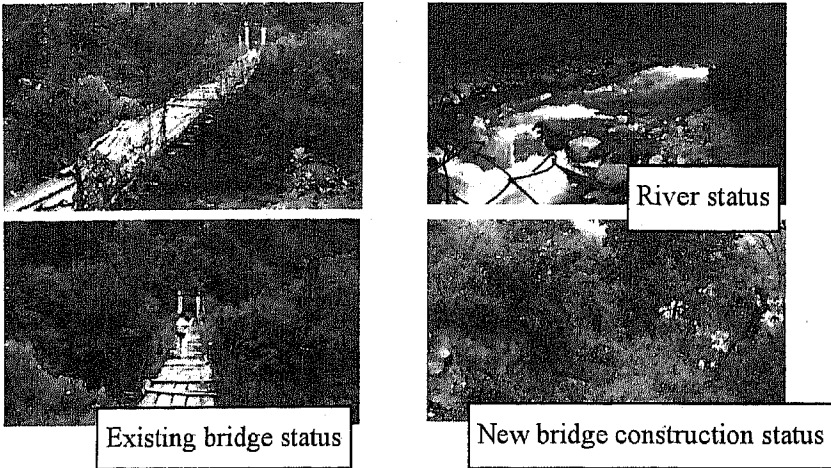
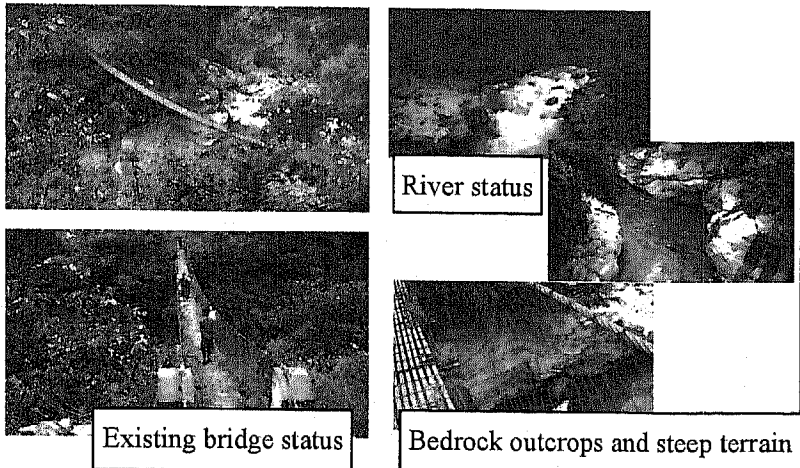
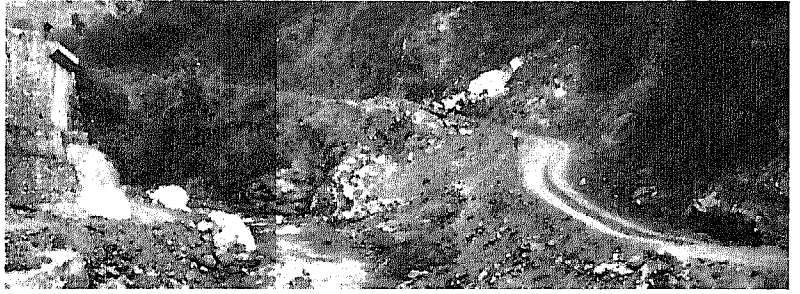
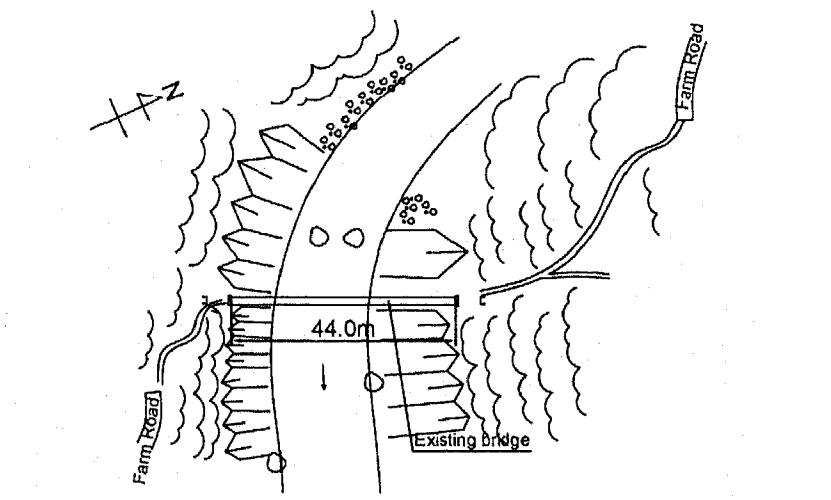
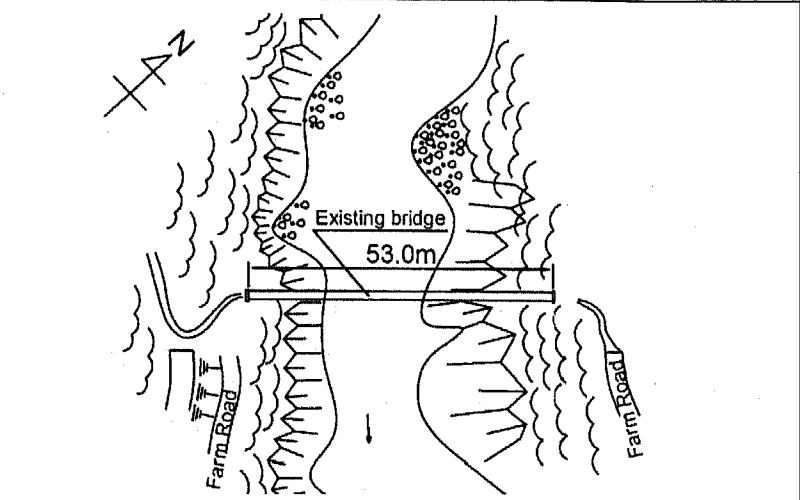
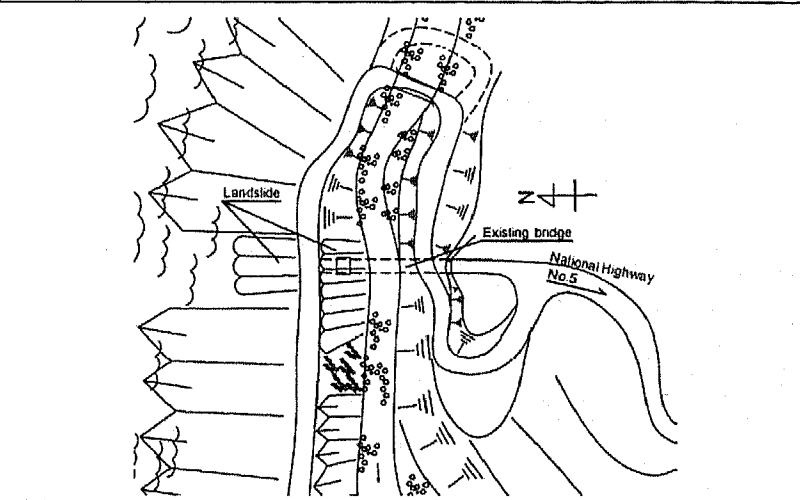


