9-2 CONSTRUCTION SECTION FOR PROPOSED ROAD

9-2-1 Establishment of Construction Section

In order to complete the proposed road economically and in a short period as much as possible, it is needed to divide the project into the appropreate numbers of section. For the division, followings will be taken into account.

-- The phisical conditions of the region

-- The economic and financial back grounds

-- The scale of construction, construction items and period.

-- The experiences and capacities of construction contractors.

The way of division of section may become an influential factor on the construction period, since the proposed road runs through the terrain with a large river aforestated.

Furthermore the following factors shall be reflected on the way of division of section;

1) Application of new construction or improvement portion.

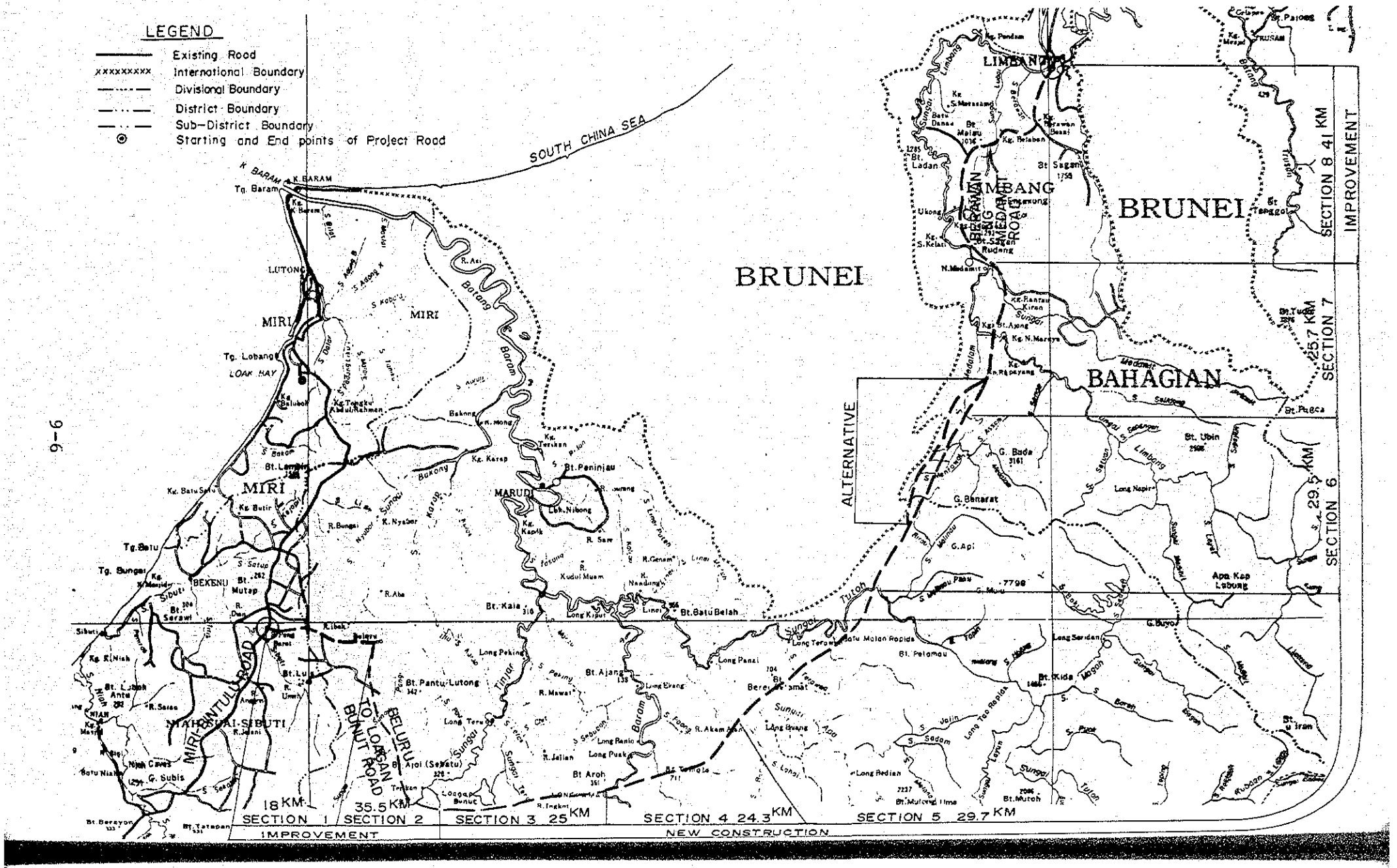
2) Execution by the local or foreign contractors.

3) Regional distribution and supply of construction materials.

4) The method of construction and scale for stage construciton.

Accordingly the division of section are established as shown in Fig. 9-4.

Fig. 9-4 MAP OF CONSTRUCTION SECTION



9-2-2 Description of Section

The 1st Section (L = 18.0kms/11.2 miles)

This section ranges 18km from the branch point of Miri-Bintulu trunk road (34 miles form Miri) to the point 1km to Beluru (called Beluru branch point).

This section was constructed in 1969 in accordance with the Feeder road standard of P.W.D. Sarawak, but it is proposed to grade up the criteria to conform with the trunk road and improve wooden bridges to the permanent ones in the construction plan starting from 1981. For the reason, we budget only the pavement cost for the seciton.

The part of 1km (0.6 miles) in length from Beluru branch point to Beluru is excluded from the project range as a feeder road for the trunk one.

The effect of the feeder road will be reviewed in Phase II.

The 2nd Section (L = 35.5kms/22.1 miles)

This section entends 35.5kms from Beluru branch point to Sg. Tinjar. The last section of 2.6km (1.6 miles) in length from the left bank of Sg. Tinjar is under construction by the M.R.C.U. 10 office started in 1975 and palnned to be finished in 1980.

For the first 9.7km (6.0 miles) section from the starting point, the road is constructed on the standard for feeder roads, while for the remainder part 25.8km (16.1 miles) it is on that for trunk roads with permanent bridges and gravel pavement.

The first feeder road section of 9.7km (6.0 miles) in length will be upgrade after 1981.

From these reason, only a pavement cost is budgeted for this section.

As for the bridge crossing over Sg. Tinjar (with a bridge length of about 100m), the Australian team finished the

investigation and has provided design services for the construction under the Colombo Plan.

The 3rd Section (L = 25.0kms/15.5 miles)

This section covers the new construction of 25.0kms in length, starting at the right bank of Sg. Tinjar, passing the southern side of Loagan Bunut, crossing Sg. Teru and ending at the right bank of Batang Baram. At the right bank of Batang Baram, the route meets Long Lama where the biggest village among the proposed area, but has no villages on the midway.

The 4th Section (L = 25kms/15.5 miles)

This section, with a total length of 25kms, starts at the right bank of Batang Baram passing on the north of Long Lama and running eastward along Batang Baram, and ends at the left bank of Sg. Apoh.

