SUPPORTING REPORT I (MASTER PLAN)

PAPER XII

Road and Bridge Engineering

THE STUDY ON FLOOD AND DEBRIS FLOW IN THE CASPIAN COASTAL AREA FOCUSING ON THE FLOOD-HIT REGION IN GOLESTAN PROVINCE

SUPPORTING REPORT I (MASTER PLAN)

PAPER XII ROAD AND BRIDGE ENGINEERING

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CHAPTER 1 BACKGROUND OF ROAD PROJECT IN GOLESTAN PROVINCE AND THE STUDY AREA

1.1 Current Status of Road Network in Golestan Province

Since the 1990s, the traffic density in this province increased year by year as well as the evolution of motorization. Before 1998 Golestan Province had a poor road network with 2-lane way and the traffic density much exceeded the capacity of this road network.

Therefore, widening the roads and bridges to extend the highway network such as Sari-Gorgan Highway and Gorgan-Ali Abad Highway on 1998 started for National Road Improvement Program.

Figure 1.1 shows current status of the road network. In this Figure, all highlighted highway was constructed in recent 5 years.

Figure 1.1 Current Status of Road Network in Golestan Province (2004)

Table 1.1 Road Classification

Class	No. of lane	Width
Highway	4 lanes	21.6m – 25.6m
Main Road	2 lanes	about 11m
Sub-main Road	2 lanes	7 – 8 m
Boundary Road	2 lanes	6.5 m

1.2 On-going Road Project in Golestan Province

Following the above-mentioned completed highway project (widening), Natinal Road Improvement Project is continuously conducted on the sections between Gorgan and Ali Abad, etc. as shown in Figure 1.2.

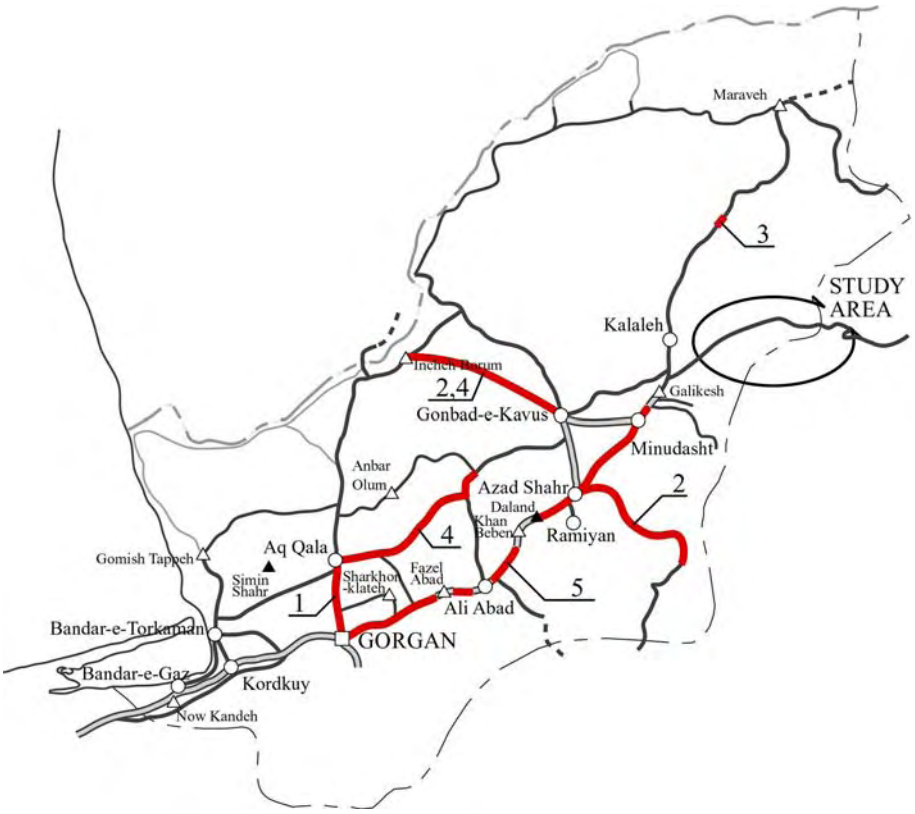

Figure 1.2 On-going Road Projects in Golestan Province (2004 – 2005)

(1) Road Improvement Project (Gorgan - Aq Qala)

(2) Road Improvement Project (Azad Shahr – Khosh Yeylagh, Inche Borun – Gonbad)

(3) Goggeh Bridge Reconstruction Project

(4) Intersection Improvement (Aq Qala – Imer, Inche Borun - Gonbad)

(5) Highway Network Project (Gorgan – Aliabad – Azad Shahr – Minudasht - Galikesh)

The Highway Network Project (Gorgan – Aliabad – Azad Shahr – Minudasht - Galikesh) has been almost completed on March 2005.

1.3 Extension of Highway Network

In addition to the above-mentioned process, MORT formulated the Master Plan to widen the existed main road in Madarsoo river basin (Galikesh – Kallaleh Junction – Tangrah – Golestan Park – Golestan Tunnel).

This was an extension of the Highway Network Project. The final target was to connect Gorgan, Golestan Provincial Capital City, and Mashad, Khorasan Provincial Capital City with 4-lane road for regional development and traffic demands.

However, the existed road was much damaged by the 2001 flood, occured on August 10th(Friday) to 11th(Saturday), 2001/Mordad 19(Jomeh) to 20(Shanbeh), 1380, and the 2002 flood, occured on August 12th(Monday), 2002/Mordad 21(2 shanbeh), 1381.

After the floods MORT constructed temporary road in Golestan Park, while MORT, DOE, MPO and the relevant ministries discussed on reconstruction plan of road in Golestan Park. Then through the discussion an agreement was made till January 2005. The agreement includes the following point;

1) Road reconstruction in Golestan Park must be completed within a couple of years to reduce any losses in connection with traffic safety and traffic limitation and also the environmental damages which are given by reconstruction activities must be minimized.
2) Highway between Golestan Province and North-Khorasan Province must be constructed in the north side of Golestan Park, to pass Kalaleh, Golidagh and Ashkhane, not inside of Golestan Park. MORT shall conduct the feasibility study on the mentioned highway project and implement this construction by widening the existing road after completion of the study.
3) Road inside of Golestan Park shall be reconstructed as a park road for natural habitats, tourists, campers and regional capacities.
4) Hydrological and Hydraulic study for flood control and the feasibility study on river control project in Madarsoo river (Dough river) must be completed at same time of road reconstruction.

The highway passing Kalaleh, Golidagh and Ashkhane, mentioned in the agreemnet, is shown as Plan-3 in Figure 1.3. This route is mostly located on the existing rural road (width=about 8m).

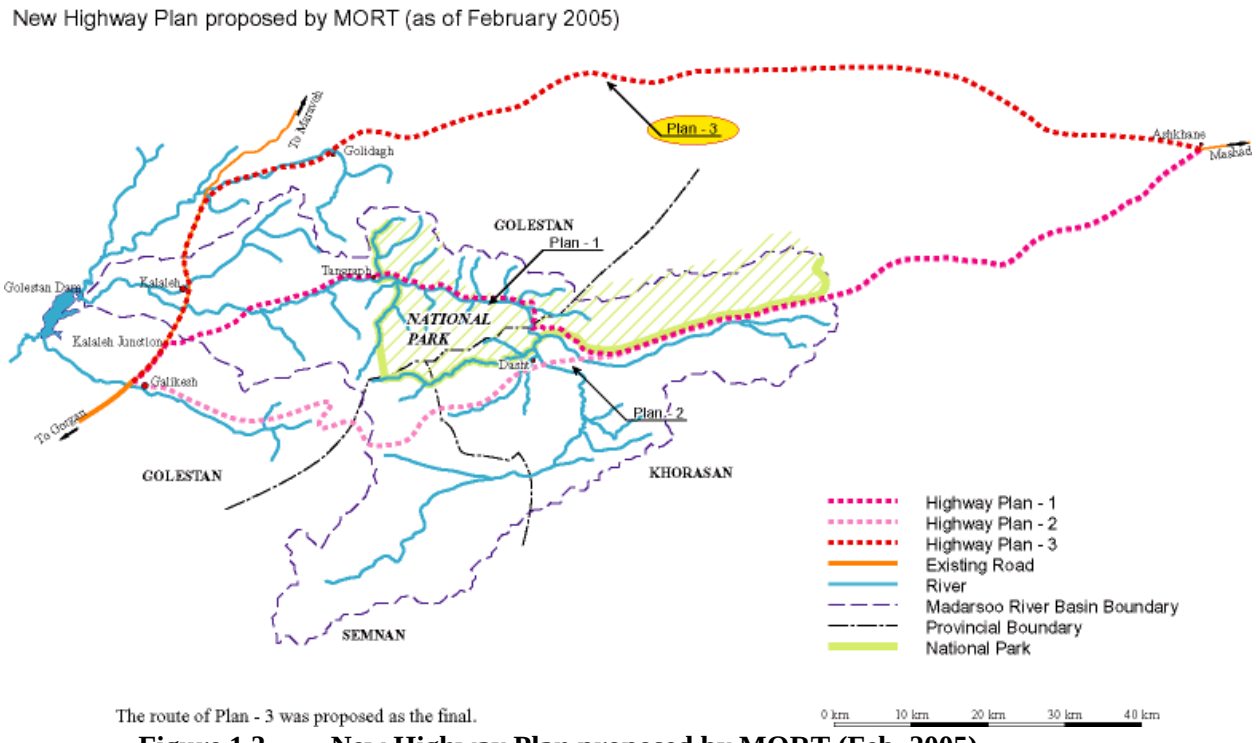

Figure 1.3 New Highway Plan proposed by MORT (Feb. 2005)

1.4 Other Issues on Road and Bridge Management in Golestan Province

MORT provincial units stresses that not only the road in Madarsoo river basin needs urgent improvement project. He is reporting many critical points, which need urgent improvement projects, as shown in Table 1.2.

As the result of consideration on the current flood condition, the numerous constructed bridges should be replaced with the longer spanned bridges, and the road embankments along rivers should be reinforced.

He pointed that one of reasons is speed and volume of the natural water stream increased by the development and the forest-degradation on the northern slope of the Elborz Mountains.