List of Field Survey Results (3/3)

	No.19 Kela Bridge	No.20 Jangbi Bridge	No.21 Chenchey Bridge
Field photograph			
Schematic plan view			
Road classification (Jurisdiction)	Farm Road (DoA)	Farm Road (DoA)	Feeder Road (DoA)
Existing bridge type	Pedestrian suspension bridge (L=44.0m)	Pedestrian suspension bridge (L=53.0m)	Bailey bridge (L=30.0m)
Topography and geology	Steep terrain with bedrock outcrops	Steep terrain with bedrock outcrops	Steep terrain with bedrock outcrops
River status	Large river discharge and high flow velocity	Large river discharge and high flow velocity	Small river discharge and low flow velocity
Use status	Passage of about one pedestrian every 15 minutes has been confirmed. On the opposite shore of the bridge, there are two settlements consisting of 57 households.	Passage of about one pedestrian every 15 minutes has been confirmed. On the opposite shore of the bridge, there are five settlements consisting of 64 households.	Passage of about one vehicle every 15 minutes has been confirmed. On the opposite shore of the bridge, there is a settlement with a population of 2,000.
Bridge status quo	There is significant damage such as deterioration of the main bridge structure and falling of the wooden slabs.	No damage is observed.	This bridge has already been washed out, and the superstructure has been removed. Landslide of the banking around the abutments and destruction of the joints of the abutment walls have been confirmed. Low construction quality influenced the damage. There is a plan in progress to reconstruct a new bridge at a location 800 m upstream.
Access road status	There are farm roads at both ends. If a bridge is constructed, vehicles will be able to cross the river.	There are farm roads at both ends. If a bridge is constructed, vehicles will be able to cross the river.	Feeder roads have been constructed. There is a plan in progress to construct an alternative road to the new bridge upstream.
Importance of route	This is one of the important farm roads covered in the 10th Five-Year Plan.	For poverty reduction of residents on the opposite shore, this route is considered relatively important. There is a plan to promote construction of a farm road on the opposite shore from December 2010 to June 2011.	There is a plan to construct a new bridge upstream including an alternative road. The route has low importance.
Possibility of damage from similar floods	Since sufficient vertical clearance is ensured, there is a low possibility of damage from similar floods.	Since sufficient vertical clearance is ensured, there is a low possibility of damage from similar floods.	Since there is a plan to construct a new bridge upstream, there is a low possibility of damage.