Along the route there exist villages, Long Buang and R. Akam Ajang.

The 5th Section (L = 29.7kms/18.5 miles)

This section starts at the right bank of Sg. Apoh, passing through Sg. Terawan and the point 10kms (6.3 miles) northeast of Long Terawan, then ends at Sg. Tutoh.

Since there is no transportation roads for construction materials at either Sg. Apoh or Sg. Tutoh, it will be required to construct the approach (approx. 2kms/1.3 miles in length) to the section starting at the point some 10kms upstream on Sg. Tutoh from Long Terawan.

The 6th Section (L = 29.5kms/18.3 miles)

This section is a newly constructed with 29.5kms in length, which starts at the right bank of Sg. Tutoh, runs northward along the borderline with Brunei passes the Divisional border of the Fourth and Fifth Divisions, and ends at Sg. Medalam.

Also this section is located within the area of Mulu National Park which has a large potential of future development for tourism.

In this section, the transportation of the construction material will be possible through the forest road starting at Sg. Tutoh.

The 7th Section (L = 25.7kms/16.0 miles)

This section is a newly construction an extension of 25.7kms, which streches northward from the right bank of Sg. Medalam and corresponds to the existing road at the right bank of Sg. Limbang.

There exist Ng. Medamit on the left bank and the camp for collecting wood on the right bank of Sg. Limbang.

The 8th Section (L = 41kms/25.5 miles)

This section ranges on the existing road from the right bank of Sg. Limbng to the center of Limbang.

The existing road was constructed in accordance with the standard for feeder roads before 1966 and the pavement was executed by gravel.. (pardially paved with an asphalt pavement in Limbang)

The P.W.D. has no plan for the grading up of the existing road to the trunk road, therefore, its improvement will be included in this project.

9-3 STAGE CONSTRUCTION

9-3-1 Introduction of Stage Construction

It is not preferable from the economic point of view do implement the improvement and new construction simultaneously on the entire project, since it will require the huge amount of capital cost, large numbers of construction machinery and plant, and concentrative labor forces.

In the sense, it is recommendable to establish the plan of stage construction, and encourage the effect of the initial cost investment, taking into consideration the factors such as physical conditions, priority of regional development and constructability itself.

The study of the stage construction has been carried out both on the construction section and component of cross section for road.

As for the construction section of proposed road, the priority of construction shall be determined in consideration for technical and economic propriety and role of trunk road.

There is an evident order of priority for construction in the two improvement sections for the existing roads, that is, Miri/Bintulu Road to Beluru, Beluru and Sg. Tinjar and section between Ng. Medamit and Limbang, and also the new construction sections which connects above two improvement sections.

Namely, if we lay stress on the factor of regional development, the priority shall be given to the whole improvement sections and the new construction section to Long Lama which is a sub-center of the 4th Division and the top priority shall be so on the new construction section which starts at Sg. Tinjar, passing Batang Baram and ends at Long Lama.

From the viewpoint of component of cross section for road following stage construction is proposed.

1) On the first stage of construction, only one lane of roadway (lane of 3.66m and 2 shoulder of 3.05m in whidth), gravel pavement, and one lane of bridge and other structure are to be executed. Then on the second stage of construction they are to be expanded to the two lanes standard.

2) On the first stage, the road is to be paved by gravel for public use and on the second stage it is gradually improved to the asphalt pavement.

3) On the first stage the bridge is to be executed as a permanent bridge of one lane and it will be improved to the two lanes in the future.

9-3-2 Stage Construction Plan

There may be some plans for stage construction from the viewpoint of an effective investment of capital cost. In this project, following cases are studied in consideration of common characteristics for both sections of improvement of existing road and new construction.

-- Plan to expand the carrige way from one lane to two lanes

-- Plan to give a priority on the construction section

-- Plan to pave by gravel or asphalt concrete

(1) Expansion of Lane Number

The future traffic volume 2002 which is calculated in Chapter 4 is shown as below.

	Road Section	Total Traffic (Vehicle/day)
A.	Miri - Bintulu Rd. - Beluru	1,863
B.	Beluru - Sg. Bakong	485
C.	Sg. Bokong - Sg. Tinjar	392
D.	Sg. Tinjar - L. Lama	342
E.	L. Lama - Sg. Apoh	237
F.	Sg. Lama - Sg. Limbang (Ng. Medamit)	184
G.	Sg. Limbang (Ng. Medamit) - Limbang	340 ∿ 2,717

From the total traffic, the Road Section B ∿ F (Beluru - Long Lama - Ng. Medamit) does not need two lanes of traffic way on the initial stage. But the final construction of road bed for the single lane road contradicts both the P.W.D. Sarawak and P.W.D. State goemetric standards for trunk roads, and the traffic accidents occur so frequently on such a single lane road. Therefore, it is desirable to construct two lanes of road.

Consequently, the review shall be made on a plan to construct the road of one lane for the public use on the initial stage and to improve it to of two lane at the final stage.

For the review it is necessary to study on followings.

i. Execution of the new embankment along side the old one, especially, in compaction and slope treatment.

ii. Execution of approach, filled and cut, to the bridge.

iii. Treatment of the joint of an asphaltic concrete at the time of expansion of carrige way.

iv. Selection of construction method and machinery not to interfere with the present traffic.

v. Expansion of the carrige way on bridge (pararel construction of the bridge of single lane or enlargement to two lanes of bridge).

(2) Priority for Construction Section

The construction section of the proposed road is classified into the followings.

-- The improvement section of existing road
Miri-Bintulu Rd. - Beluru - Sg. Tinjar
Ng. Medamit - Limbang

-- The new construciton section
Sg. Tinjar - Long Lama - Ng. Medamit

The priority of construction is to be determined subject to the physical conditions (Tropical rainy and dry seasons, discharge of river, etc.), the existence of development area, the magnitude of work amount and construct ability of the section.

The improvement section of existing road of Miri-Bintulu Rd. - Beluru - Sg. Tinjar is a two lanes of road paved by the gravel. It has been for the purblic use from 1969, and the population along its route and the traffic volume tends to increase annually. Therefore, the improvement of the section will contribute to the socio-economic development of the area.

As for the section of Ng. Medamit - Limbang, which has been for the public use from 1966, the effect by the improvement will be large in consideration of the growth of traffic volume.

For the new construction section, the priority of construction shall be determined subject to the following regional development factors,

1) Long Lama as a center of regional community
2) Development of tourism with a background of Mulu National Park
3) Regional agricultural and foresty development

and the magnitude of work quantity and constructability.

The construction of section of Sg. Tinjar - Long Lama shall be given a priority, since there are found various potentials of development such as Long Lama for the sub center of the area, the land dotted along the section for the agriculture and the tropical jungle for the foresty.