Table 1.2 (1/2) Critical Points in accordance with flood condition

Location	Road Name	Stations	Counter-measure	River Length	Revetment	Cost Estimation (M. Rials)
Bandargaz	Gorgan-Nokandeh	32.00km Sarkalateh	River Improvement	150m		60
Kordkoy	Gorgan-Nokandeh	12km	River Improvement	60m		25
Bandargaz	Shastkolah-Nokandeh	47.9km	River Improvement	300m	270m	1,470
Bandargaz	Shastkolah-Nokandeh	43.7km	River Improvement	300m		120
Bandargaz	Shastkolah-Nokandeh	41.7km	River Improvement	70m		30
Bandargaz	Shastkolah-Nokandeh	39.1km	River Improvement	180m		90
Kordkoy	Shastkolah-Nokandeh	13.1km Miandareh	River Improvement	30m	35m	295
Kordkoy	Shastkolah-Nokandeh	8.95km Roshanabad	River Improvement	80m		35
Gorgan	Gorgan-Azadshahr	18km	River Improvement		20m	100
Gorgan	Gorgan-Azadshahr	18km	River Improvement		360m	126
AqQala	Ring Road of Aqqla	3.5km	River Improvement		50m	250
Gorgan	Mohamad abad - Sorkhan kalateh	14.8km	River Improvement	270m		120
Minudasht	Minudasht-Tangrah	30km Aq Qomishan bridge	River Improvement	100m		30
Kallaleh	Kallaleh-Maravehtape	29km Fazelabad bridge	River Improvement	100m	100m	530
Aliabad	Gorgan-fazelabad	30km Fazelabad bridge		1000-100m		430
Aliabad	Gorgan-fazelabad	43km Zaringol bridge		1500-100m		600
Ramian	Gorgan-Azadshahr	69km Ghareh Ghach bridge		100-1000m	200m	1,430
Ramian	Gorgan-Azadshahr	56km syah joob bridge		100-1500m		550

Table 1.2 (2/2) Critical Points in accordance with flood condition

Location	Road Name	Stations	Counter-measure	River Length	Revetment	Cost Estimation (M. Rials)
Azad shahr	Azad shahr-Khosh yellagh	16.5km	River Improvement	200m	85m	465
Azad shahr	Azad shahr-Khosh yellagh	14.5km	River Improvement	250m	110m	600
Azad shahr	Azad shahr-Khosh yellagh	21.1km	River Improvement	200m	100m	560
Azad shahr	Azad shahr-Khosh yellagh	21.5km	River Improvement	250m	80m	480
Azad shahr	Azad shahr-Khosh yellagh	21.9km	River Improvement	300m	100m	590
Azad shahr	Azad shahr-Khosh yellagh	23km	River Improvement	350m	170m	950
Azad shahr	Azad shahr-Khosh yellagh	23.6km	River Improvement	250m	80m	480
Azad shahr	Azad shahr-Khosh yellagh		River Improvement			
Azad shahr	Azad shahr-Khosh yellagh	28km	River Improvement	150m	60m	345
Azad shahr	Azad shahr-Khosh yellagh	28.5km	River Improvement	200m	60m	360
Azad shahr	Azad shahr-Khosh yellagh	29km	River Improvement	350m	170m	950
Azad shahr	Azad shahr-Khosh yellagh	31km	River Improvement	250m	80m	480
Azad shahr	Azad shahr-Khosh yellagh	32km	River Improvement	250m	120m	680
Azad shahr	Azad shahr-Khosh yellagh	57.5km	River Improvement	200m	500m	2,580
Kallaleh	Kallaleh-Maravehtapeh	41.1km	River Improvement	240m		100
Kallaleh	Kallaleh-Maravehtapeh		River Improvement			120
Kallaleh	Kallaleh-Maravehtapeh	44km	River Improvement	245m		100
Kallaleh	Kallaleh-Maravehtapeh	44.3km	River Improvement	350m	200m	800
Kallaleh	Kallaleh-Maravehtapeh	44.5km	River Improvement	200m	100m	400
Kallaleh	Kallaleh-Maravehtapeh	44.7km	River Improvement	100m	60m	240
Kallaleh	Kallaleh-Maravehtapeh	45.8km	River Improvement	150m	60m	240
Kallaleh	Kallaleh-Maravehtapeh	48km	River Improvement	100m	35m	140
Kallaleh	Kallaleh-Maravehtapeh		River Improvement	500m	50m	400
Kallaleh	Kallaleh-Maravehtapeh	50km	River Improvement	600m		240
Ramyan	Gorgan-Azadshahr	65km Ghareh Ghach bridge	Bridge Improvement	45m		20
Gorgan	Gorgan-Azadshahr	18km Taghiabad bridge	River Improvement		20m	100
Kallaleh	Kallaleh Junction - Kallaleh	Kooseh bridge	River Improvement		40m	200
TOTAL						20,761

CHAPTER 2 CURRENT CONDITION OF ROAD AND BRIDGE IN THE STUDY AREA

2.1 Accomplished MORT Urgent Projects

MORT Golestan provincial unit conducted and completed the construction of a temporary road in the Golestan Park and road reconstruction in 2002 and 2003 as the Urgent Project in order to restore the connection between cities and rural communities in the northern part of Golestan Province and Khorasan Province.

The connection, or the road between Kalaleh Junction and Golestan Tunnel, which was constructed in the 1960s passing the Madarsoo River Basin with about 75 km length, was destroyed by the huge flood occurrence in 2001 and 2002.

At the time of the 2001 flood, MORT Golestan Provincial Unit had immediately conducted the construction of emergency temporary road with cooperation of the other MORT provincial units; Tehran, Mazandaran, Gilan, Esfahan, Kordestan, Kermanshah, Birjand, Zanjan, Hamedan and so on.

Then MORT Golestan provincial unit conducted the construction of temporary road after the 2002-flood as the above-mentioned.

Urgent Projects accomplished after the 2002-flood, are listed below;

(1) Goggeh Bridge Reconstruction (16m spanned bridge / Kalaleh - Maraveh)

(2) Kouseh Bridge Reconstruction (4 x 20m spanned bridge / Entrance of Kalaleh)

(3) Revetment Work in Tergenly village (250m length / Kalaleh Junction - Tangrah)

(4) Road Reconstruction

(4)-a Approach road of 14 metry bridge

(4)-b Road in front of Tergenly village

(4)-c Road inside the Golestan National Forest Park

(5) Construction of Submerged Bridges (18 bridges in and out of Madarsoo River Basin)

(6) River treatment and Excavation Work (200,000m^3 / Madarsoo River)

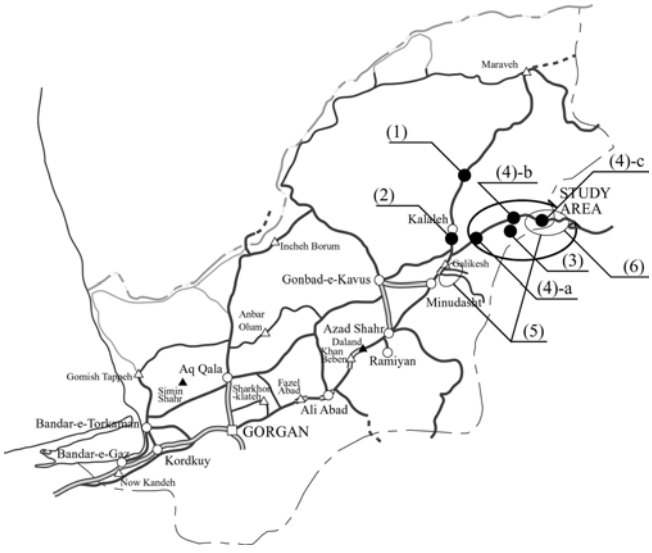

Figure 2.1 Location of MORT Urgent Projects

Table 2.1, 2.2 shows costs spent for the urgent projects in 2001 and 2002.

Table 2.1 Costs for Urgent Projects of MORT in 2001

Location	Length	Estimated Cost		Description
		Billion Rials	Million Dollars	
(1) Kalaleh Junction – Tangrah*	39 km	15	1.7	About 20 % of this road was damaged and collapsed
(2) Tangrah – Golestan Tunnel*	15 km	75	8.5	About 75 % of this road and all bridges are washed away
(3) Goggeh Bridge	64 m	3	0.4	This bridge was washed away
(4) Kouseh Bridge	80 m	5	0.6	Approach road of this bridge was collapsed and washed away
(5) Azad Shahr – Khosh Yellagh	24 km	12	1.4	About 15 % of this road was damaged and collapsed
TOTAL		110	12.6	

*: Urgent project in the study area
Estimated by MORT (1$ = 8,800 Rials)

Table 2.2 Costs for Urgent Projects of MORT in 2002

Location	Estimated Cost		Description
	Billion Rials	Million Dollars	
(1) Tangrah – Golestan Tunnel*	25	2.8	800,000m3 of earthwork and submerged bridges
(2) Tangrah – Golestan Tunnel*	8	0.9	15 km of asphalt pavement
(3) Tangrah – Golestan Tunnel*	10	1.1	River treatment and excavation of riverbed with 25 km length
(4) Kalaleh Junction – Golestan Tunnel*	2	0.2	Maintenance of road surface
(5) Kalaleh Junction – Tangraph*	30	3.4	Construction management
(6) Kalaleh Junction – Golestan Forest*	3	0.3	Ancillary work
(7) Minudasht – Tangraph*	1	0.1	Temporary road for construction
(8) Minudashit – Tangraph* Kalaleh – Maraveh Tapeh Marave Tapeh – Dashlibroon	5	0.6	Reconstruction of roads, bridges and revetment
(9) Maraveh Tapeh - Dashlibroon	1	0.1	Treatment of roads, bridges and revetment (37 km)
TOTAL	85	9.5	

*: Urgent project in the study area
Estimated by MORT (1$ = 8,800 Rials)

2.2 Current status of road and bridges between Golestan Dam and Tangraph

There are 7 bridges crossing Madarsoo river in the section between Golestan Dam and Tangraph as shown in Table 2.3 and Figures 2.2 to 2.8.

Table 2.2 Existing Bridges between Golestan Dam and Tangraph

No.	Name	Width (m)	Length (m)	Span (m)	Use	Description
1	**Kalaleh Bridge**	9 (18)	84	20	**Main road**	This bridge was existed with shorter length before the 2001 flood, but it was washed away. Then it was reconstructed in 2003 and 2004, as shown in Photo 2.1. However this bridge doesn't have enough flow capacity. MORT is planning to widen this bridge with 4-lane road.
2	**Unknown**	5	45	11	Agricultural road	This has a structural style like a submerged bridge.
3	**14-Metry Bridge**	9	14	12.5	**Main road**	Approach embankment was damaged at the time of 2001 flood, because this bridge has a poor flow capacity. This should be improved as soon as possible with enough flow capacity.
4	**unknown**	8	30	30	Agricultural road	This bridge functioned as submerged bridge like.
5	**Loveh**	8	28 + About 20 m	28	Agricultural road / entrance of village	Existed bridge was washed away in the 2001 flood and it was reconstructed as shown in Photo 2.3 with 28m long steel bridge and about 20m long spillway.
6	**unknown**	5	16	8	Agricultural road / entrance of village	This has a structural style like a submerged bridge.
7	**unknown**	8	10	10	Agricultural road	This has a structural style like a submerged bridge.

( ) is future plan

In these seven bridges, Kalaleh bridge, 14-Metry bridge and Loveh bridge were big damaged by the 2001 flood, such as collapse and washed away. Although other bridges also were affected, damages were still small and they are survived.

The difference between the first-mentioned three bridges and other bridges is that the three bridges were big barriers against strong flood flow but other bridges were not big barriers. The other bridges had structural styles such as submerged bridge.

Figure 2.2 Satellite Image of Existing Bridge No.1 (Kalaleh Bridge)

Figure 2.3 Satellite Image of Existing Bridge No.2

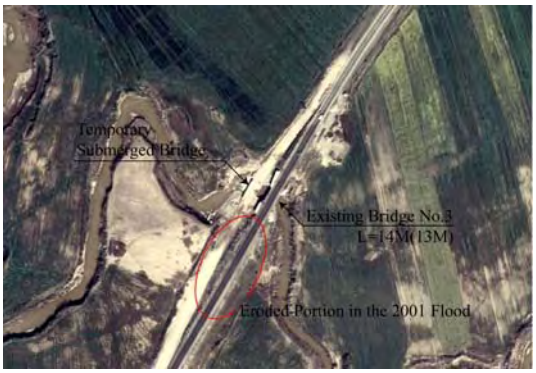

Figure 2.4 Satellite Image of Existing Bridge No.3 (14 Metry Bridge)

Figure 2.5 Satellite Image of Existing Bridge No.4

Figure 2.6 Satellite Image of Existing Bridge No.5

Figure 2.7 Satellite Image of Existing Bridge No.6

Figure 2.8 Satellite Image of Existing Bridge No.7

Kalaleh bridge was reconstructed in 2003 as shown in Photo 3.1. But its flow capacity might be about 1,400 – 1,800 m^3/sec. According to hydraulic model simulation, about 2,200 m^3/sec of discharge is estimated as of the 2001 flood. This bridge doesn't have enough flow capacity yet for it.

