPERATING COST	60	61	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	1,778
SAVINGS OF REHABILITATION COST	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,222	1,222	1,222	1,222	1,222	1,222	1,222	1,222	1,222	1,222	32,612
DEPRECIATION	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	3,830
OPERATING PROFIT	958	959	959	959	959	959	959	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	29,796
INTEREST PAYMENT	106	96	86	76	67	57	47	37	27	17	7	1	0	0	0	0	0	2,830
NET PROFIT	852	862	872	882	892	902	912	1,096	1,106	1,116	1,126	1,132	1,133	1,133	1,133	1,133	1,133	26,966
CUMULATIVE NET PROFIT	10,401	11,264	12,136	13,019	13,911	14,813	15,725	16,821	17,927	19,043	20,169	21,301	22,434	23,567	24,700	25,833	26,966	
FINANCE PROGRAM																		
FINANCE IN FOREIGN CURRENCY																		
BORROWING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,784
REPAYMENT	429	429	429	429	429	429	429	429	429	429	429	214	0	0	0	0	0	8,784
LOAN BALANCE	4,499	4,071	3,642	3,214	2,785	2,357	1,928	1,500	1,071	643	214	0	0	0	0	0	0	
INTEREST	106	96	86	76	67	57	47	37	27	17	7	1	0	0	0	0	0	2,830
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	484
FINANCE IN LOCAL CURRENCY																		
CASH SHORT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,729
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,729
BALANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
INVESTMENT																		
CIVIL WORKS F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,275
CIVIL WORKS L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,933
BRIDGE REPAIR F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
BRIDGE REPAIR L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
F/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,301
L/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,959
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,260
CASH FLOW STATEMENT																		
CASH FLOW FOR FIRR	1,080	1,081	1,081	1,081	1,081	1,081	1,081	1,255	1,255	1,255	1,255	1,255	1,255	1,255	1,255	1,255	9,660	29,771
OPERATING PROFIT	958	959	959	959	959	959	959	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	1,133	29,796
DEPRECIATION	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	3,830
INVESTMENT(-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,260
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,404	8,404
FIRR (ROI)																		

APPENDIX 20-2-5(1)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE IV

(UNIT: THOUSAND US$)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PROFIT & LOSS STATEMENT																				
TOTAL REVENUE		0	2	4	6	26	46	64	66	68	70	72	74	75	76	77	78	79	80	81
OPERATING COST		0	1	3	4	16	28	40	41	42	43	45	46	47	48	48	49	50	51	52
SAVINGS OF REHABILITATION COST		0	30	57	76	328	570	776	776	776	776	776	776	776	776	776	776	931	931	931
DEPRECIATION		0	5	9	12	52	90	122	122	122	122	122	122	122	122	122	122	122	122	122
OPERATING PROFIT		0	26	50	66	286	498	678	679	680	681	682	682	682	683	683	683	838	838	838
INTEREST PAYMENT		0	0	0	0	0	0	202	202	202	202	195	185	175	165	155	145	136	126	116
NET PROFIT		0	26	50	66	286	498	476	477	478	479	487	498	508	518	527	537	703	712	722
CUMULATIVE NET PROFIT		0	26	76	142	428	926	1,403	1,880	2,357	2,836	3,323	3,821	4,328	4,846	5,373	5,911	6,613	7,326	8,048
FINANCE PROGRAM																				
FINANCE IN FOREIGN CURRENCY																				
BORROWING		405	394	213	2,848	2,787	2,137	0	0	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT		0	0	0	0	0	0	0	0	0	0	429	429	429	429	429	429	429	429	429
LOAN BALANCE		405	799	1,012	3,860	6,648	8,784	8,784	8,784	8,784	8,784	8,356	7,927	7,499	7,070	6,642	6,213	5,785	5,356	4,928
INTEREST		0	0	0	0	0	0	202	202	202	202	195	185	175	165	155	145	136	126	116
INTEREST DURING CONSTRUCTION		9	18	23	87	149	197	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCE IN LOCAL CURRENCY																				
CASH SHORT		79	20	52	1,143	851	720	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH SURPLUS		0	0	0	0	0	0	598	599	600	601	180	191	96	0	0	0	0	0	0
BALANCE		79	100	152	1,295	2,146	2,865	2,267	1,668	1,068	467	287	96	0	0	0	0	0	0	0
INVESTMENT																				
CIVIL WORKS	F/C	396	376	190	2,761	2,614	1,937	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	79	51	111	1,221	1,164	1,307	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR	F/C	0	0	0	0	24	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	0	0	0	0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0
F/C TOTAL		396	376	190	2,761	2,638	1,939	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C TOTAL		79	51	111	1,221	1,189	1,308	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL		475	427	301	3,982	3,827	3,247	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH FLOW STATEMENT																				
CASH FLOW FOR FIRR		-475	-396	-243	-3,904	-3,489	-2,659	800	801	802	803	804	804	805	805	805	805	960	960	960
OPERATING PROFIT		0	26	50	66	286	498	678	679	680	681	682	682	682	683	683	683	838	838	838
DEPRECIATION		0	5	9	12	52	90	122	122	122	122	122	122	122	122	122	122	122	122	122
INVESTMENT(-)		475	427	301	3,982	3,827	3,247	0	0	0	0	0	0	0	0	0	0	0	0	0
SALVAGE VALUE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRR (ROI)		6.91%																		