Mulu National Park, which has a stalactite cave of the largest scale in the world, will be gradually developed as a tourism spot through the scientific research and conservation for flora and fauna following to the socio-economic development of the area.

Subject to the above reviewed, the construction priority for the construction priority for the new construction sections is given in following orders.

Priority order	Section	Length
1	Sg. Tinjar ∿ Long Lama	25.0kms (15.6 miles)
2	Long Lama ∿ Sg. Medalam	83.5kms (52.2 miles)
3	Sg. Medalama ∿ Sg. Limbang	25.7kms (16.1 miles)

(3) Stage Construction in Pavement Work

In the improvement sections of existing roads, 1) Miri/ Bintulu Rd. ∿ Beluru, 2) Beluru ∿ Sg. Tanjar, and 3) Ng. Medamit ∿ Limbang, the pavements were executed by by either gravel or crucher run.

According to the traffic census by the ADT and P.W.D. of 1978, the traffic volumes are 356 vehic./day and 227 vehic./day in the sections Miri/Binturu Rd. ∿ Belur and Ng. Medamit ∿ Limbang respectively.

They are very small at present, and the future traffic volumes cast in 2002 will be only 1863 vehic./day and 2717 vehic./day respectively. In 1982, they will be 554 vehic./day and 913 vehic./day respectively. Even if the sections will be provided for the public use in 1982, the gravel pavement will enough to accommodate such number of traffic volumes.

The traffic volume of new construction section, Sg. Tinjar ∿ Long Lama, will be 126 vehic./day and 346 vehic./day in 1982 and 2002 respectively, and also that of the section, Long Lama ∿ Ng. Medamit, will be 88 vehic./day and 237 vehic./day in 1982 and 2002 respectively. From those traffic volume, it is proposed that the initial stage of pavement will be executed by gravel, and will be graded up by the asphalt concrete after the public use of 5 ∿ 10 years.

(4) Method of Stage Construction

The introduction method of stage construction is summarized as in following alternatives, persuant to these studies.

The 1st Plan

The 1st stage:

i. Improvement of the roadway surface by gravel in the existing road sections.

ii. Construction of the one lane of road with gravel pavement in the section Sg. Tinjar ∿ Long Lama (Bridges in one lane).

The 2nd stage:

Construction of the one lane of road with gravel pavement in the seciton, Long Lama ∿ Ng. Medamit.

The 3rd stage:

i. Improvement of the roadway surface by asphalt concrete in the existing road sections.

ii. Expansion of the lane number from one to two, and pavement by asphalt concrete in the section, Sg. Tinjar ∿ Long Lama

The 4th stage:

i. Expansion of the lane number from one to two, and pavement by asphalt concrete in the section, Long Lama ∿ Sg. Limbang (Ng. Medamit).

ii. Expansion of the lane number on bridges from one to two in the section Sg. Tinjar ∿ Sg. Limbang (Ng. Medamit).

The 2nd Plan

The last stage:

Construction of the 2 lanes of road with gravel pavement in the section, Sg. Tinjar ∿ Long Lama (Bridges in one lane).

The 2nd stage:

i. Improvement of the raodway surface by asphalt concrete in the existing road section.

ii. Ditto but in the section Sg. Tinjar ∿ Long Lama.

The 3rd stage:

Construction of the one lane of raod with gravel pavement in the section, Long Lama ∿ Sg. Limbang (Ng. Medamit). (bridges in one lane)

The 4th stage:

i. Expansion of the lane number fron one to two, and pavement by asphalt concrete in the section, Long Lama ∿ Sg. Limbang (Ng. Medamit).

ii. Expansion of the lane number on bridges from one to two in the section, Sg. Tinjar ∿ Sg. Limbang (Ng. Medamit).

In Phase II, the further studies will be carried out on each alternative plan and the construction cost will be estimated.

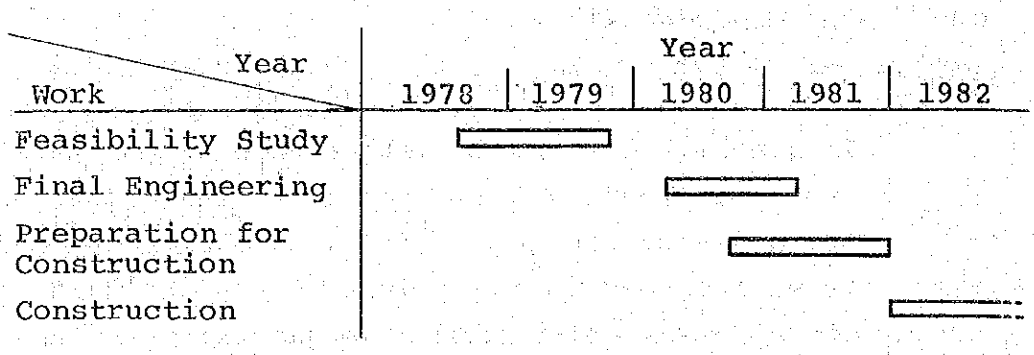
9-4 CONSTRUCTION SCHEDULE

9-4-1 Organization for Construction

In general, for the implementation of construction projects, there are two types of management system, that is, a direct management and a management by contract. It will depend on the judgement for the holding number of engineers, plant and construction materials on the side of the employer, and also for the current capacity of construction contractors, whether which system is adopted for the project. At present in the Sarawak, the construction of roads are directly managed by the P.W.D. The detailed review on the management system will be added in items of Phase II study, but the latter system seems to be advantageous in so far as judged from the scale of the project.

9-4-2 Construction Plan

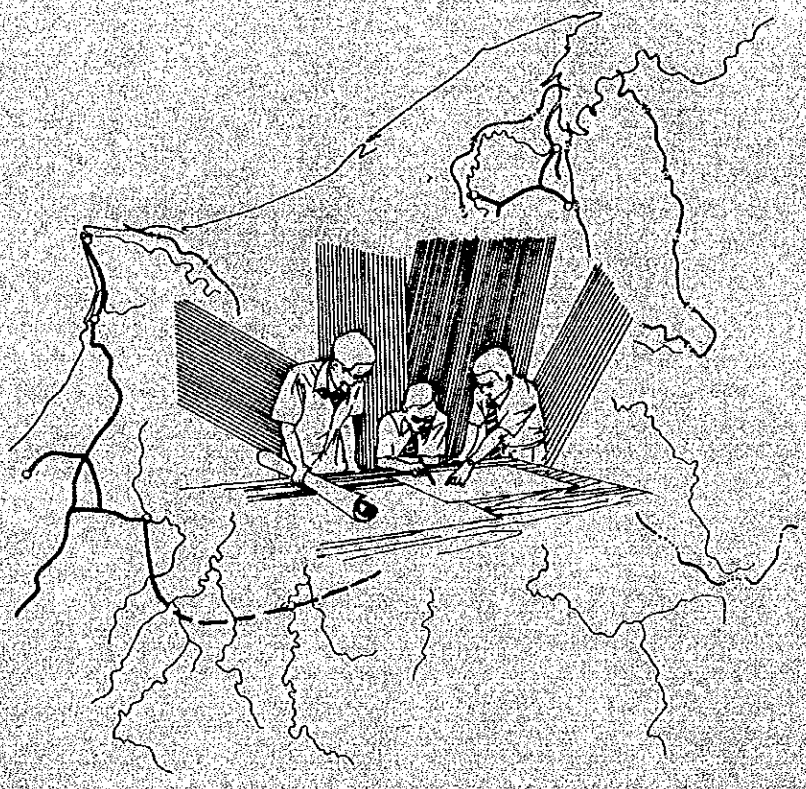
The following works shall be completed by the commencement of construction, i.e. the detailed topographical survey, geological survey, detailed design, acquisition of land, and financial negociation and acquirement. It is expected that it will take around two years and half to fulfill those works during the period from the submittal of final report to the commencement of construction. Accoringly we anticipate that the final report will be presented in September of 1979, immediately after it, the detailed design will be started and completed in one year, then all the preparatory works including the financial negotiation, acquisition of land and selection of contractors will be finished until the end of 1981, so the construction will be commenced in 1982.