Furthermore, river meanders at sharp angle near this bridge as shown in Figure 2.2 and embankment, around bridge, is not protected. Therefore, this bridge will be affected again if large flood such as the 2001 flood occurs.

This road belongs to class "main road" and is one of the most important lifelines in this region, the bridge should be reconstructed with enough flow capacity accordingly. And also river should be improved with smooth line and embankment protection.

Photo 3.1 Reconstructed Kalaleh Bridge (L=84M) (No.1)

Photo 2.2 14 Metry Bridge (Existing Bridge No.3)

Photo 2.2 shows the existing 14 metry bridge. This was not lost at the time of flood. But approach road liked with this bridge was eroded and washed away. Generally the structural weakest point is damaged when the flood hits road and bridges.

At the time of 2001 flood also, the weakest point, approach bank, was damaged. If this bridge had enough flow capacity, approach bank would be saved.

Figure 3.8 shows rough sketch of 14 metry bridge and that the opening area of the bridge has about 60 m^2.

If flow velocity is 4 m/sec, the flow capacity of the bridge is only 240 m^3/sec.

At the time of the 2001 flood, it is reported that the maximum water discharge was about 2,200 m^3/sec in this section of Madarsoo river.

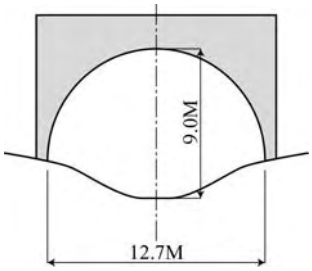

Figure 2.9 Flow Area of 14 Metry Bridge

Because the bridge did not have an enough flow capacity, the water elevation increased more than the road elevations, then road (or bridge) were flooded over by the strong current in the 2001 flood as shown in Figure 2.10

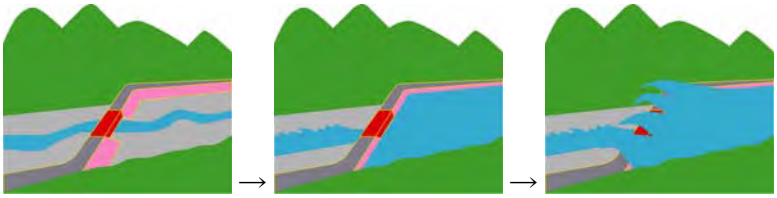

Figure 2.10 A Mechanism of Road Destruction by the Flood

Photo 2.3 Reconstructed Loveh Bridge (No. 5)

Photo 2.3 shows Loveh Bridge which was reconstructed in 2003 because the existed bridge was washed away at the time of 2001 flood. Any documents on the existed bridge were not found, perhaps shorter concrete bridge was located.

Although Loveh bridge was reconstructed with steel girder bridge, its length is only 28m. Of course flow capacity of the bridge is entirely not enough.

That is why about 20m width of spillway was constructed beside of the bridge.

It's understandable that such strange bridge was constructed because of financial short for construction cost. But it is not able to understand why such design decision was given.

If enough budget was not appropriated, it was much better that the submerged bridge was constructed completely. Because, although the construction cost was spent much more than cost of submerged bridge, the reconstructed bridge has only the efficacy as much as the submerged bridge.

Furthermore, as shown in Figure 2.6, satellite image, river meanders intensely. Unprotected embankment will be easily affected by flood and strong stream again in such condition. Previously river and embankment should have been improved before bridge reconstruction.

Photo 2.4 Existing Bridge No. 6

Photo 2.5 Existing Bridge No.7

Photo 2.4 and 2.5 show existing bridges that were affected by the floods but still survived. These bridges are small and functioned like submerged bridges at the time of floods. They didn't fight against the strong current of the flood and didn't impede the stream. That is why they were survived.

However, they were not complete submerged bridges, so some damages were given. And also they should be replaced with complete submerged bridges at the same time of river improvement project. Where, the complete submerged bridge means entirely not to resist river stream as shown in Figure 2.11. Safety fence and anything should not be attached on the top of submerged bridges.

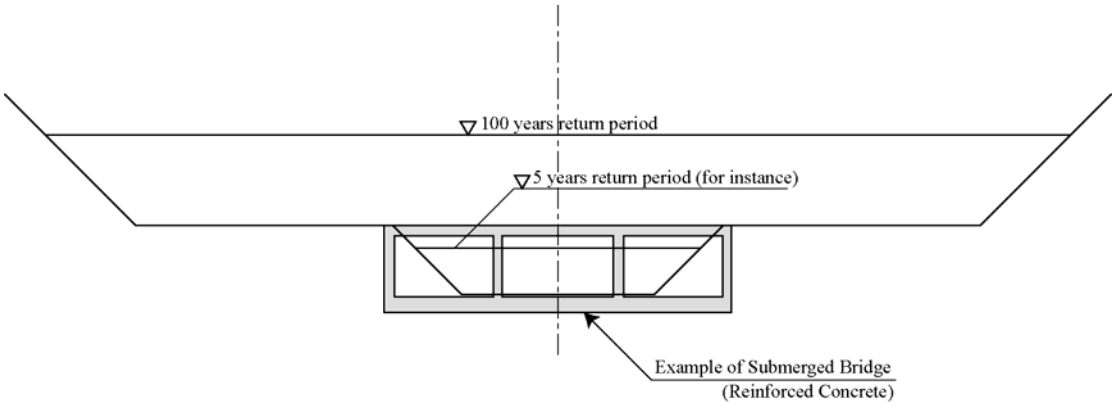

Figure 2.11 Example of Submerged Bridge

In addition to bridge damages, three types of road damage by the flood were confirmed obviously between Golestan Dam and Tangraph, as follows:

(1) Embankment erosion

(2) Road closing by sediment and debris carried from tributaries

(3) Road Flooding

2.3 Current status of road and bridges between Tangraph and Dasht

After the 2001 flood, MORT provincial unit tried to construct bridges in the area of Golestan Park. However those works were unfortunately affected and damaged by the 2002 flood. The construction site offices, equipment and workers also were washed away at same time.

For the time being, only temporary road was constructed with submerged bridges (pipe culvert type). The temporary road and submerged bridges will be used until that Park Road Project will be accomplished in this area.

The differences of elevation between top of temporary road and riverbed are 2m - 4m. It can not be used under rainy weather condition. And also its structure is so easy that it might be washed away at the time of flood.

From the above-mentioned situation, at present, traffic officers are checking and controlling the traffic at the entrances of the temporary road, Tangrah (west side) and Chesmekan (east side) and patrolling during 24 hours. The speed in the temporary road is limited under 40 km/hr. Moreover MORT provincial unit also always conduct monitoring on the road with cooperation of traffic officers to take prompt countermeasures at the time of food, if occurs.

Table 2.3 shows information found through investigation on the submerged bridges (pipe culvert type). The diameter of concrete pipe culvert used in submerged bridge is 1.0m. 8 or 10 pipes are arranged for each submerged bridges. The flow capacities of bridges are estimated about 20 – 25 m^3/sec as shown in this table.

Table 2.3 Submerged Bridges between Tangraph and Dasht

No.	Width (m)	Length (m)	Num. of pipe	Dia. of pipe (m)	Flow Capacity (m3/sec)
1	10	16	10	1.0	25
2	10	20	10	1.0	25
3	10	21	8	1.0	20
4	10	23	8	1.0	20
5	10	25	10	1.0	25
6	10	25	8	1.0	20
7	10	30	8	1.0	20
8	10	23	8	1.0	20

Photos 2.1 to 2.8 shows submerged bridges (No.1 to No.8).

Photo 2.9 shows a survived bridge. But approach road around submerged bridge were washed away. That is why the bridge was survived.

Photo 2.1 Submerged Bridge No. 1

Photo 2.2 Submerged Bridge No. 2

Photo 2.3 Submerged Bridge No. 3

Photo 2.4 Submerged Bridge No. 4

Photo 2.5 Submerged Bridge No. 5

Photo 2.6 Submerged Bridge No. 6

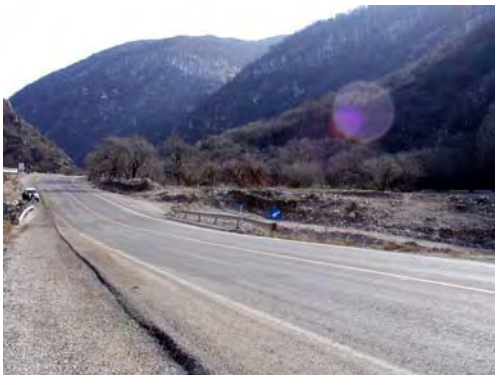

Photo 2.7 Submerged Bridge No. 7

Photo 2.8 Submerged Bridge No. 8

Photo 2.9 Survived Bridge

2.4 On-going Road Construction in Golestan Park

MORT had already ordered the road reconstruction work from construction company in order to follow the agreement made with DOE. In the agreement, the work must be completed within a couple of years. Then the work is carried out partially limited on retaining walls as shown in Photo 2.10 to 2.13. Their work is conducted with old manners and low quality control.

Moreover the relation between their working plan and hydraulic analysis is not cleared. It seems to carry out construction work without hydraulic analysis. They are conducting under MORT with the Consultant, Pasilou Consultant, located in Tehran, Road Engineering Services' Consultant, in spite of that the retaining wall work should be done as a hydraulic structure.

Photo 2.10 Completed Retaining Wall Work upstream of Golestan Tunnel (1)

Photo 2.11 Completed Retaining Wall Work upstream of Golestan Tunnel (2)

Photo 2.12 On-going Retaining Wall Work downstream of Golestan Tunnel (1) (Concrete Wall)

(Taken on June 20, 2005)

Photo 2.13 On-going Retaining Wall Work downstream of Golestan Tunnel (2) (Limestone Masonry)

(Taken on June 20, 2005)

On other hand, road planning and designing, conducted by a consultant company, are not finalized yet and they are still under evaluation of MORT as of June 2005. This condition, that plan is not completed but work is on going, shall not be appreciated. Primarily the construction activities shall be started after completion of planning and designing.

Although latest plan made by the Consultant can be watched in MORT office, its documents and drawings were not provided us, the JICA study team, from the reason that those are still under evaluation. The JICA study team requested to provide design data and drawing through MOJA, but it was not granted.

In annex 5 and 6, the road alignments and composite satellite images are shown. The JICA study team through watching in MORT provincial offices makes those drawings. Therefore, it's not cleared whether the documents and drawings are really latest plan.

In any case, if we have to evaluate on their plan, we have to mention that almost of road plan is not suited to the design condition in Golestan Park and the planning should be made over again with the result of hydrological and hydraulic analysis.