(2) Selection of the Bridges to be Surveyed

Among the nine bridges that were scheduled to be surveyed, No.3 Naja/Geling Haa Chhu Suspension Bridge and No.21 Chanchey Bridge were excluded for the following reasons. Thus, it was decided to carry out the survey on seven bridges.

i) No.3 Naja/Geling Haa Chhu Suspension Bridge

Construction of a new bridge has already started at a high point 75m upstream of the existing bridge.

ii) No.21 Chanchey Bridge

Preparations are underway to build a new bridge (Bailey bridge) at a point 800m upstream of the existing bridge.

(3) Selection of the Bridges to be Covered by the Project

For the above-mentioned reasons, seven bridges were selected as the scope of survey from nine bridges. The priorities of the site were determined as shown in "Table 2-2 Site Priorities" by evaluating these seven bridges in terms of urgency, benefit, importance of the road, possibility of being damaged in the event of a disaster of an equivalent scale, and workability in construction. The priority ranking is indicated below in order:

- No.9 Mandechhu (Reotala) Bridge
- No. 17 Dolkhola Bridge
- No. 18 Jigmiling Bridge
- No. 19 Kela Bridge
- No. 20 Jangbi Bridge

It was determined that the reconstruction of No. 16 Dzongkhachulum Bridge and No. 5 Tshendona Bridge was of less necessity. Thus, it was decided to select the highly-ranked 5 bridges to be covered by the project.

The details of the evaluation of each bridge are given in the following pages.

Table 2-2 Site Priorities

No	Bridge name	Urgency	Scale of beneficiaries	Importance of the route	Possibility of suffering damage caused by a similar disaster	Difficulty of construction (implementation by the Bhutanese side)	Score	Rank
9	Mangdechhu bridge	⊙	⊙	⊙	⊙	⊙	15	1st
17	Dolkhola bridge	○	⊙	⊙	⊙	⊙	14	2nd
18	Jigmiling bridge	○	⊙	⊙	⊙	⊙	14	2nd
19	Kela bridge	○	△	⊙	△	○	9	4th
20	Jangbi bridge	○	△	⊙	△	○	9	5th
16	Dzongkhachulum bridge	△	○	⊙	△	○	9	6th
5	Tshendona bridge	△	△	△	△	△	5	7th

⊙: 3 points, ○: 2 points, △: 1 point

※ Bridges with the same score are ranked in order of urgency.




※ No.19 is ranked the 4th, because it is creakier than No.20.



Bridges to be covered by the project

List of the results of the evaluation of the surveyed bridges (1/4)


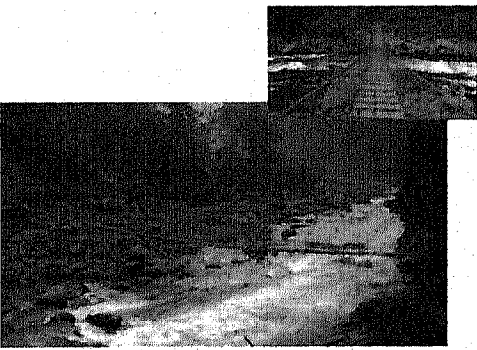
No.5 Tshendona Bridge	
Road classification	Farm Road
Jurisdiction	DoA
Existing Size	L=30m
Existing Bridge Type	Suspension Bridge
Beneficiaries	-

※ The piers are tilted because of scouring resulting from the insufficient width of the abutment footings and insufficient depth of embedding

<p>【Urgency】 As a road bridge was constructed 3.5 km downstream of the site in a Japanese ODA project, replacement of this bridge with a road bridge is not urgently required.</p>	△
<p>【Scale of beneficiaries】 As there are few scattered houses around the bridge, the number of users is limited.</p>	△
<p>【Importance of the route】 As a pedestrian bridge is sufficient to meet local demand, the need to construct a road bridge is low and the importance of the route is also low.</p>	△
<p>【Possibility of suffering damage caused by a similar disaster】 The bridge is unusable because it has collapsed.</p>	△
<p>【Difficulty of construction】 The Bhutanese side will be able to construct a pedestrian suspension or Bailey bridge at the site.</p>	△

No.9 Mangdechhu (Reotala) Bridge	
Road classification	Farm Road
Jurisdiction	DoA
Existing Size	L = 70m
Existing Bridge Type	Bailey Bridge
Beneficiaries	210HH (3,000 people)






※ The pier collapsed because of poor work on the joints.