Besides, the construction programme for each section and the overall construction plan considering the stage construction will be proposed through detailed analysis of Phase II.

Chapter 10

SELECTION OF ALTERNATIVE ROUTE



10-1 ALTERNATIVE ROUTES

This chapter describes the comparative routes which are reviewed within the new construction section that starts at the ending point, on the right bank of Sg. Tinjar, of existing road in the 4th Division (Miri/ Bintulu Rd. ∿ Beluru ∿ Sg. Tinjar), subsequently passing through Long Lama, a sole sub center, and Mulu National Park Designated Area, and ends at the ending point of existing road of Ng. Medamit in 5th Division.

10-1-1 Sg. Tinjar ∿ Sg. Baram (Long Lama) Section

In this section there exist a low swampy zone including Loagan Bunut, and the Lemiting Protected Forest, and also the basins of Sg. Tinjar, Sg. Tru and Sg. Baram as well.

Therefore, the route shall be located in a full conderation for keeping off swamps, and conservation of existing concessions of the forest trader in the development plan for the protected forest. And also sites shall be allocated at the hydraulically stable point of the basin. There are scattered small villages with population of less than 100 a long the route of a few kms in length (Ingkot, Kubal, Liam, Entri and Belulok) except for Long Lama with population of 1,500, which is expected to become a subcenter in the Study Area.

Taking those topographical situation and rigional socio-economic development plan into account, the route is proposed as shown in Fig. 10-1.

In the section of Long Lama, the route is so located as to avert the both area of future unban development and that of agricultural development potentials, especially for wet and hill paddy.

Consequently we set forward a single plan for the route in this section.

10-1-2 Sg. Baram (Long Lama) ∿ Sg. Tutoh Section

The topographical situation of this section is represented by the protected forest of Telang Usan extending from the right bank of Sg. Baram, and the protected forest of Melana reaching to Sg. Tutoh, and also the river Sg. Apoh meadering through the midway of those both forest. As Sg. Apoh has its many tributaries, Sg. Bemang, Sg. Lahai, Sg. Tabih, Sg. Ulat and Sg. Melama in its basin, so there expands swampy zones along them.

Sg. Tutoh meaders westward in the northern border of the area, and its tributary Sg. Terawan runs northward in the lowland and joining to Sg. Tutoh in the vicinity of Long Terawan.

In this area, dotted are villages, R. Akam Ajang, Long Buang, Long Wat Lli, Long Wat Ulu and Long Atip along Sg. Apoh, and a village Long Terawan along Sg. Tutoh.

The distribution of population are 1,500 in R. Akam Ajang, 624 in Long Atip, 614 in Long Terawan and less than 100 in other villages.

Accordingly the following two alternative routes are compared in this section.

A) The route A, which is located to start at Long Lama, run near villages of R. Akam Ajang and Long Buang averting swampy zones, cross Sg. Apoh and run in the neighbourhood of Long Terawan keeping off the swamps along meandering Sg. Apoh.

At the crossing of Sg. Tutoh, the point with a geological stability and narrow river width is selected.

B) The route B, which is located to start at Long Lama, run in the southern side of swampy zones along Sg. Bemong and Sg. Lahai, cross Sg. Apoh adjacent to Long Atip and reach to Sg. Tutoh being deverted northward along the foot of Melana Portected Forest.

In the comparison of these two alternatives, studies are made from the viewpoints of development potentiality of both Long Atip and R. Akam Ajang areas, and also the required constructional techniques. Following reasons, thus, lead to the selection of the alternative A.

1) From the technical point of view, the length of Route B is larger than Route A by 10kms (6.3 miles) and the former's earthwork quantity is evidently larger than the latter's one.

2) As the population of Long Atip is being decreased annually, while that of R. Akam Ajang seems to be increased constantly in a rate of 2.6%, the development potentiality of Route A is larger than that of Route B.

The alternative route shown in Fig. 10-2.

10-1-3 Sg. Tutoh ∿ Sg. Limbang (Ng. Medamit)

This section starts at crossing point of Sg. Tutoh and passes through the area, where both mountains of Mulu National Park designated (Mulu Mountain 7,796 feets above the sea level) in the east and the border with Brunei in the west are forming the watersheds for Sg. Limbang which is jointed with Sg. Medalam and meanders northward, and reaches the village of Ng. Medamit.

Since the area expands in the mountains or hills covered by the thick tropical jungle, it is scarcely populated and developed.

Sg. Limbang and Sg. Medalam run northward in a zig-zag line, so it has many small channels in its basin.

No villages are found in the Mulu National Park, but along Sg. Limbang and Sg. Medalam there are dotted many villages, R. Ambau, R. Haling, R. Medalam, Belong, Maruyu, Pakaton, Kuala Medalam, Kuala Medalam Behanu, Rantau Kiran, Ng. Awang and Ng. Medamit, which

population are all less than 100 except for a case of Ng. Medamit (378 in the year 1977). In this area, there may exist the potentials for foresty, but it is yet undeveloped due to the designation as a national park. Also almost no other kinds of development are being carried out.

Accordingly, in this section, the comparative routes A, B and C are selected in the area of Mulu National Park as shown in Fig. 10-3.

The route A is to be located in the basins of Sg. Assam and Sg. Mentakong within the steep Mountains of Mulu and Api in the east and those in the west.

The routes B and C are to be located in the direction of north-south in the mountainous or hill area, including saddles which lie between Burunei border in the west and mountains in the east.

The route A may suffer damages annually from the floods since it is located in the tropical rain belt (annual rainfall 2,500 ∿ 3,000 mm). Furthermore the Investigation Team for Mulu Mountain points out that the area has much value for the academic research, and warns against the environmental destruction incurred by the road construction. For these technical and social reasons, this route A shall be delted from the extent of following comparative studies.