CHAPTER 3 RECOMMENDATIONS ON ROAD AND BRIDGES FOR MASTERPLAN

As mentioned in Chapter 2, mainly there were four types of road damages by the floods between Golestan Dam and Tangraph and those should be solved with suitable countermeasures as follows;

(1) Bridge damages → Bridge Improvement Project

(2) Road embankment erosion → This should be solved by river improvement project

(3) Road closing by sediment carried from tributaries → Outfall improvement Project

(4) Flooding → Road Improvement Project (Rising)

3.1. Bridge Improvement Project

As result of consideration on the importance and/or priority of bridge improvement, we would like to propose to include Kalaleh Bridge and 14 Metry Bridge Improvement Project in the master plan.

The submerged type is suitable for other bridges as mentioned in Chapter 2, then submerged bridges should be constructed with river improvement project. Improvement on other bridges are not proposed as road projects accordingly.

Table 3.1 Importance of Bridges between Golestan Dam and Tangraph

No.	Name	Importance	Priority	Proposed Plan
1	**Kalaleh Bridge**	High	High	3-spanned 102 m long PC Girder Bridge
2	**unknown**	Low	Low	Submerged bridge should be constructed as a part of river improvement project
3	**14-Metry Bridge**	High	High	3-spanned 102 m long PC Girder Bridge
4	**unknown**	Low	Low	Submerged bridge should be constructed as a part of river improvement project
5	**Loveh**	Middle	Middle	Submerged bridge should be constructed as a part of river improvement project
6	**unknown**	Low	Low	Submerged bridge should be constructed as a part of river improvement project
7	**unknown**	Low	Low	Submerged bridge should be constructed as a part of river improvement project

3.2 Kalaleh bridge and 14 Metry Bridge Improvement

Drafts of the Kalaleh Bridge and 14 Metrry Bridge improvements are shown in Figures 3.1 to 3.5. Those are temporary planned on condition as follows;

(1) Flood discharge is about 2,200 m^3/sec and velocity is 3 m/sec

(2) River improvement also is carried out especially on retaining wall

If river improvement is not carried out, the length of bridge should be longer than draft length.

Each costs for bridge improvement is shown in Annex 7 for references.

Figure 3.1 Satellite Image with Kalaleh Bridge Improvement and River improvement (1/2) (DRAFT)

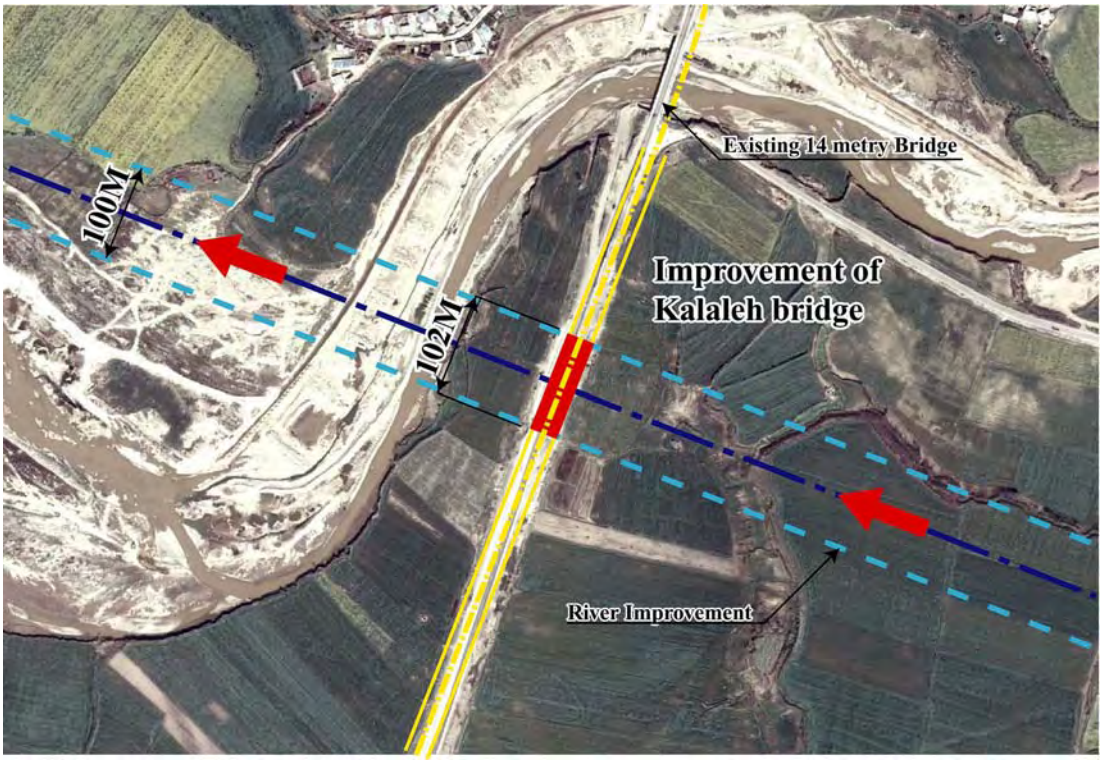

Figure 3.2 Satellite Image with Kalaleh Bridge Improvement and River improvement (2/2) (DRAFT)

Figure 3.3 Satellite Image with 14 Metry Bridge Improvement and River improvement (1/2) (DRAFT)

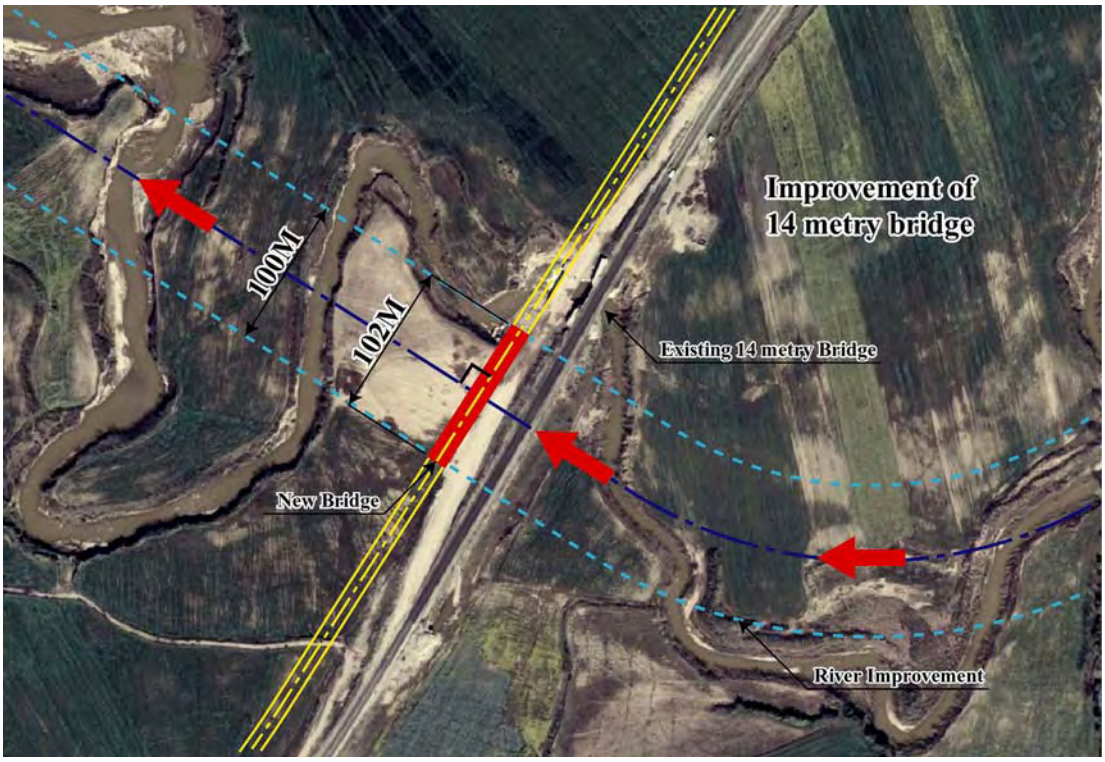

Figure 3.4 Satellite Image with 14 Metry Bridge Improvement and River improvement (2/2) (DRAFT)

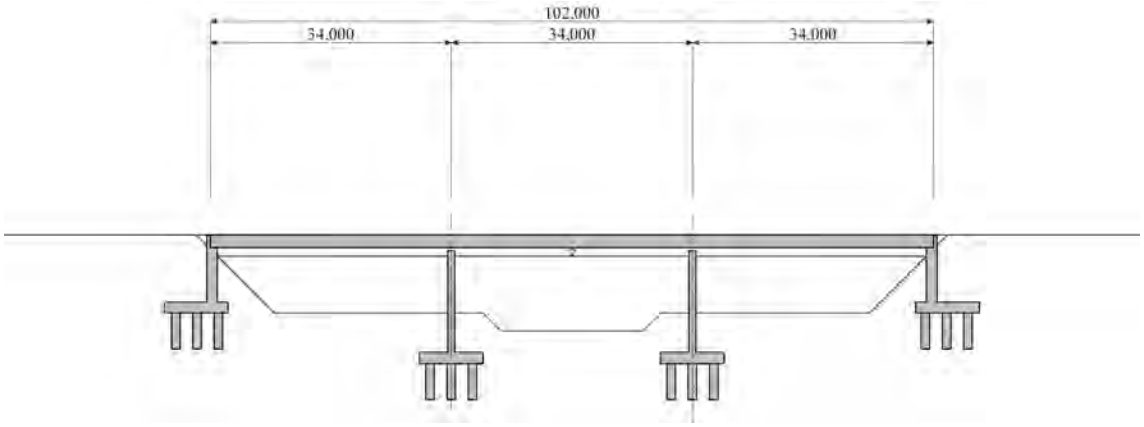

Figure 3.5 Improvement Profiles of Kalaleh and 14 Metry Bridge

3.3 Improvement of Tributary's Outfall

And also sediment and water carried out from tributaries covered road and closed the traffic at the time of floods. It is one of big causes that some tributaries doesn't have any enough outfall and road was a barrier for the streams.

Therefore, some outfalls needs to be constructed with bridges or culvert boxes as shown in Figures 3.6 and 3.7.

Figure 3.6 Improvement Plan on Outfalls (1) of Tributaries (DRAFT)

Figure 3.7 Improvement Plan on Outfalls (2) of Tributaries (DRAFT)

3.4 Road Rising

The main road should not be flooded for evacuations at the time of disaster. To avoid road flooding, the existing road shall be raised. The height of rising should be determined by flood model simulation.

In Annex 7, cost for road riding is indicated for references.

Figure 3.8 Locations of Improvement Plan (Draft) between 14Metry Bridge and Tangraph

ANNEX 1 ORGANIZATIONAL DATA ON MORT (MINISTRY OF ROADS AND TRANSPORTATION)

Ministry of Roads and Transportation (MORT) unifies 5 affiliated organizations as shown in Figure A1-1. All these organizations related to transportation systems. These organizations have responsibility to arrange systems for traveling and transportation of passengers and goods in domestic and international.