APPENDIX 20-2-5(2)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE IV

(UNIT: THOUSAND US$)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	TOTAL
PROFIT & LOSS STATEMENT																		
TOTAL REVENUE	82	83	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	2,482
OPERATING COST	53	54	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	1,581
SAVINGS OF REHABILITATION COST	931	931	931	931	931	931	931	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	28,988
DEPRECIATION	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	3,830
OPERATING PROFIT	838	838	839	839	839	839	839	994	994	994	994	994	994	994	994	994	994	26,060
INTEREST PAYMENT	106	96	86	76	67	57	47	37	27	17	7	1	0	0	0	0	0	2,830
NET PROFIT	732	742	752	762	772	782	792	957	967	976	986	992	994	994	994	994	994	23,230
CUMULATIVE NET PROFIT	8,780	9,523	10,275	11,037	11,809	12,591	13,383	14,340	15,306	16,283	17,269	18,262	19,255	20,249	21,243	22,236	23,230	
FINANCE PROGRAM																		
FINANCE IN FOREIGN CURRENCY																		
BORROWING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,784
REPAYMENT	429	429	429	429	429	429	429	429	429	429	429	214	0	0	0	0	0	8,784
LOAN BALANCE	4,499	4,071	3,642	3,214	2,785	2,357	1,928	1,500	1,071	643	214	0	0	0	0	0	0	
INTEREST	106	96	86	76	67	57	47	37	27	17	7	1	0	0	0	0	0	2,830
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	484
FINANCE IN LOCAL CURRENCY																		
CASH SHORT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,865
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,865
BALANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
INVESTMENT																		
CIVIL WORKS F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,275
CIVIL WORKS L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,933
BRIDGE REPAIR F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
BRIDGE REPAIR L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
F/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,301
L/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,959
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,260
CASH FLOW STATEMENT																		
CASH FLOW FOR FIRR	960	961	961	961	961	961	961	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116	9,520	26,034
OPERATING PROFIT	838	838	839	839	839	839	839	994	994	994	994	994	994	994	994	994	994	26,060
DEPRECIATION	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	122	3,830
INVESTMENT(-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12,260
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,404	8,404
FIRR (ROI)																		