10-2 STUDY ON COMPARATIVE ROUTES

Comparison is made on route B and C from such view-points as phisical conditions, alignment designs and construction costs.

The details of the routes are shown in the sheet No. 18 and 19 of attached drawings. (Volume II).

10-2-1 Physical Conditions

The routes B and C run northward in the mountainous and hilly area of 100 ∿ 200m (300 ∿ 600 feets) above sea level covered by the tropical jungle, and they are just located in the tropical rain belt of 2,500 ∿ 4,000mm (140 ∿ 160 inches) in the annual rainfall, so, with a high temperature and moisture.

From geological and soil-mechanical points of view, the both routes are covered by the Upper Cretaceous sedimentary rocks and the Red yellow Podzol Soil.

The route C is very close to the border of Brunei, hence, it is worried for the route to cross with an unidentified portion of the border line. Also it comes a problem that the route exists in the much foulded area.

The route B passes in the saddle 3kms off in the east of route C and, will contribute to the future access to Mulu National Park.

10-2-2 Alignment

Both comparative routes B and C are designed to maintain their service level by adopting the standard for mountains and hills as a geographical condition.

As for a horizontal alignment of route B, it is designed to minimize the curve radius at the point of watershed of both Sg. Putut and Sg. Mentawi, and also to make fewer the number of crossing with meadering of Sg, Mentawai.

In case of that for route C, an accent are laid on the combination of curve radius and vertical alignment.

The vertical alignment is so designed as to reduce the earthwork quantity, and also 6% is adopted as a maximum gradient to meet the traffic capacity with a high rate of large scale vehicles.

The above discussed factors for the alignment design are summarized as in Table 10-1.

Table 10-1 COMPARISON OF ALIGNMENT

		Route B	Route C
i.	Length of Route	27.4km	28.4 kms
ii.	Train	Rolling/mountainous	Rolling/mountainous
iii.	Min. Radius	1,500 m	1,000 m
iv.	Max. Gradient	6%	6%
v.	Length of Bridge	340 m	280 m
vi.	Nos. of Culvert		
	Box Culvert	14	14
	Pipe Culvert	65	67

10-2-3 Construction Cost

The work quantity and estimated construction cost are shown in Table 10-2 and 10-3 respectively.

Table 10-2 COMPARISON OF WORK QUANTITY

		Route B	Route C
i.	Clearing/Grubbing	495,940 m^2	651,360 m^2
ii.	Excavation/Filling		
	Cut. Soil	65,000 m^3	846,675 m^3
	Soft - Rock	-	225,825 m^3
	Hard - Rock	-	56,400 m^3
	Embankment	45,000 m^3	533,030 m^3
iii.	Pavement		
	Subgrade preparation	200,600 m^3	207,900 m^2
	Sub-Base/Base Course	40,100 m^3	41,600 m^3
	Bituminus		
	Primcoat/Surface	200,600 m^2	207,900 m^2
iv.	Bridges		
	Short-Span	1,190.4 m^2	892.8 m^2
	Intermediate-Span	992 m^2	992 m^2
	Long-Span	-	-
v.	Drainage Structure		
	Box-Culvert		
	2.0 x 2.0	72 m	72 m
	3.0 x 2.0	72 m	72 m
	3.0 x 3.0	72 m	72 m
	Pipe-Culvert		
	ϕ 900 m/m	924 m	966 m
	ϕ 1,500 m/m	672 m	672 m
vi.	Guard Rail	14,800 m	17,650 m
vii.	Marking	54,800 m	56,800 m
viii.	Traffic Sign	3 ech	3 ech

Table 10-3 COMPARISON OF CONSTRUCTION COST
(Unit; 1,000 M$)

		Route B	Route C
i.	Construction Cost (a)	15,524	28,813
	Clearing/Grubbing	2,400	3,167
	Excavation/Filling	671	13,329
	Pavement	6,632	6,877
	Bridges	4,487	3,910
	Drainage Structures	289	294
	Guard Rail	977	1,165
	Marking	66	69
	Traffic Sign	2	2
ii.	Contingencies (b) (a x 10%)	1,553	2,882
iii.	Survey and Administration Fees (c) (a + b x 10%)	1,708	3,170
iv.	Total Construction Cost (a + b + c)	18,785	34,869

10-3 STUDY OF ECONOMIC AND TRAFFIC ANALYSIS FOR COMPARATIVE ROUTES

In selecting the route, followings are fundamental Matters in order to progress the development of project area effectively, from the transportational and economic viewpoints.

(1) The route shall pass through Long Lama which will play an important role for the development of area.

(2) It shall pass through the area with high potentials for the agricultural development.

(3) It shall be so located as to permit its feeder roads to access to the main communities as much as possible if required.

(4) It shall have a certain range of the flat area or the area with a future development potential at the crossing point with the main river.

(5) It shall be so located as not to place an desirable effect on the natural resource or ecology conserved in the area.

The route selected in Clause 10-1 complies with the above stated requirements to a considerable extent. We have not found any other competitive alternatives in a process of selection, in sofar as standing at the view points of transportations and economics.