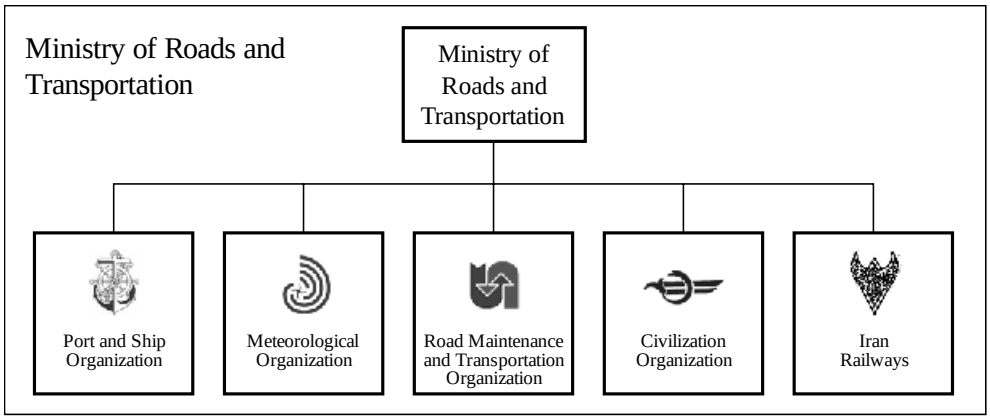

Figure A1-1 Organizational Chart of MORT

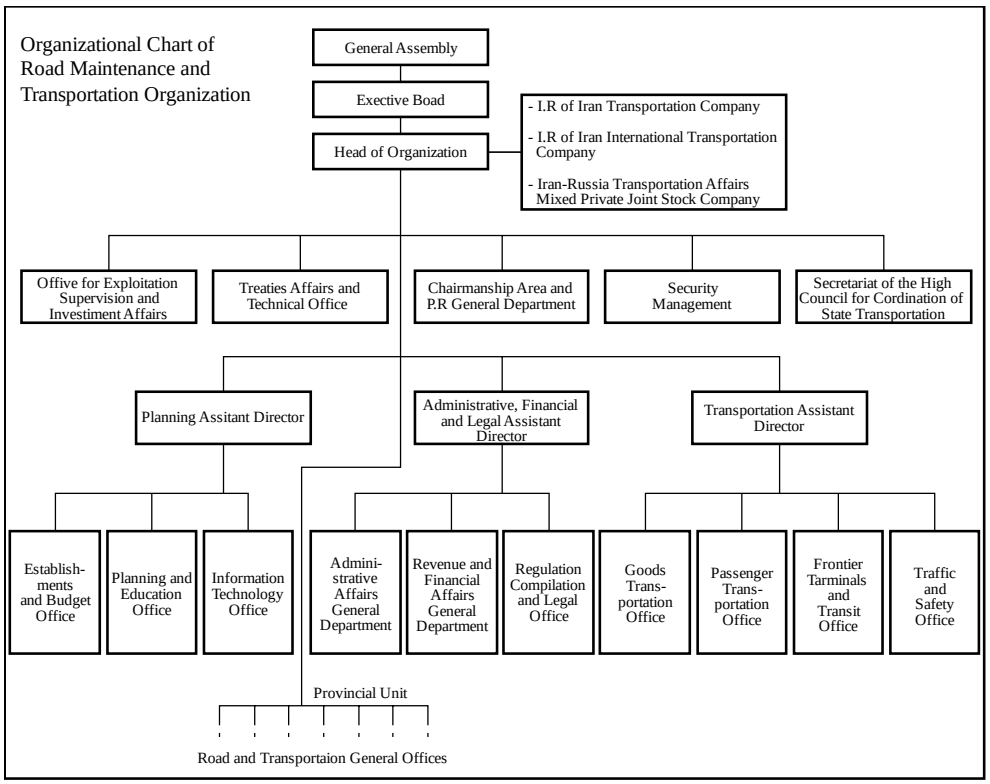

Figure A1-2 Organizational Chart of Road Maintenace and Transportation Organization

Road Maintenance and Transportation Organization (RMTO) is one of organizations unified by MORT in IRAN. This organization has a duty to provide safety traffic control and road construction, which are directly related to people life and sequrity.

Central Office of RMTO, located in Tehran, has the highest authority and responsibility on implementations and engineering evaluations in connection with National Road Project. Budgets and finances on the above-mentioned shall be determined by Central Office of MORT.

This Organization, RMTO, has provicial offices established in each province. The duty of provincial offices is to maintain regional roads and National Roads in provincial area and regional road constructions. Budgets and finances shall be determined through discussion between provincial offices and MPO for provincial offices.

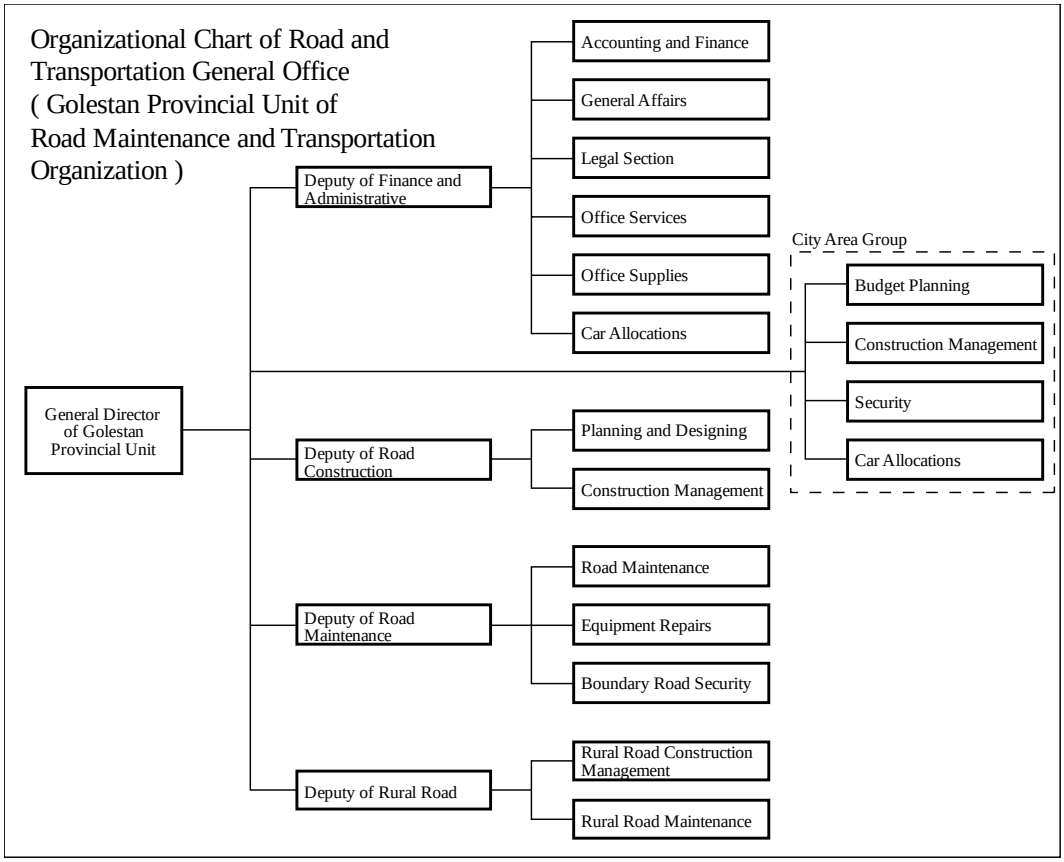

Figure A1-3 Organizational Chart of Golestan Provincial Office of Road Maintenace and Transportation Organization

ANNEX 2 ASIAN HIGHWAY NETWORK

At present, the number of member countries participating in the Asian Highway network project is 32 countries in total, Afghanistan, Armenia, Azerbaijan, Bangladesh, Bhutan, Cambodia, China, Democratic People's Republic of Korea, Georgia, India, Indonesia, Islamic Republic of Iran, Japan, Kazakhstan, Kyrgyzstan, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Republic of Korea, Russian Federation, Singapore, Sri Lanka, Tajikistan, Thailand, Turkey, Turkmenistan, Uzbekistan, Viet Nam.

The Islamic Republic of Iran is located in the important area for the South Asia routes of the Asian Highway, linking Iran to Afghanistan, Azerbaijan, Pakistan, Turkey and Turkmenistan, and both important routes, AH1 and AH2, are passing the capital city, Tehran. And also North –South routes are linking the seaports, Bandar Abbas, Bandar Emam, Chabahar, to the Russian Federations, Caucasus regions and the Central Asia as shown in Figure A2-1 and Table A2-1.

Figure A2-1 Asian Highway Route Map in the Islamic Republic of Iran

Table A2-1 Status of the Asian Highway in the Islamic Republic of Iran

Route No.	Itinerary	Length (km)	Paved 2 Lanes or more
AH1	Dogharun–Mashhad–Sabzevar–Damghan–Semnan–Tehran–Qazvin–Tabriz–Iveoqlu–Bazargan	2,103	2,103
AH2	Mirjaveh–Zahedan–Kerman–Anar–Yazd–Tehran–Saveh–Hamadan–Khosravi	2,310	2,310
AH8	Astara–Rasht–Qazvin–Tehran–Saveh–Ahwaz–Bandar Emam	1,207	1,207
AH70	Inche Boroun–Gorgan–Sari–Semnan–Damghan–Yazd–Anar–Bandar Abbas	1,390	1,390
AH71	Milak–Zabol–Dashtak	162	162
AH72	Tehran–Qom–Esfahan–Shiraz–Bushehr	1,214	1,214
AH75	Sarakhs–Mashhad–Birjand–Nehbandan–Dashtak–Zahedan–Chabahar	1,751	1,751
AH78	Bajgiram–Quchan–Sabzevar–Kerman	1,033	1,033
AH81	Border of Azerbaijan–Jolfa	1	1
AH82	Nour Douz–Jolfa–Eyvoghli	146	146
TOTAL		11,317	11,317

Figure A2-2 is the northern east part of the Asian Highway Map. The road passing this study area is not registered as one part of the Asian Highway as shown in this map as of 2005.

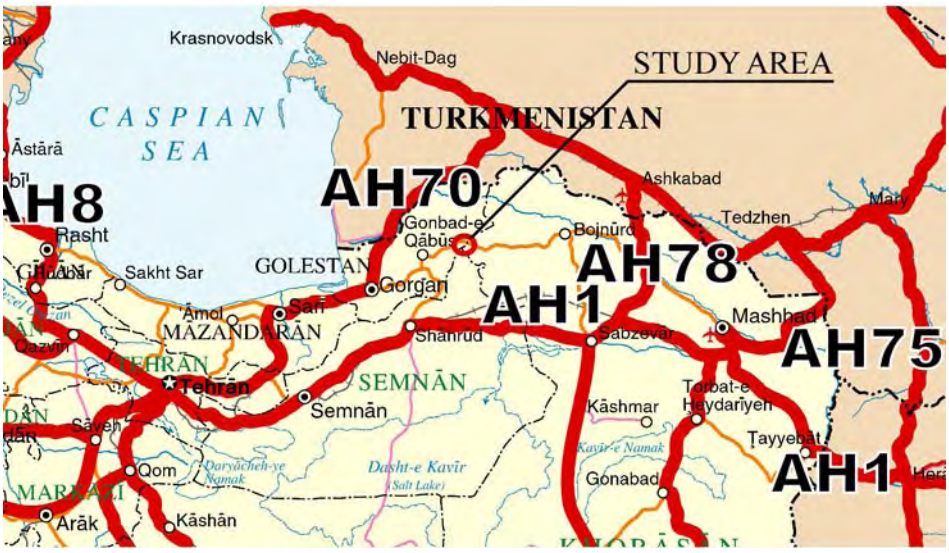

Figure A2-2 Asian Highway Map in and arround Golestan Province

Table A2-2 shows the design standards for the Asian Highway, and it's to be one of requirements for the Asian Highway.