APPENDIX 20-2-6(1)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE V

(UNIT: THOUSAND US$)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PROFIT & LOSS STATEMENT																				
TOTAL REVENUE		0	2	5	6	29	52	73	75	77	79	82	84	85	86	87	88	89	91	92
OPERATING COST		0	1	3	4	18	32	45	46	48	49	50	51	52	53	54	55	56	57	59
SAVINGS OF REHABILITATION COST		0	34	64	86	369	642	873	873	873	873	873	873	873	873	873	873	1,047	1,047	1,047
DEPRECIATION		0	5	10	13	57	99	134	134	134	134	134	134	134	134	134	134	134	134	134
OPERATING PROFIT		0	30	56	75	323	563	766	767	768	769	770	771	771	771	771	771	946	946	946
INTEREST PAYMENT		0	0	0	0	0	0	222	222	222	222	214	203	192	182	171	160	149	138	127
NET PROFIT		0	30	56	75	323	563	544	545	546	547	556	567	578	589	600	611	797	808	819
CUMULATIVE NET PROFIT		0	30	86	161	484	1,046	1,590	2,135	2,681	3,227	3,783	4,350	4,929	5,518	6,119	6,730	7,527	8,334	9,153
FINANCE PROGRAM																				
FINANCE IN FOREIGN CURRENCY																				
BORROWING		446	433	234	3,133	3,066	2,351	0	0	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT		0	0	0	0	0	0	0	0	0	0	471	471	471	471	471	471	471	471	471
LOAN BALANCE		446	879	1,114	4,246	7,312	9,663	9,663	9,663	9,663	9,663	9,191	8,720	8,249	7,777	7,306	6,835	6,363	5,892	5,421
INTEREST		0	0	0	0	0	0	222	222	222	222	214	203	192	182	171	160	149	138	127
INTEREST DURING CONSTRUCTION		10	20	25	95	164	217	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCE IN LOCAL CURRENCY																				
CASH SHORT		87	22	56	1,255	928	777	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH SURPLUS		0	0	0	0	0	0	678	679	680	681	219	188	0	0	0	0	0	0	0
BALANCE		87	109	165	1,420	2,348	3,125	2,447	1,767	1,087	407	188	0	0	0	0	0	0	0	0
INVESTMENT																				
CIVIL WORKS	F/C	436	414	209	3,037	2,875	2,131	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	87	56	122	1,343	1,280	1,438	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR	F/C	0	0	0	0	26	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	0	0	0	0	28	1	0	0	0	0	0	0	0	0	0	0	0	0	0
F/C TOTAL		436	414	209	3,037	2,901	2,133	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C TOTAL		87	56	122	1,343	1,308	1,438	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL		523	470	331	4,381	4,209	3,572	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH FLOW STATEMENT																				
CASH FLOW FOR FIRR		-523	-435	-265	-4,292	-3,829	-2,910	900	901	902	903	904	905	905	905	905	905	1,080	1,080	1,080
OPERATING PROFIT		0	30	56	75	323	563	766	767	768	769	770	771	771	771	771	771	946	946	946
DEPRECIATION		0	5	10	13	57	99	134	134	134	134	134	134	134	134	134	134	134	134	134
INVESTMENT(-)		523	470	331	4,381	4,209	3,572	0	0	0	0	0	0	0	0	0	0	0	0	0
SALVAGE VALUE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRR (ROI)		7.08%																		

APPENDIX 20-2-6(2)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE V

(UNIT: THOUSAND US$)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	TOTAL
PROFIT & LOSS STATEMENT																		
TOTAL REVENUE	93	94	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	2,793
OPERATING COST	60	61	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62	1,778
SAVINGS OF REHABILITATION COST	1,047	1,047	1,047	1,047	1,047	1,047	1,047	1,222	1,222	1,222	1,222	1,222	1,222	1,222	1,222	1,222	1,222	32,612
DEPRECIATION	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	4,213
OPERATING PROFIT	946	946	946	946	946	946	946	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	29,413
INTEREST PAYMENT	117	106	95	84	73	62	51	41	30	19	8	1	0	0	0	0	0	3,113
NET PROFIT	830	841	852	862	873	884	895	1,080	1,091	1,102	1,113	1,120	1,121	1,121	1,121	1,121	1,121	26,300
CUMULATIVE NET PROFIT	9,983	10,823	11,675	12,537	13,411	14,295	15,190	16,270	17,361	18,463	19,576	20,696	21,817	22,938	24,059	25,179	26,300	
FINANCE PROGRAM																		
FINANCE IN FOREIGN CURRENCY																		
BORROWING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,663
REPAYMENT	471	471	471	471	471	471	471	471	471	471	471	236	0	0	0	0	0	9,663
LOAN BALANCE	4,949	4,478	4,007	3,535	3,064	2,592	2,121	1,650	1,178	707	236	0	0	0	0	0	0	
INTEREST	117	106	95	84	73	62	51	41	30	19	8	1	0	0	0	0	0	3,113
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	532
FINANCE IN LOCAL CURRENCY																		
CASH SHORT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,125
CASH SURPLUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,125
BALANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
INVESTMENT																		
CIVIL WORKS F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,103
CIVIL WORKS L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,327
BRIDGE REPAIR F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
BRIDGE REPAIR L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
F/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,131
L/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,355
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,486
CASH FLOW STATEMENT																		
CASH FLOW FOR FIRR	1,080	1,081	1,081	1,081	1,081	1,081	1,081	1,255	1,255	1,255	1,255	1,255	1,255	1,255	1,255	1,255	10,500	29,385
OPERATING PROFIT	946	946	946	946	946	946	946	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	29,413
DEPRECIATION	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	134	4,213
INVESTMENT(-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13,486
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,245	9,245
FIRR (ROI)																		