Fig. 10-1 ALTERNATIVE ROUTE

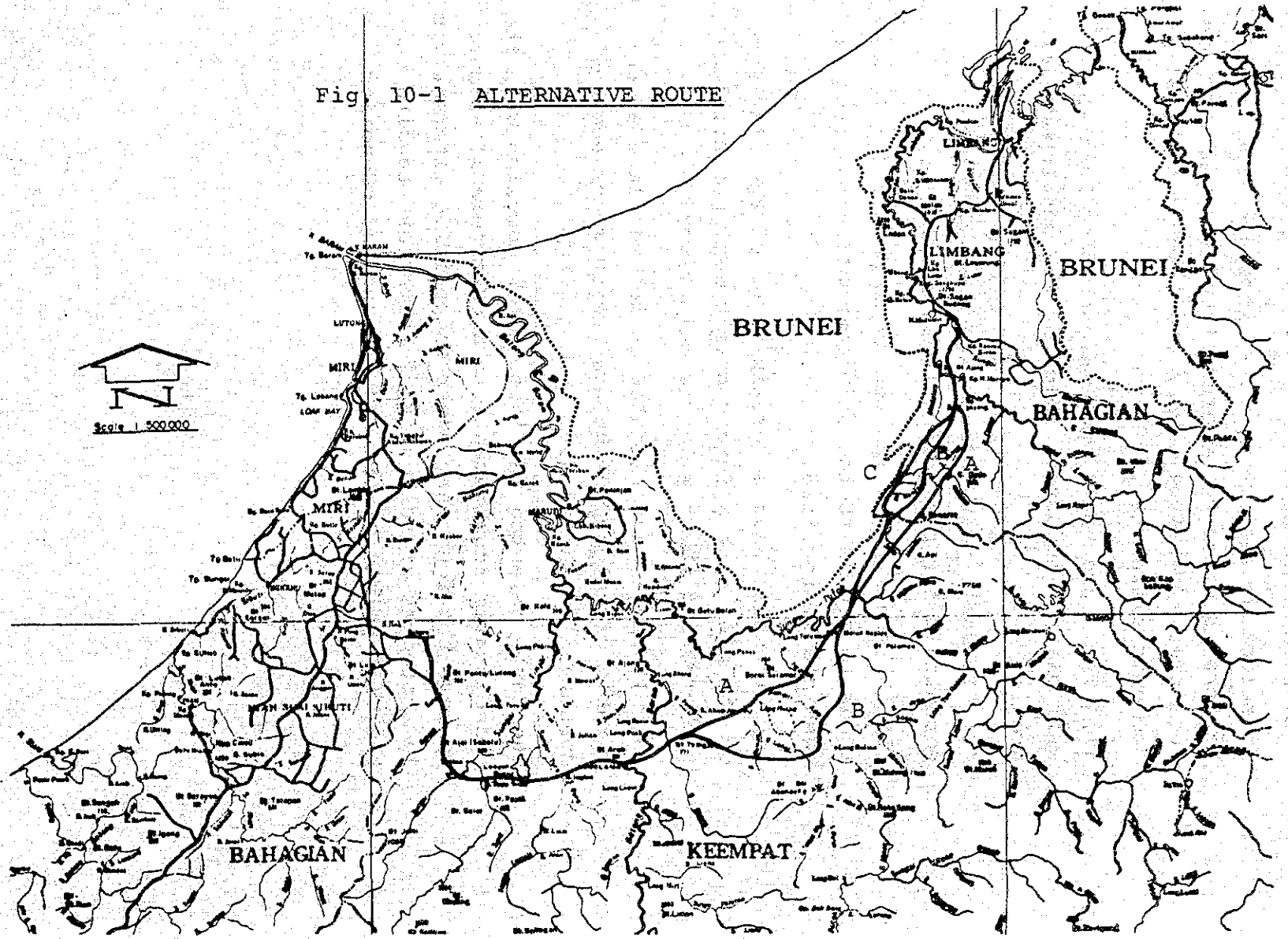


Fig. 10-2 PLAN AND PROFILE (1)