<p>【Urgency】 Since a temporary pedestrian/road bridge was constructed on the abutments after the bridge was washed out, the bridge is likely to be washed out in the rainy season. There is no detour if the bridge is washed out. For these reasons, reconstruction of this bridge is urgently required.</p>	◎
<p>【Scale of beneficiaries】 Since the bridge is a major access route to a village of 3,000 people, the number of beneficiaries is large.</p>	◎
<p>【Importance of the route】 As the route is included in the 10th Five-Year Plan, it is a very important farm road. It is also an important route because of the scale of beneficiaries.</p>	◎
<p>【Possibility of suffering damage caused by a similar disaster】 Since the girders of the temporarily erected bridge are below the high water level recorded when Cyclone Aila hit the area, the temporary bridge is likely to suffer damage from a similar disaster.</p>	◎
<p>【Difficulty of construction】 The pier of the existing Bailey bridge collapsed because of improper work on the joints. Because of the height of the substructure, construction of the new bridge will be technically difficult. The new bridge is expected to be a Bailey suspension bridge, which the Bhutanese side will be able to construct.</p>	◎

List of the results of the evaluation of the surveyed bridges (2/4)

No.16 Dzongkhachulum Bridge	
Road classification	National Highway No.4
Jurisdiction	DoR
Existing Size	L=23m
Existing Bridge Type	Truss Bridge
Beneficiaries	3 dzongkhags





※ Damage to the main structure by fallen rocks


<p>[Urgency] Despite the damage caused by fallen rocks, vehicles can cross the bridge. The traffic is relatively light.</p>	△
<p>[Scale of beneficiaries] Although the bridge is used by the general public because it is on National Highway No. 4, the traffic is relatively light.</p>	○
<p>[Importance of the route] The importance of the bridge is high because of its location on National Highway No. 4.</p>	◎
<p>[Possibility of suffering damage caused by a similar disaster] Because it has sufficient vertical clearance, the bridge is not likely to suffer damage.</p>	△
<p>[Difficulty of construction] Construction of a new bridge is difficult because a bridge with a span length of 70 m will have to be constructed in order to avoid falling rocks. If a temporary baily bridge (a span length of 30 to 35 m) is constructed next to the existing bridge, the Bhutanese side will be able to construct it.</p>	○

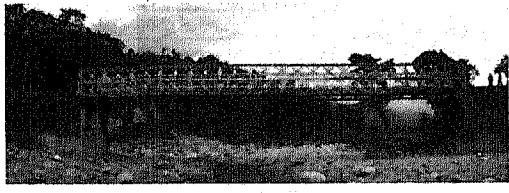
No.17 Dolkhola Bridge	
Road classification	National Highway No.5
Jurisdiction	DoR
Existing Size	L=40m
Existing Bridge Type	Bailey Bridge
Beneficiaries	5 dzongkhags

Upstream side



Downstream side





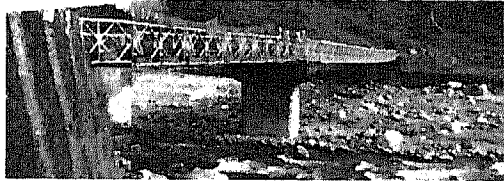


※ Reduction in the width of the river channel by the bridge

<p>[Urgency] The bridge reduces the width of the river channel and the revetment is partially eroded. In addition, since there is no detour nearby, reconstruction of this bridge has relatively high urgency.</p>	○
<p>[Scale of beneficiaries] The bridge is located on National Highway No. 5 and is used by the general public.</p>	◎
<p>[Importance of the route] The bridge is located on National Highway No. 5, which is an important route from Gelephu to Sarpang and Wangdi.</p>	◎
<p>[Possibility of suffering damage caused by a similar disaster] The bridge reduces the width of the river channel and there are traces (an area with gravel deposit) suggesting that the river was once wider upstream of the bridge. There are also the remains of a collapsed bridge of a similar scale. For these reasons, the bridge at this site is likely to suffer damage from a similar flood.</p>	◎
<p>[Difficulty of construction] The existing bridge is a Bailey bridge. Since replacement with a permanent bridge with a span length of 35 m which can be used by 40 t trucks is assumed, the construction work will technically be very difficult.</p>	◎