APPENDIX 20-2-7(1)

THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS

SENSITIVITY ANALYSIS CASE VI

(UNIT: THOUSAND US$)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
PROFIT & LOSS STATEMENT																				
TOTAL REVENUE		0	2	4	6	26	46	64	66	68	70	72	74	75	76	77	78	79	80	81
OPERATING COST		0	1	3	4	16	28	40	41	42	43	45	46	47	48	48	49	50	51	52
SAVINGS OF REHABILITATION COST		0	30	57	76	328	570	776	776	776	776	776	776	776	776	776	776	931	931	931
DEPRECIATION		0	6	11	14	62	108	147	147	147	147	147	147	147	147	147	147	147	147	147
OPERATING PROFIT		0	25	48	64	276	480	654	655	655	656	657	658	658	658	658	658	814	814	814
INTEREST PAYMENT		0	0	0	0	0	0	242	242	242	242	234	222	210	198	186	174	163	151	139
NET PROFIT		0	25	48	64	276	480	411	412	413	414	424	436	448	460	472	484	651	663	675
CUMULATIVE NET PROFIT		0	25	73	137	413	893	1,304	1,716	2,130	2,543	2,967	3,403	3,851	4,311	4,783	5,267	5,918	6,581	7,256
FINANCE PROGRAM																				
FINANCE IN FOREIGN CURRENCY																				
BORROWING		486	473	256	3,418	3,345	2,564	0	0	0	0	0	0	0	0	0	0	0	0	0
REPAYMENT		0	0	0	0	0	0	0	0	0	0	514	514	514	514	514	514	514	514	514
LOAN BALANCE		486	959	1,215	4,632	7,977	10,541	10,541	10,541	10,541	10,541	10,027	9,513	8,999	8,484	7,970	7,456	6,942	6,428	5,913
INTEREST		0	0	0	0	0	0	242	242	242	242	234	222	210	198	186	174	163	151	139
INTEREST DURING CONSTRUCTION		11	22	27	104	179	237	0	0	0	0	0	0	0	0	0	0	0	0	0
FINANCE IN LOCAL CURRENCY																				
CASH SHORT		95	31	75	1,387	1,089	981	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH SURPLUS		0	0	0	0	0	0	558	559	560	560	56	69	80	92	104	116	283	295	307
BALANCE		95	126	200	1,587	2,676	3,657	3,099	2,541	1,981	1,421	1,365	1,296	1,216	1,124	1,019	903	620	325	17
INVESTMENT																				
CIVIL WORKS	F/C	475	451	228	3,314	3,137	2,325	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	95	61	133	1,465	1,396	1,569	0	0	0	0	0	0	0	0	0	0	0	0	0
BRIDGE REPAIR	F/C	0	0	0	0	28	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	L/C	0	0	0	0	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0
F/C TOTAL		475	451	228	3,314	3,165	2,327	0	0	0	0	0	0	0	0	0	0	0	0	0
L/C TOTAL		95	61	133	1,465	1,427	1,569	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL		571	513	362	4,779	4,592	3,896	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH FLOW STATEMENT																				
CASH FLOW FOR FIRR		-571	-482	-303	-4,700	-4,254	-3,309	800	801	802	803	804	804	805	805	805	805	960	960	960
OPERATING PROFIT		0	25	48	64	276	480	654	655	655	656	657	658	658	658	658	658	814	814	814
DEPRECIATION		0	6	11	14	62	108	147	147	147	147	147	147	147	147	147	147	147	147	147
INVESTMENT(-)		571	513	362	4,779	4,592	3,896	0	0	0	0	0	0	0	0	0	0	0	0	0
SALVAGE VALUE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIRR (ROI)		5.70%																		