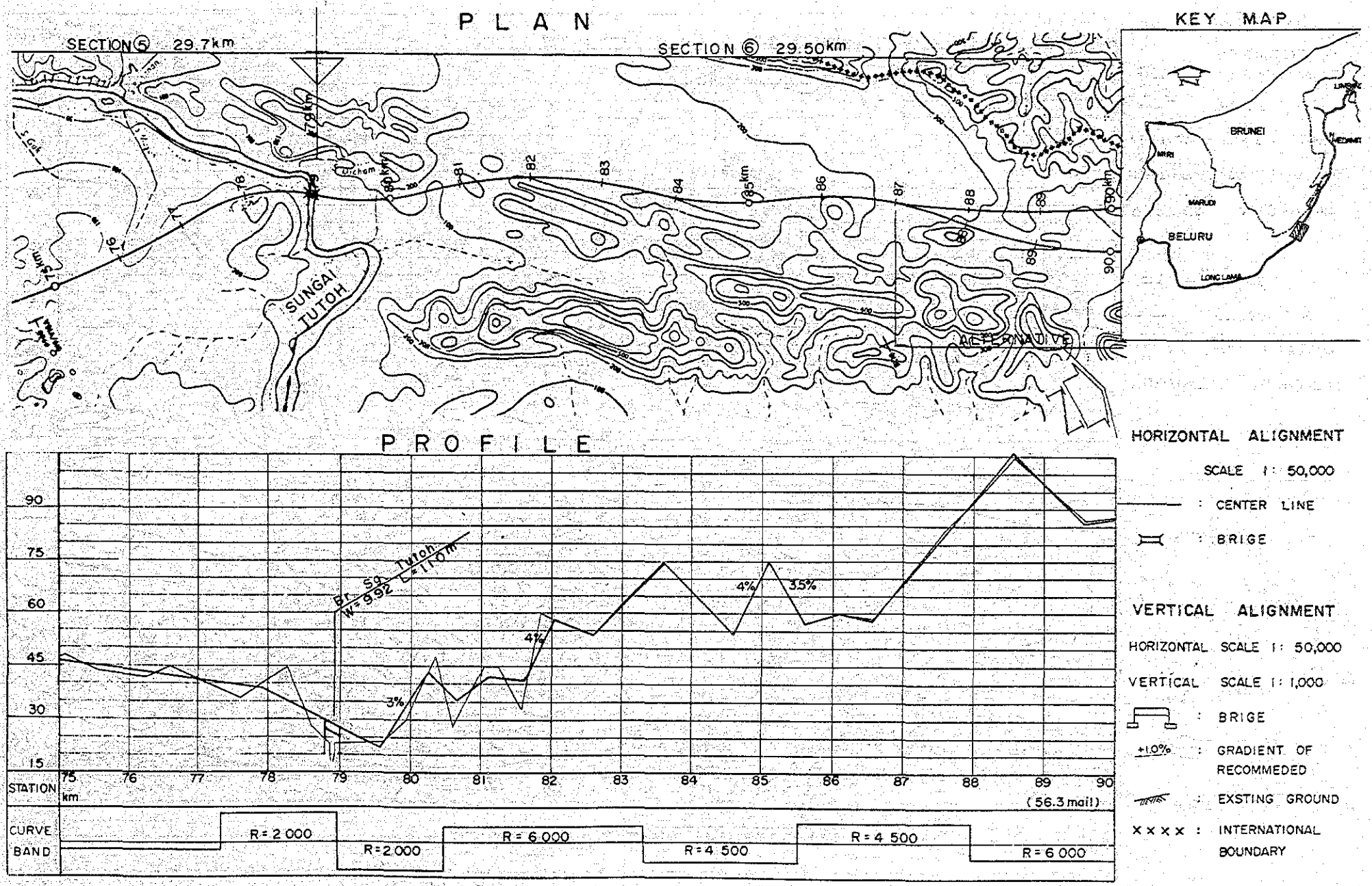
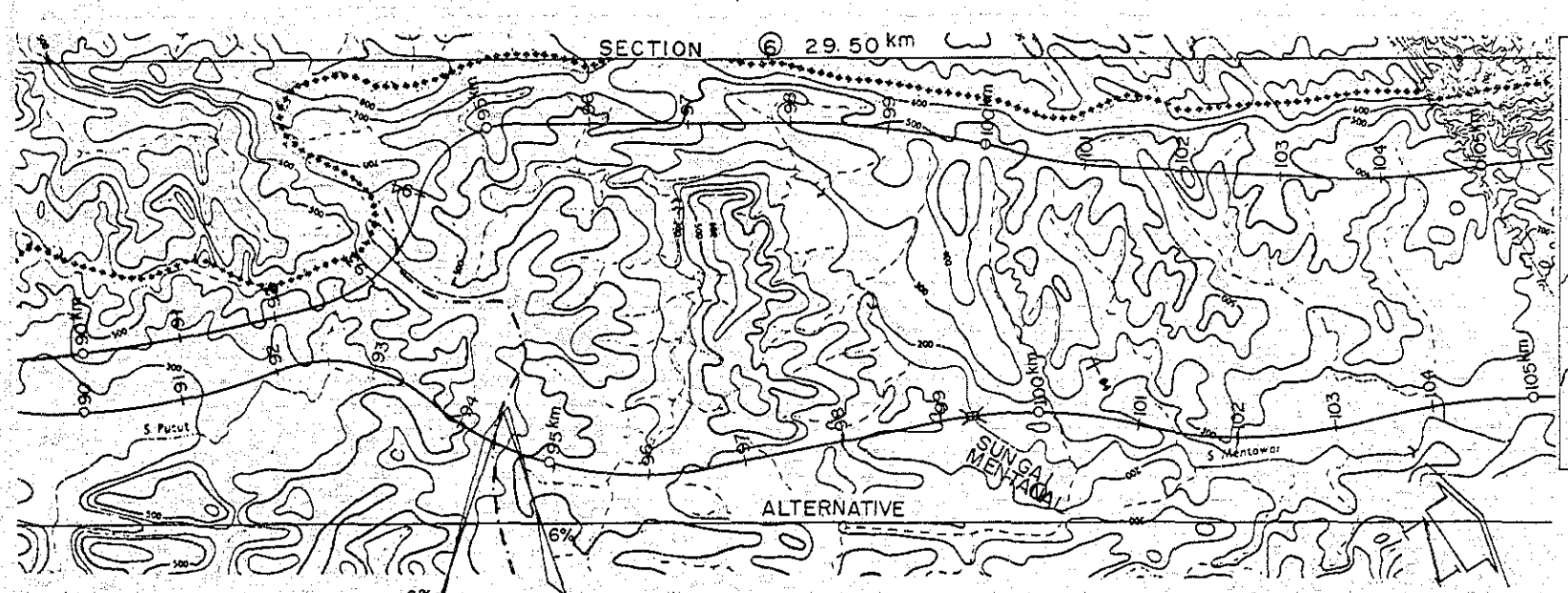
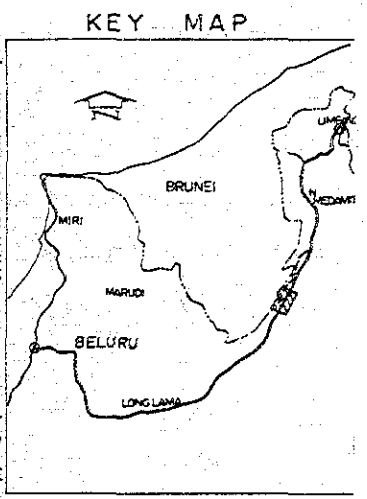
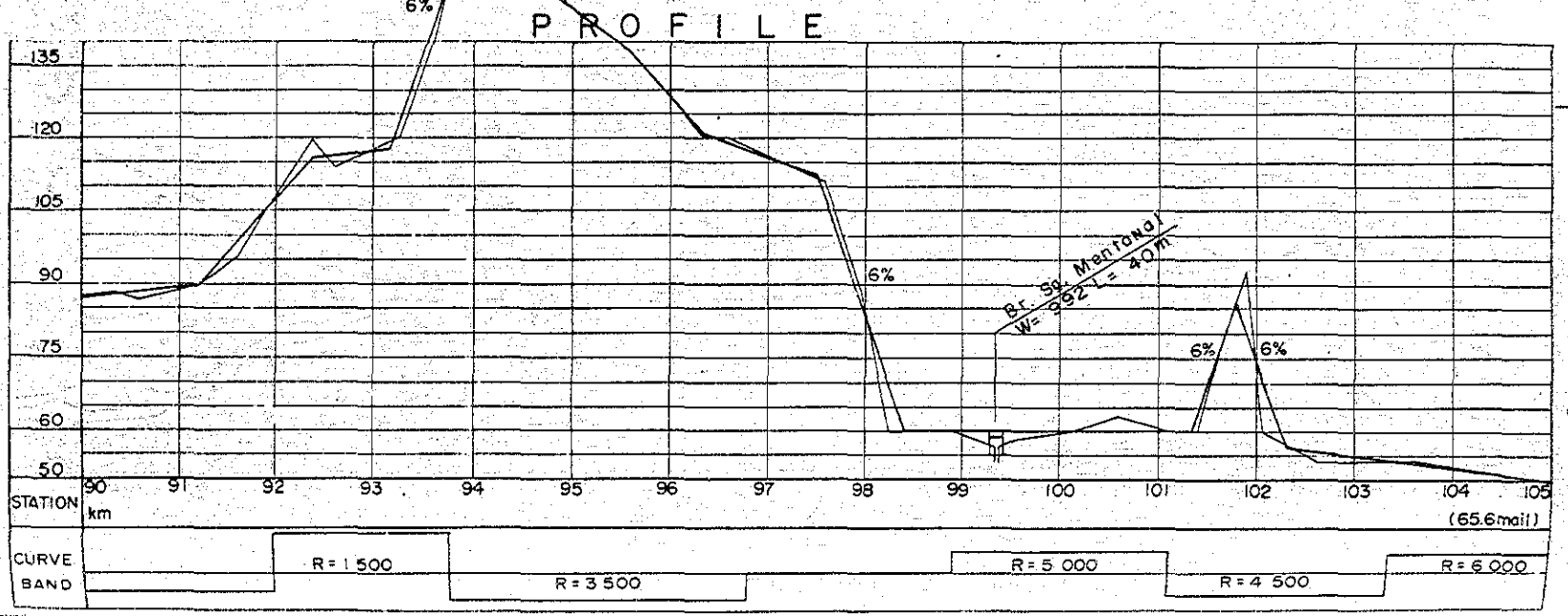


Fig. 10-3 PLAN AND PROFILE (2)