Table A2-2 Asian Highway design standards

Highway classification		Primary (4 or more lanes)				Class I (4 or more lanes)				Class II (2 lanes)				Class III (2 lanes)			
Terrain classification		L	R	M	S	L	R	M	S	L	R	M	S	L	R	M	S
Design Speed (km/h)		120	100	80	60	100	80	50	50	80	60	50	40	60	50	40	30
Width (m)	Right of Way	(50)				(40)				(40)				(30)			
	Lane	3.5				3.5				3.5				3.0 (3.25)			
	Shoulder	3.00		2.50		3.00		2.50		2.50		2.00		1.5 (2.0)		0.75 (1.5)	
	Median strip	4.00		3.00		3.00		2.50		N/A		N/A		N/A		N/A	
Min. radii of horizontal curve (m)		520	350	210	115	350	210	80	80	210	115	80	50	115	80	50	30
Pavement Slope (%)		2				2				2				2 - 5			
Shoulder Slope (%)		3 - 6				3 - 6				3 - 6				3 - 6			
Type of Pavement		Asphalt/ cement conc.				Asphalt/ cement conc.				Asphalt/ cement conc.				Dbl. Bituminous treatment			
Max. superelevation (%)		10				10				10				10			
Max. Vertical grade (%)		4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7
Structure loading (Min.)		HS20-44				HS20-44				HS20-44				HS20-44			

Notes: Figures in parentheses are desirable values.
Minimum radii of horizontal curve should be determined in conjunction with superelevation.
The recommended width of the median can be reduced with the proper type of guard fence.
The Parties should apply their national standards when constructing structures such as bridges, culverts and tunnels along

Reference : ASIAN HIGHWAY HANDBOOK (Economic and Social Commission for Asia and the Pacific, United Nations, 2003)

ANNEX 3 TRAFFIC DENSITY

Table A3-1 and Figure A3-1 shows the result of traffic survey conducted by MORT Golestan Provincial Unit on February 25th, 2002 (after the 2001 Flood, before the 2002 Flood).

In the section between Kallaleh Junction and Ashkhaneh, including the Study Area, the daily traffic density was only 3,100 units in total.

However, the daily traffic density was more than 20,000 units during the tourist season, from the middle of March to the beginning of April and from July to September, before the floods according to a interview in MORT Golestan Provincial Unit.

Table A3-1 Daily Traffic Density in Golestan Province (Feb. 25, 2002/MORT)

SECTION		Passenger Car	Trucks	Others	Total
Kordkouy	**-- Gorgan**	**16,760**	**8,978**	**1,174**	**26,912**
Gorgan	**-- Ali Abad**	**14,246**	**8,698**	**1,322**	**24,266**
Ali Abad	**-- Azad Shahr**	**6,705**	**4,938**	**1,965**	**13,608**
Azad Shahr	**-- Gonbad Kavus**	**9,571**	**4,047**	**1,347**	**14,965**
Gonbad Kavus	**-- Kallaleh**	**4,343**	**2,188**	**1,849**	**8,380**
Galikesh	**-- Kallaleh Junction**	**5,673**	**3,029**	**724**	**9,426**
Kallaleh Junction	**-- Ashkhaneh**	**1,637**	**1,286**	**177**	**3,100**

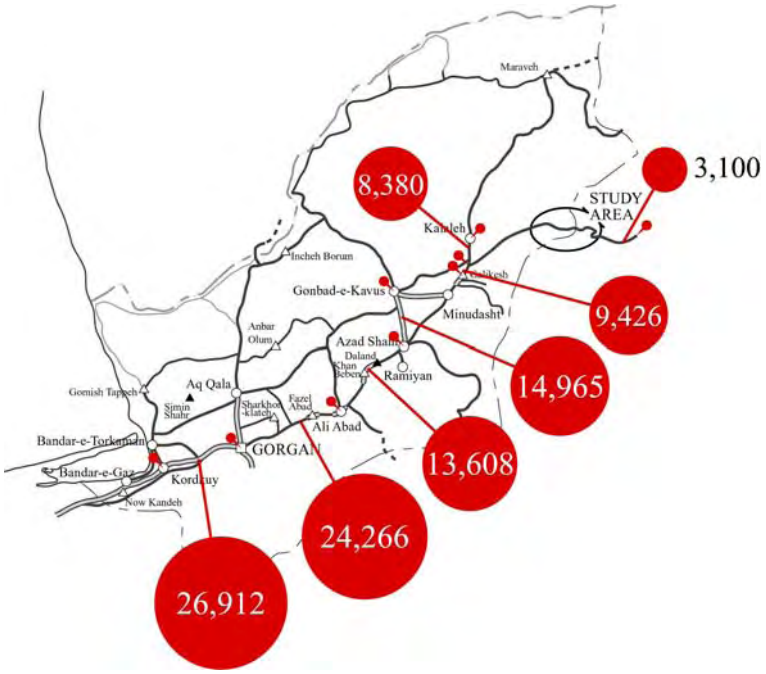

Figure A3-1 Daily Traffic Density Map of Golestan Province (Feb. 25, 2002/MORT)

ANNEX 4 ROAD CONDITION AND SPEED TEST

The road, between Gorgan and Golestan National Park, has been reconstructed in recent 5 years and is kept in good condition. Even the temporary road in the study area has well-constructed with asphalt pavement, gentle curve and gentle slope.

Fig.A4-1 shows the result of speed test (by sedan type) conducted by JICA Study Team on January 2nd, 2005 and testified enough good conditions.

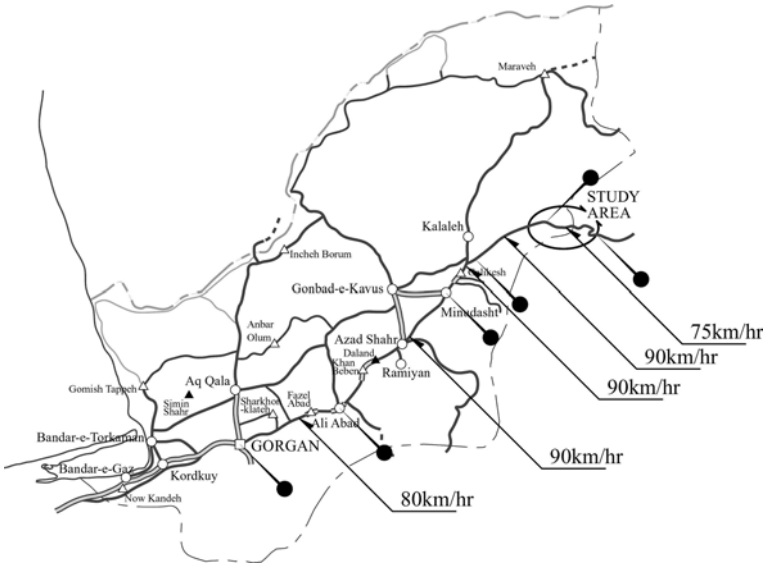

Figure A4-1 Result of Speed Test in Golestan Province (Jan. 2, 2005/JICA Study Team)

Table A4-1 Speed Limit (Traffic Rules)

Type	Speed Limit
Sedan	95 km/hr (80 km/hr : night)
Bus and Truck	60 km/hr (80 km/hr : permitted)

ANNEX 5 ROAD GEOMETRIC ALIGNMENT

The road planning inside Golestan Park was on-going and not completed as of June 2005, when the JICA study team conducted the data collection on road projects in the study area. The consultant company, Pasilou Consultant located in Tehran directory consigned for engineering services on this road plannning by MORT Centarl Office, has just submitted his drawings and design documents to MORT Central Office for his evaluation.

From the above-mentioned situation, the JICA Study Team didn't receive any drawings and documents from both MORT and the mentioned consultant company, although the drawing of road plan can be watched in their offices.

The following data, road alignments, were recorded by the JICA Study Team through the wathing in their offices and it's not cleared whether the drawing is final plan.

Hence the following data may be not useful, but for the present time being.

Table A5-1 Road Horizontal Alignment (1/2)

No.	STATION	LENGTH	ALIGNMENT		No.	STATION	LENGTH	ALIGNMENT	
			R	A				R	A
1	36 + 500.00				40	40 + 849.55	59.91	280.00	
2	36 + 814.66	314.66	∞		41	40 + 900.97	51.42		120.00
3	36 + 866.08	51.42		120.00	42	40 + 914.62	13.65	∞	
4	37 + 3.64	137.56	280.00		43	40 + 988.10	73.48		-130.00
5	37 + 55.07	51.43		120.00	44	41 + 22.63	34.53	-230.00	
6	37 + 112.99	57.92	∞		45	41 + 75.24	52.61		-110.00
7	37 + 170.59	57.60		-120.00	46	41 + 77.63	2.39	∞	
8	37 + 320.79	150.20	-250.00		47	41 + 121.11	43.48		100.00
9	37 + 378.39	57.60		-120.00	48	41 + 227.70	106.59	230.00	
10	37 + 451.78	73.39	∞		49	41 + 301.18	73.48		130.00
11	37 + 506.23	54.45		140.00	50	41 + 479.98	178.80	∞	
12	37 + 880.94	374.71	360.00		51	41 + 545.31	65.33		-140.00
13	37 + 935.38	54.44		140.00	52	41 + 654.18	108.87	-300.00	
14	38 + 10.77	75.39	∞		53	41 + 719.51	65.33		-140.00
15	38 + 58.77	48.00		-120.00	54	41 + 781.00	61.49	∞	
16	38 + 114.49	55.72	-300.00		55	42 + 19.13	238.13	2,500.00	
17	38 + 162.49	48.00		-120.00	56	42 + 839.88	820.75	∞	
18	38 + 210.17	47.68	∞		57	42 + 904.68	64.80		-180.00
19	38 + 261.59	51.42		120.00	58	43 + 68.67	163.99	-500.00	
20	38 + 336.67	75.08	280.00		59	43 + 133.47	64.80		-180.00
21	38 + 388.10	51.43		120.00	60	43 + 353.33	219.86	∞	
22	38 + 460.58	72.48	∞		61	43 + 420.93	67.60		-130.00
23	38 + 525.38	64.80		180.00	62	43 + 605.55	184.62	-250.00	
24	38 + 612.18	86.80	500.00		63	43 + 673.15	67.60		-130.00
25	38 + 676.98	64.80		180.00	64	43 + 674.33	1.18	∞	
26	38 + 927.46	250.48	∞		65	43 + 730.58	56.25		150.00
27	39 + 2.46	75.00		-150.00	66	44 + 133.09	402.51	400.00	
28	39 + 152.17	149.71	-300.00		67	44 + 189.34	56.25		150.00
29	39 + 227.17	75.00		-150.00	68	44 + 282.23	92.89	∞	
30	39 + 445.52	218.35	∞		69	44 + 323.38	41.15		-120.00
31	39 + 502.66	57.14		-200.00	70	44 + 384.66	61.28	-300.00	
32	40 + 60.47	557.81	-700.00		71	44 + 425.81	41.15		-120.00
33	40 + 117.61	57.14		-200.00	72	44 + 447.55	21.74	∞	
34	40 + 172.80	55.19	∞		73	44 + 498.75	51.20		160.00
35	40 + 239.46	66.66		200.00	74	44 + 771.61	272.86	500.00	
36	40 + 552.83	313.37	600.00		75	44 + 822.81	51.20		160.00
37	40 + 619.50	66.67		200.00	76	45 + 26.34	203.53	∞	
38	40 + 738.22	118.72	∞		77	45 + 93.01	66.67		200.00
39	40 + 789.64	51.42		120.00	78	45 + 122.23	29.22	600.00	