APPENDIX 20-2-7(2) **THE REHABILITATION PROJECT OF THE MONGOLIAN RAILWAY FINANCIAL ANALYSIS**

SENSITIVITY ANALYSIS CASE VI (UNIT: THOUSAND US$)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	TOTAL
PROFIT & LOSS STATEMENT																		
TOTAL REVENUE	82	83	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84	2,482
OPERATING COST	53	54	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	1,581
SAVINGS OF REHABILITATION COST	931	931	931	931	931	931	931	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	1,086	28,988
DEPRECIATION	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	4,596
OPERATING PROFIT	814	814	814	814	814	814	814	969	969	969	969	969	969	969	969	969	969	25,294
INTEREST PAYMENT	127	115	103	92	80	68	56	44	33	21	9	1	0	0	0	0	0	3,396
NET PROFIT	687	699	711	722	734	746	758	925	937	949	960	968	969	969	969	969	969	21,898
CUMULATIVE NET PROFIT	7,943	8,642	9,352	10,075	10,809	11,555	12,313	13,238	14,175	15,124	16,084	17,052	18,021	18,990	19,960	20,929	21,898	
FINANCE PROGRAM																		
FINANCE IN FOREIGN CURRENCY																		
BORROWING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10,541
REPAYMENT	514	514	514	514	514	514	514	514	514	514	514	257	0	0	0	0	0	10,541
LOAN BALANCE	5,399	4,885	4,371	3,857	3,342	2,828	2,314	1,800	1,286	771	257	0	0	0	0	0	0	
INTEREST	127	115	103	92	80	68	56	44	33	21	9	1	0	0	0	0	0	3,396
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	580
FINANCE IN LOCAL CURRENCY																		
CASH SHORT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,657
CASH SURPLUS	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,657
BALANCE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
INVESTMENT																		
CIVIL WORKS F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,930
CIVIL WORKS L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,720
BRIDGE REPAIR F/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
BRIDGE REPAIR L/C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
F/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9,961
L/C TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,751
GRAND TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14,712
CASH FLOW STATEMENT																		
CASH FLOW FOR FIRR	960	961	961	961	961	961	961	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116	11,201	25,263
OPERATING PROFIT	814	814	814	814	814	814	814	969	969	969	969	969	969	969	969	969	969	25,294
DEPRECIATION	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	147	4,596
INVESTMENT(-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14,712
SALVAGE VALUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10,085	10,085
FIRR (ROI)																		

APPENDIX 20-2-8 (1)

Mongolian Railway: Repayment Schedule of Foreign Currency Loan

(UNIT: THOUSAND US$)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Project No. 1																		
Borrowing	8,844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	442	884	884	884	884	884	884	884	884	884	442	0	0
Interest	0	0	0	0	0	155	286	255	224	193	163	132	101	70	39	8	0	0
Repayment & Int.	0	0	0	0	0	597	1,171	1,140	1,109	1,078	1,047	1,016	985	954	923	450	0	0
Balance	8,844	8,844	8,844	8,844	8,844	8,401	7,517	6,633	5,748	4,864	3,980	3,095	2,211	1,327	442	0	0	0
Project No. 2																		
Borrowing	31,629	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	0	0	0	0	771	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543
Interest	0	0	0	0	316	316	316	316	316	316	305	289	274	258	243	228	212	197
Repayment & Int.	0	0	0	0	316	316	316	316	316	1,088	1,848	1,832	1,817	1,801	1,786	1,770	1,755	1,740
Balance	31,629	31,629	31,629	31,629	31,629	31,629	31,629	31,629	31,629	30,857	29,314	27,771	26,229	24,686	23,143	21,600	20,057	18,514
Project No. 3																		
Borrowing	1,562	33,562	8,552	1,590	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	0	0	0	0	0	0	2,208	2,208	2,208	2,208	2,208	2,208	2,208
Interest	0	0	0	0	1,177	1,177	1,177	1,177	1,177	1,177	1,177	1,163	1,105	1,048	990	933	876	818
Repayment & Int.	0	0	0	0	1,177	1,177	1,177	1,177	1,177	1,177	1,177	3,371	3,313	3,256	3,198	3,141	3,084	3,026
Balance	1,562	35,124	43,676	45,267	45,267	45,267	45,267	45,267	45,267	45,267	45,267	43,059	40,850	38,642	36,434	34,226	32,018	29,810
Short-Term Urgent	Project																	
Borrowing	0	0	0	0	0	405	394	213	2,848	2,787	2,137	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	429	429	429
Interest	0	0	0	0	0	0	0	0	0	0	0	202	202	202	202	195	185	175
Repayment & Int.	0	0	0	0	0	0	0	0	0	0	0	202	202	202	202	624	614	604
Balance	0	0	0	0	0	405	799	1,012	3,860	6,647	8,784	8,784	8,784	8,784	8,784	8,355	7,926	7,497
TOTAL																		
Borrowing	42,034	33,562	8,552	1,590	0	405	394	213	2,848	2,787	2,137	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	442	884	884	884	1,656	2,427	4,635	4,635	4,635	4,635	4,622	4,180	4,180
Interest	0	0	0	0	1,493	1,648	1,780	1,749	1,718	1,687	1,644	1,785	1,682	1,578	1,474	1,363	1,273	1,190
Repayment & Int.	0	0	0	0	1,493	2,090	2,664	2,633	2,602	3,342	4,071	6,421	6,317	6,213	6,109	5,985	5,453	5,370
Balance	42,034	75,596	84,148	85,739	85,739	85,702	85,211	84,540	86,504	87,635	87,345	82,709	78,074	73,439	68,803	64,181	60,001	55,821