List of the results of the evaluation of the surveyed bridges (3/4)


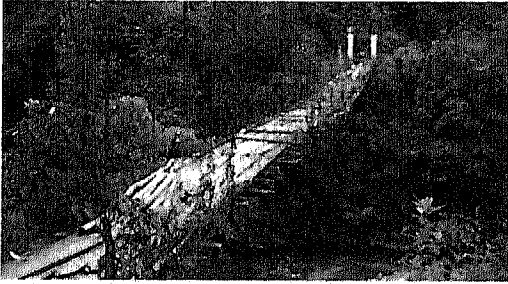
No.18 Jigmiling Bridge	
Road classification	National Highway No.5
Jurisdiction	DoR
Existing Size	L=64m
Existing Bridge Type	Bailey Bridge
Beneficiaries	5 dzongkhags

※ Erosion of the revetment ※ Short distance between the abutments and the piers

<p>[Urgency]</p> <p>The short distance between the piers and the abutments is likely to increase the flow velocity near the bridge in the event of flooding. In fact, the revetment is partially eroded. In addition, since there is no detour nearby, reconstruction of this bridge has relatively high urgency.</p>	○
<p>[Scale of beneficiaries]</p> <p>The bridge is located on National Highway No. 5 and is used by the general public.</p>	◎
<p>[Importance of the route]</p> <p>The bridge is located on National Highway No. 5, which is an important route from Gelephu to Sarpang and Wangdi.</p>	◎
<p>[Possibility of suffering damage caused by a similar disaster]</p> <p>The short distance between the piers and the abutments is likely to increase the flow velocity near the abutments in the event of flooding. The high flow velocity may damage or even wash out the bridge. (It is recommended to erect piers at appropriate locations.)</p>	◎
<p>[Difficulty of construction]</p> <p>The existing bridge is a Bailey bridge. Since replacement with a permanent bridge with a span length of 35 m which can be used by 40 t trucks is assumed, the construction work will technically be very difficult.</p>	◎



No.19 Kela Bridge	
Road classification	Farm Road
Jurisdiction	DoA
Existing Size	L=45m
Existing Bridge Type	Suspension Bridge
Beneficiaries	2 villages, 57HH

※ Farm road under construction

<p>[Urgency]</p> <p>The existing bridge which was built a long time ago is badly damaged. Since the route is included in the 10th Five-Year Plan and a farm road is being constructed on each side of the bridge, replacement with a road bridge is expected.</p>	○
<p>[Scale of beneficiaries]</p> <p>People from 57 households in two villages are expected to use the bridge.</p>	△
<p>[Importance of the route]</p> <p>As the route is included in the 10th Five-Year Plan, it is a very important farm road.</p>	◎
<p>[Possibility of suffering damage caused by a similar disaster]</p> <p>Because it has sufficient vertical clearance, the bridge is not likely to suffer damage.</p>	△
<p>[Difficulty of construction]</p> <p>Since a Bailey bridge is the assumed structure of the new bridge, it will be possible for the Bhutanese side to construct it's superstructure.</p> <p>As the bridge will be constructed on steep slopes, the substructure work will be somewhat difficult.</p>	○

List of the results of the evaluation of the surveyed bridges (4/4)

No.20 Jangbi Bridge	
Road Classification	Farm Road
Jurisdiction	DoA
Existing Size	L= 53m
Existing Bridge Type	Suspension Bridge
Beneficiaries	5 villages, 64HH
 	
* Farm road under construction	
[Urgency] Since access by vehicles is required for poverty reduction and a farm road is being constructed on each side of the bridge, construction of a new road bridge is expected.	○
[Scale of beneficiaries] The bridge will be used by people from 64 households in five villages	△
[Importance of the route] As a farm road is being constructed on each side of the bridge, it is considered to be a relatively important route in Bhutan.	◎
[Possibility of suffering damage caused by a similar disaster] Because it has sufficient vertical clearance, the bridge is not likely to suffer damage.	△
[Difficulty of construction] Since a Bailey bridge is the assumed structure of the new bridge, it will be possible for the Bhutanese side to construct it's superstructure. As the bridge will be constructed on steep slopes, the substructure work will be somewhat difficult.	○