Table A5-2 Road Horizontal Alignment (2/2)

No.	STATION			LENGTH	ALIGNMENT		No.	STATION			LENGTH	ALIGNMENT	
					R	A						R	A
79	45	+	188.90	66.67		200.00	139	52	+	677.67	65.33		140.00
80	45	+	292.21	103.31	∞		140	52	+	821.61	143.94	∞	
81	45	+	358.88	66.67		-200.00	141	52	+	886.94	65.33		-140.00
82	45	+	500.59	141.71	-600.00		142	53	+	27.76	140.82	-300.00	
83	45	+	537.26	36.67		-200.00	143	53	+	93.10	65.34		-140.00
84	45	+	700.81	163.55	∞		144	53	+	147.43	54.33	∞	
85	45	+	766.15	65.34		140.00	145	53	+	212.77	65.34		140.00
86	45	+	879.59	113.44	300.00		146	53	+	243.80	31.03	300.00	
87	45	+	944.92	65.33		140.00	147	53	+	309.13	65.33		140.00
88	46	+	42.26	97.34	∞		148	53	+	444.54	135.41	∞	
89	46	+	98.51	56.25		150.00	149	53	+	484.54	40.00		-100.00
90	46	+	155.93	57.42	400.00		150	53	+	616.62	132.08	-250.00	
91	46	+	212.18	56.25		150.00	151	53	+	656.62	40.00		-100.00
92	46	+	691.89	479.71	∞		152	53	+	657.72	1.10	∞	
93	46	+	761.89	70.00		-140.00	153	53	+	697.72	40.00		100.00
94	46	+	988.68	226.79	-280.00		154	53	+	765.61	67.89	250.00	
95	47	+	58.68	70.00		-140.00	155	53	+	805.61	40.00		100.00
96	47	+	264.54	205.86	∞		156	53	+	832.59	26.98	∞	
97	47	+	329.87	65.33		140.00	157	53	+	890.19	57.60		-120.00
98	47	+	494.22	164.35	300.00		158	54	+	23.31	133.12	-250.00	
99	47	+	559.55	65.33		140.00	159	54	+	80.91	57.60		-120.00
100	47	+	740.87	181.32	∞		160	54	+	206.71	125.80	∞	
101	47	+	788.87	48.00		-120.00	161	54	+	248.37	41.66		100.00
102	47	+	911.27	122.40	-300.00		162	54	+	550.53	302.16	240.00	
103	47	+	959.27	48.00		-120.00	163	54	+	592.20	41.67		100.00
104	48	+	265.93	306.66	∞		164	54	+	605.27	13.07	∞	
105	48	+	483.33	217.40	-2,500.00		165	54	+	629.27	24.00		120.00
106	48	+	533.40	50.07	∞		166	54	+	741.10	111.83	600.00	
107	48	+	716.81	183.41	-3,000.00		167	54	+	845.27	104.17		250.00
108	49	+	39.57	322.76	∞		168	54	+	942.34	97.07	∞	
109	49	+	98.48	58.91		-180.00	169	55	+	67.34	125.00		-250.00
110	49	+	293.97	195.49	-550.00		170	55	+	196.07	128.73	-500.00	
111	49	+	352.88	58.91		-180.00	171	55	+	321.07	125.00		-250.00
112	49	+	432.64	79.76	∞		172	55	+	460.29	139.22	∞	
113	49	+	488.89	56.25		150.00	173	55	+	547.79	87.50		175.00
114	49	+	618.37	129.48	400.00		174	55	+	795.68	247.89	350.00	
115	49	+	674.62	56.25		150.00	175	55	+	883.18	87.50		175.00
116	49	+	976.72	302.10	∞		176	55	+	998.41	115.23	∞	
117	50	+	328.07	351.35	-2,500.00		177	56	+	73.41	75.00		-150.00
118	50	+	513.76	185.69	∞		178	56	+	346.73	273.32	-300.00	
119	50	+	570.01	56.25		150.00	179	56	+	421.73	75.00		-150.00
120	50	+	711.47	141.46	400.00		180	56	+	660.40	238.67	∞	
121	50	+	767.72	56.25		150.00	181	56	+	755.13	94.73		300.00
122	50	+	902.50	134.78	∞		182	57	+	551.91	796.78	950.00	
123	50	+	958.75	56.25		-150.00	183	57	+	646.65	94.74		300.00
124	51	+	120.57	161.82	-400.00		184	57	+	774.36	127.71	∞	
125	51	+	176.82	56.25		-150.00	185	57	+	849.36	75.00		150.00
126	51	+	230.82	54.00	∞		186	57	+	918.44	69.08	250.00	
127	51	+	332.64	101.82	2,500.00		187	57	+	998.44	80.00		150.00
128	51	+	775.46	442.82	∞		188	58	+	71.29	72.85	∞	
129	51	+	834.67	59.21		150.00	189	58	+	119.29	48.00		-120.00
130	51	+	956.97	122.30	380.00		190	58	+	127.53	8.24	-300.00	
131	52	+	16.18	59.21		150.00	191	58	+	175.53	48.00		-120.00
132	52	+	75.16	58.98	∞								
133	52	+	140.50	65.34		-140.00							
134	52	+	279.89	139.39	-300.00								
135	52	+	345.22	65.33		-140.00					R min =	230.00	
136	52	+	431.55	86.33	∞						A min =	100.00	
137	52	+	496.89	65.34		140.00							
138	52	+	612.34	115.45	300.00								

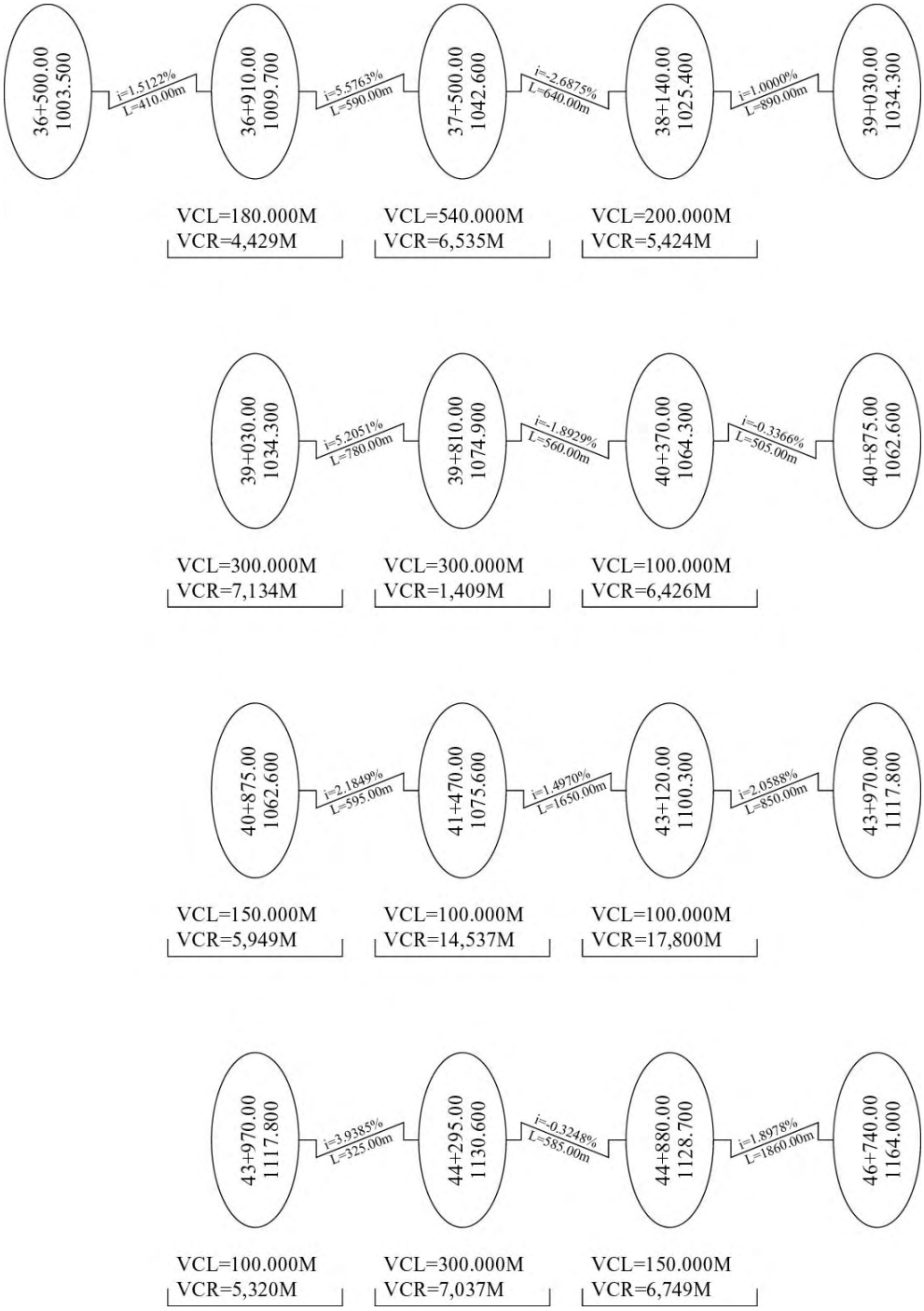

Figure A5-1 Road Vertical Alignment (1/2)