TERMS OF LOAN:

Project No. 1: from IDA — SDR6,220,000 (US$8,844,000) — INT.: 3.5% — SDR1=US$1.42180

Project No. 2: from OECF — ¥3,321,000,000 (US$31,629,000) — INT.: 1.0% — US$1=¥105.00

Project No. 3: from OECF — ¥4,753,000,000 (US$45,267,000) — INT.: 2.6%

Short-Term Urgent Project — US$8,784,000 — INT.: 2.3%

APPENDIX 20-2-8 (2)

Mongolian Railway: Repayment Schedule of Foreign Currency Loan

(UNIT: THOUSAND US$)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Project No. 1																		
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment & Int.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Balance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project No. 2																		
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	1,543	0	0	0	0	0	0
Interest	181	166	150	135	120	104	89	73	58	42	27	12	0	0	0	0	0	0
Repayment & Int.	1,724	1,709	1,693	1,678	1,662	1,647	1,632	1,616	1,601	1,585	1,570	1,554	0	0	0	0	0	0
Balance	16,971	15,429	13,886	12,343	10,800	9,257	7,714	6,171	4,629	3,086	1,543	0	0	0	0	0	0	0
Project No. 3																		
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	1,104	0	0	0	0
Interest	761	703	646	588	531	474	416	359	301	244	187	129	72	14	0	0	0	0
Repayment & Int.	2,969	2,911	2,854	2,797	2,739	2,682	2,624	2,567	2,510	2,452	2,395	2,337	2,280	1,118	0	0	0	0
Balance	27,602	25,393	23,185	20,977	18,769	16,561	14,353	12,145	9,937	7,728	5,520	3,312	1,104	0	0	0	0	0
Short-Term Urgent Project																		
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	429	214
Interest	165	155	145	136	126	116	106	96	86	76	67	57	47	37	27	17	7	1
Repayment & Int.	594	584	574	564	554	544	534	525	515	505	495	485	475	465	456	446	436	215
Balance	7,070	6,642	6,213	5,785	5,356	4,928	4,499	4,071	3,642	3,214	2,785	2,357	1,928	1,500	1,071	643	214	0
TOTAL																		
Borrowing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment	4,179	4,179	4,179	4,179	4,179	4,179	4,179	4,179	4,179	4,179	4,179	4,179	2,637	1,533	429	429	429	214
Interest	1,107	1,024	942	859	776	694	611	528	446	363	280	197	119	51	27	17	7	1
Repayment & Int.	5,287	5,204	5,121	5,038	4,956	4,873	4,790	4,708	4,625	4,542	4,460	4,377	2,755	1,584	456	446	436	215
Balance	51,643	47,464	43,284	39,105	34,925	30,746	26,566	22,387	18,207	14,028	9,848	5,669	3,032	1,500	1,071	643	214	0

Appendix 20-2-9

Mongolian Railway : Repayment Schedule of F/C Loan