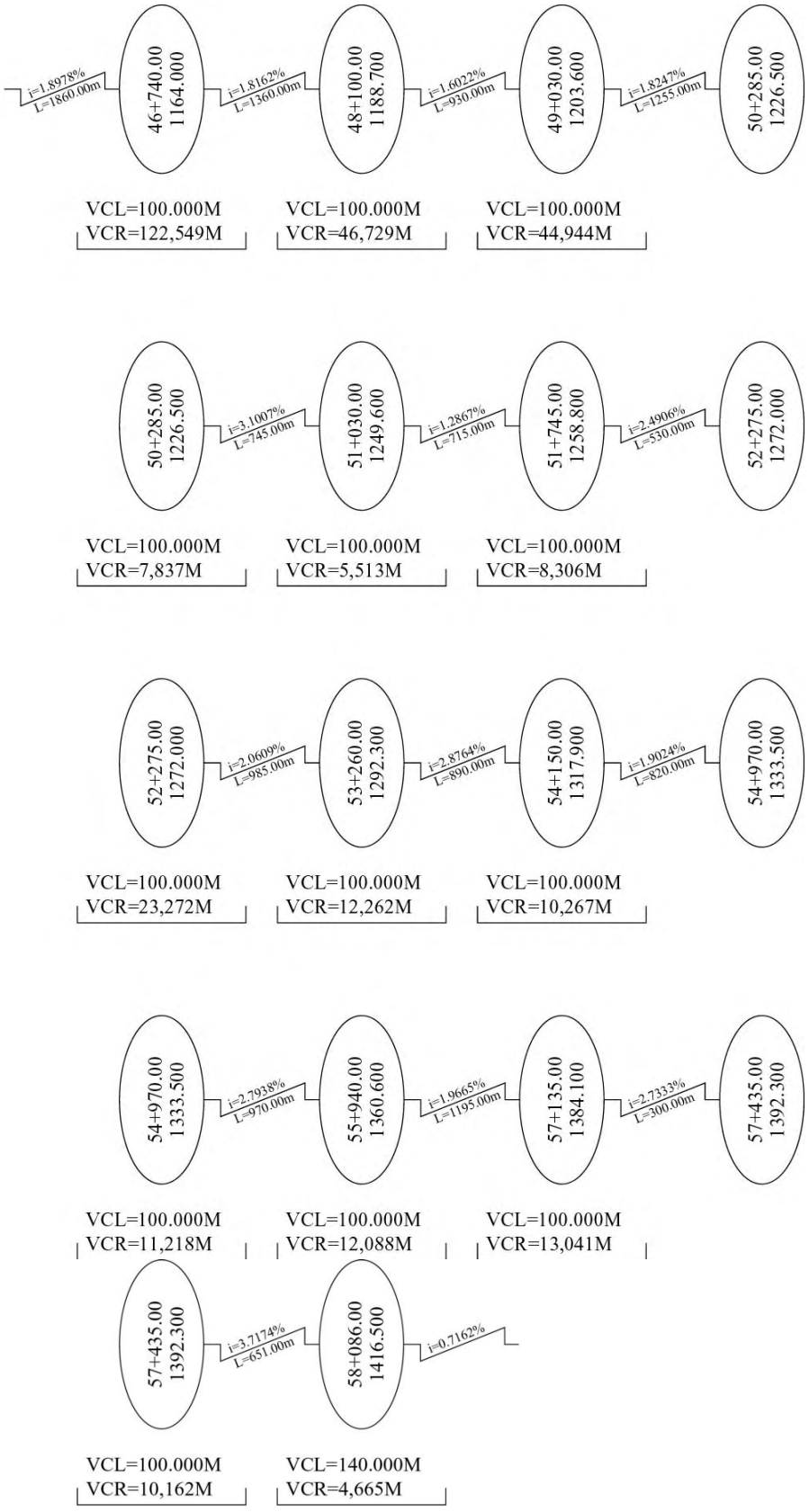

Figure A5-2 Road Vertical Alignment (2/2)

Table A5-3 Road Elevations (1/2)

STATION	ELEVATION	STATION	ELEVATION	STATION	ELEVATION
36 + 500.00	1,003.500	41 + 0.00	1,065.331	45 + 500.00	1,140.466
36 + 600.00	1,005.012	41 + 100.00	1,067.516	45 + 600.00	1,142.364
36 + 700.00	1,006.524	41 + 200.00	1,069.701	45 + 700.00	1,144.262
36 + 800.00	1,008.037	41 + 300.00	1,071.886	45 + 800.00	1,146.160
36 + 900.00	1,010.271	41 + 400.00	1,074.071	45 + 900.00	1,148.058
37 + 0.00	1,014.719	41 + 500.00	1,076.035	46 + 0.00	1,149.956
37 + 100.00	1,020.295	41 + 600.00	1,077.546	46 + 100.00	1,151.854
37 + 200.00	1,025.871	41 + 700.00	1,079.043	46 + 200.00	1,153.752
37 + 300.00	1,031.072	41 + 800.00	1,080.540	46 + 300.00	1,155.650
37 + 400.00	1,034.812	41 + 900.00	1,082.037	46 + 400.00	1,157.547
37 + 500.00	1,037.022	42 + 0.00	1,083.534	46 + 500.00	1,159.445
37 + 600.00	1,037.701	42 + 100.00	1,085.031	46 + 600.00	1,161.343
37 + 700.00	1,036.850	42 + 200.00	1,086.528	46 + 700.00	1,163.240
37 + 800.00	1,034.538	42 + 300.00	1,088.025	46 + 800.00	1,165.090
37 + 900.00	1,031.850	42 + 400.00	1,089.522	46 + 900.00	1,166.906
38 + 0.00	1,029.163	42 + 500.00	1,091.019	47 + 0.00	1,168.722
38 + 100.00	1,026.807	42 + 600.00	1,092.516	47 + 100.00	1,170.538
38 + 200.00	1,026.148	42 + 700.00	1,094.013	47 + 200.00	1,172.355
38 + 300.00	1,027.000	42 + 800.00	1,095.510	47 + 300.00	1,174.171
38 + 400.00	1,028.000	42 + 900.00	1,097.007	47 + 400.00	1,175.987
38 + 500.00	1,029.000	43 + 0.00	1,098.504	47 + 500.00	1,177.803
38 + 600.00	1,030.000	43 + 100.00	1,100.026	47 + 600.00	1,179.619
38 + 700.00	1,031.000	43 + 200.00	1,101.947	47 + 700.00	1,181.436
38 + 800.00	1,032.000	43 + 300.00	1,104.006	47 + 800.00	1,183.252
38 + 900.00	1,033.028	43 + 400.00	1,106.065	47 + 900.00	1,185.068
39 + 0.00	1,035.009	43 + 500.00	1,108.123	48 + 0	1,186.884
39 + 100.00	1,038.392	43 + 600.00	1,110.182	48 + 100	1,188.673
39 + 200.00	1,043.149	43 + 700.00	1,112.241	48 + 200	1,190.302
39 + 300.00	1,048.354	43 + 800.00	1,114.300	48 + 300	1,191.904
39 + 400.00	1,053.559	43 + 900.00	1,116.359	48 + 400	1,193.507
39 + 500.00	1,058.764	44 + 0.00	1,119.019	48 + 500	1,195.109
39 + 600.00	1,063.969	44 + 100.00	1,122.920	48 + 600	1,196.711
39 + 700.00	1,069.174	44 + 200.00	1,126.643	48 + 700	1,198.313
39 + 800.00	1,073.812	44 + 300.00	1,129.090	48 + 800	1,199.915
39 + 900.00	1,073.196	44 + 400.00	1,130.115	48 + 900	1,201.518
40 + 0.00	1,071.304	44 + 500.00	1,129.934	49 + 0	1,203.124
40 + 100.00	1,069.411	44 + 600.00	1,129.609	49 + 100	1,204.877
40 + 200.00	1,067.518	44 + 700.00	1,129.285	49 + 200	1,206.702
40 + 300.00	1,065.625	44 + 800.00	1,128.960	49 + 300	1,208.527
40 + 400.00	1,064.230	44 + 900.00	1,129.304	49 + 400	1,210.351
40 + 500.00	1,063.862	45 + 0.00	1,130.977	49 + 500	1,212.176
40 + 600.00	1,063.526	45 + 100.00	1,132.875	49 + 600	1,214.001
40 + 700.00	1,063.189	45 + 200.00	1,134.773	49 + 700	1,215.825
40 + 800.00	1,062.852	45 + 300.00	1,136.671	49 + 800	1,217.650
40 + 900.00	1,063.356	45 + 400.00	1,138.569	49 + 900	1,219.475

Table A5-4 Road Elevations(2/2)

STATION	ELEVATION	STATION	ELEVATION	STATION	ELEVATION
50 + 0	1,221.300	53 + 0	1,286.942	56 + 0	1,361.780
50 + 100	1,223.124	53 + 100	1,289.003	56 + 100	1,363.746
50 + 200	1,224.949	53 + 200	1,291.063	56 + 200	1,365.713
50 + 300	1,227.043	53 + 300	1,293.455	56 + 300	1,367.679
50 + 400	1,230.066	53 + 400	1,296.327	56 + 400	1,369.646
50 + 500	1,233.167	53 + 500	1,299.203	56 + 500	1,371.612
50 + 600	1,236.267	53 + 600	1,302.080	56 + 600	1,373.579
50 + 700	1,239.368	53 + 700	1,304.956	56 + 700	1,375.545
50 + 800	1,242.469	53 + 800	1,307.833	56 + 800	1,377.512
50 + 900	1,245.569	53 + 900	1,310.709	56 + 900	1,379.478
51 + 0	1,248.634	54 + 0	1,313.585	57 + 0	1,381.445
51 + 100	1,250.501	54 + 100	1,316.462	57 + 100	1,383.420
51 + 200	1,251.787	54 + 200	1,318.851	57 + 200	1,385.877
51 + 300	1,253.074	54 + 300	1,320.754	57 + 300	1,388.610
51 + 400	1,254.361	54 + 400	1,322.656	57 + 400	1,391.354
51 + 500	1,255.647	54 + 500	1,324.558	57 + 500	1,394.716
51 + 600	1,256.934	54 + 600	1,326.461	57 + 600	1,398.434
51 + 700	1,258.222	54 + 700	1,328.363	57 + 700	1,402.151
51 + 800	1,260.170	54 + 800	1,330.266	57 + 800	1,405.869
51 + 900	1,262.660	54 + 900	1,332.168	57 + 900	1,409.586
52 + 0	1,265.151	55 + 0	1,334.356	58 + 0	1,413.303
52 + 100	1,267.641	55 + 100	1,337.132	58 + 100	1,416.264
52 + 200	1,270.132	55 + 200	1,339.926	58 + 200	1,417.316
52 + 300	1,272.502	55 + 300	1,342.720		
52 + 400	1,274.576	55 + 400	1,345.513		
52 + 500	1,276.637	55 + 500	1,348.307		
52 + 600	1,278.698	55 + 600	1,351.101		
52 + 700	1,280.759	55 + 700	1,353.895		
52 + 800	1,282.820	55 + 800	1,356.689		
52 + 900	1,284.881	55 + 900	1,359.478		

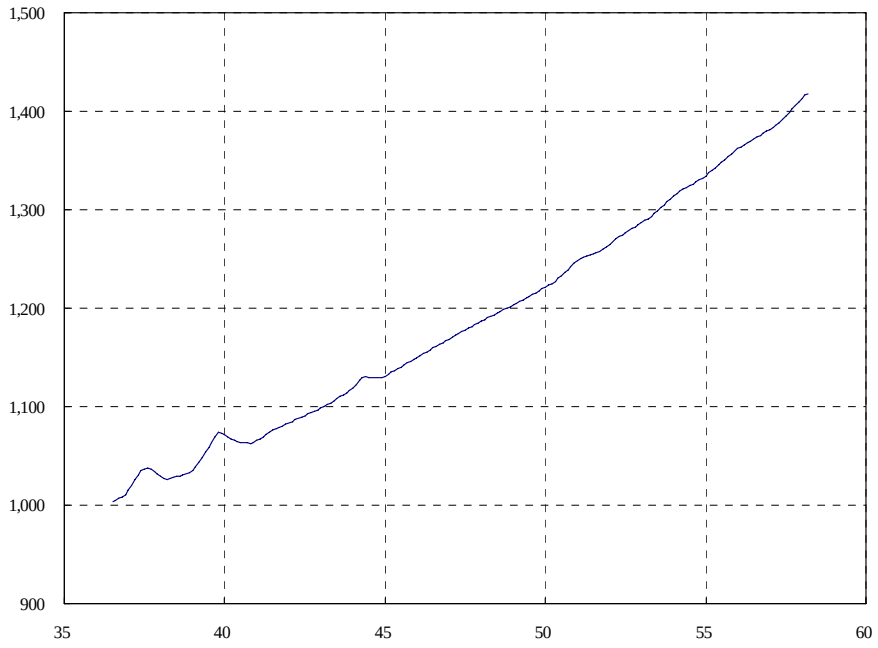

Figure A5-3 Road Elevation (Vertical: Elevation, Horizontal:Station)