HORIZONTAL ALIGNMENT

SCALE 1 : 50,000

——— : CENTER LINE

: BRIGE

VERTICAL ALIGNMENT

HORIZONTAL SCALE 1 : 50,000

VERTICAL SCALE 1 : 1,000

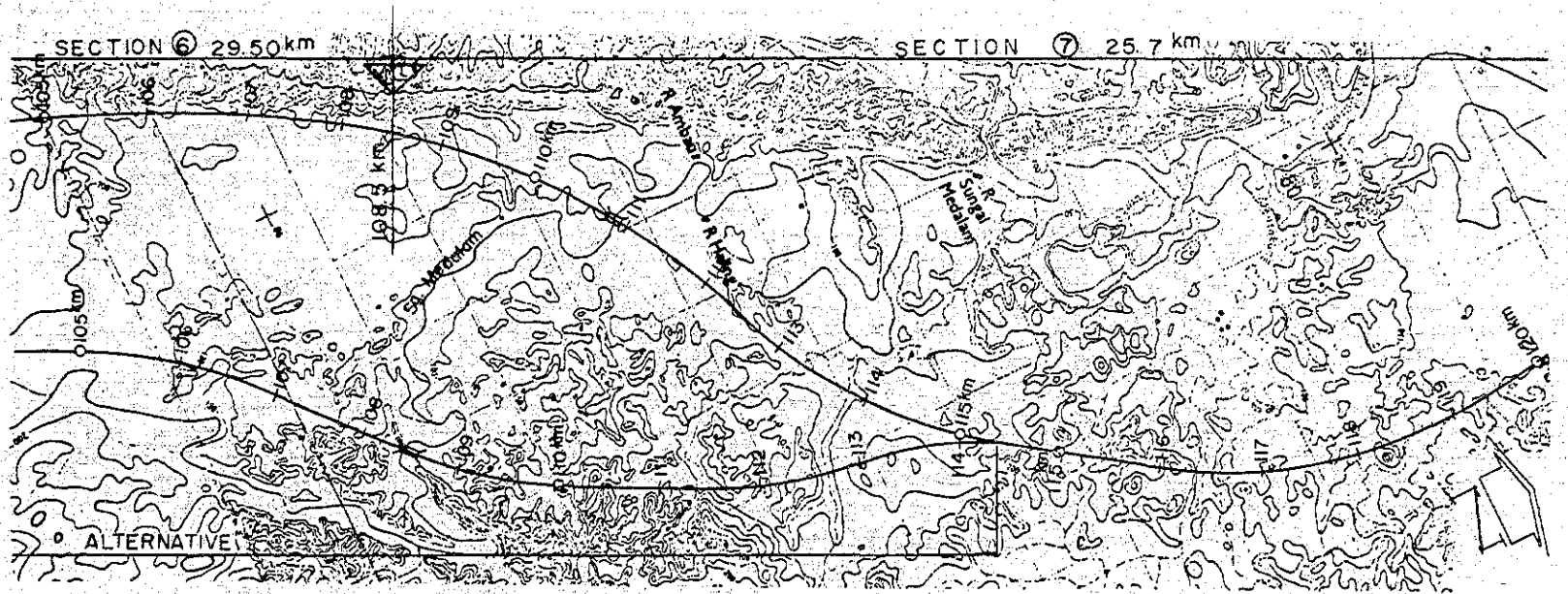
: BRIGE

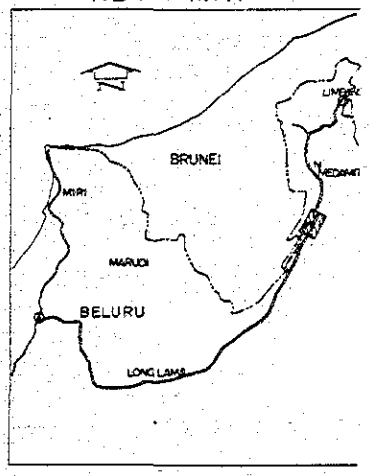
+10% : GRADIENT OF RECOMMEDED

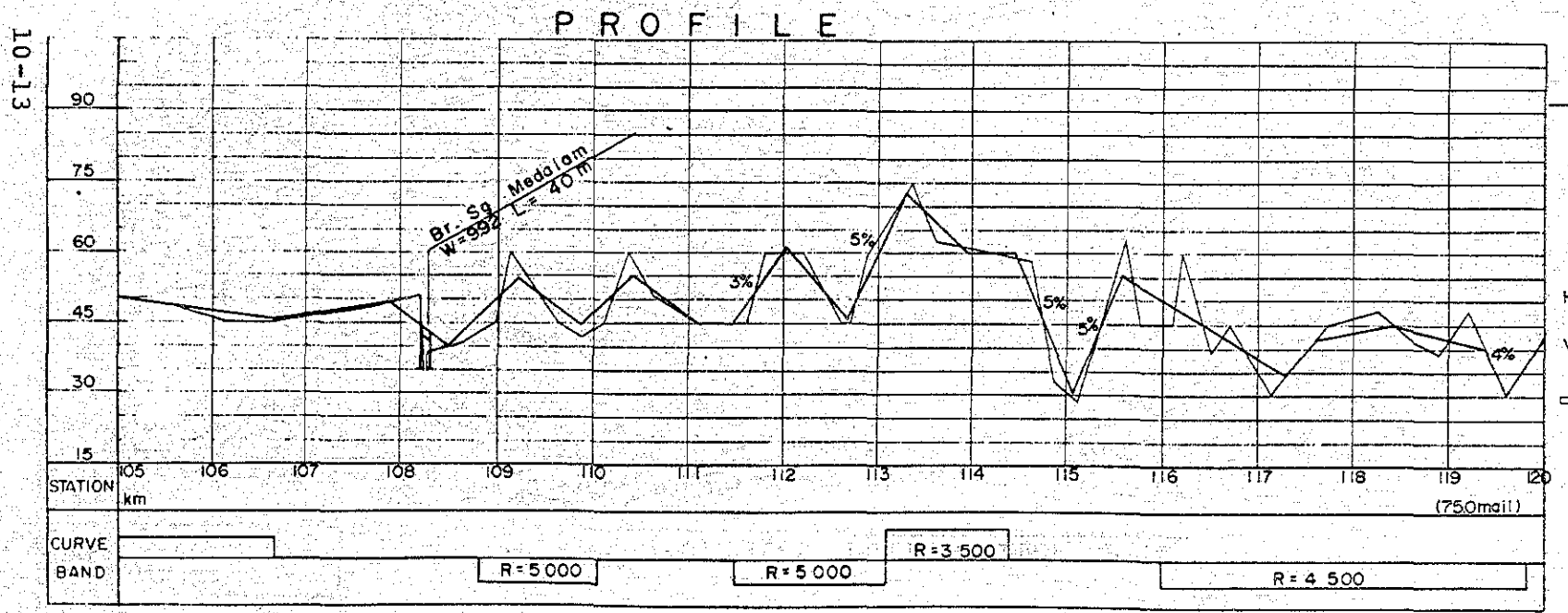
: EXSTING GROUND

× × × × : INTERNATIONAL BOUNDARY

Fig. 10-4 PLAN AND PROFILE (3)







HORIZONTAL ALIGNMENT

SCALE 1 : 50,000

: CENTER LINE

: BRIGE

VERTICAL ALIGNMENT

HORIZONTAL SCALE 1 : 50,000

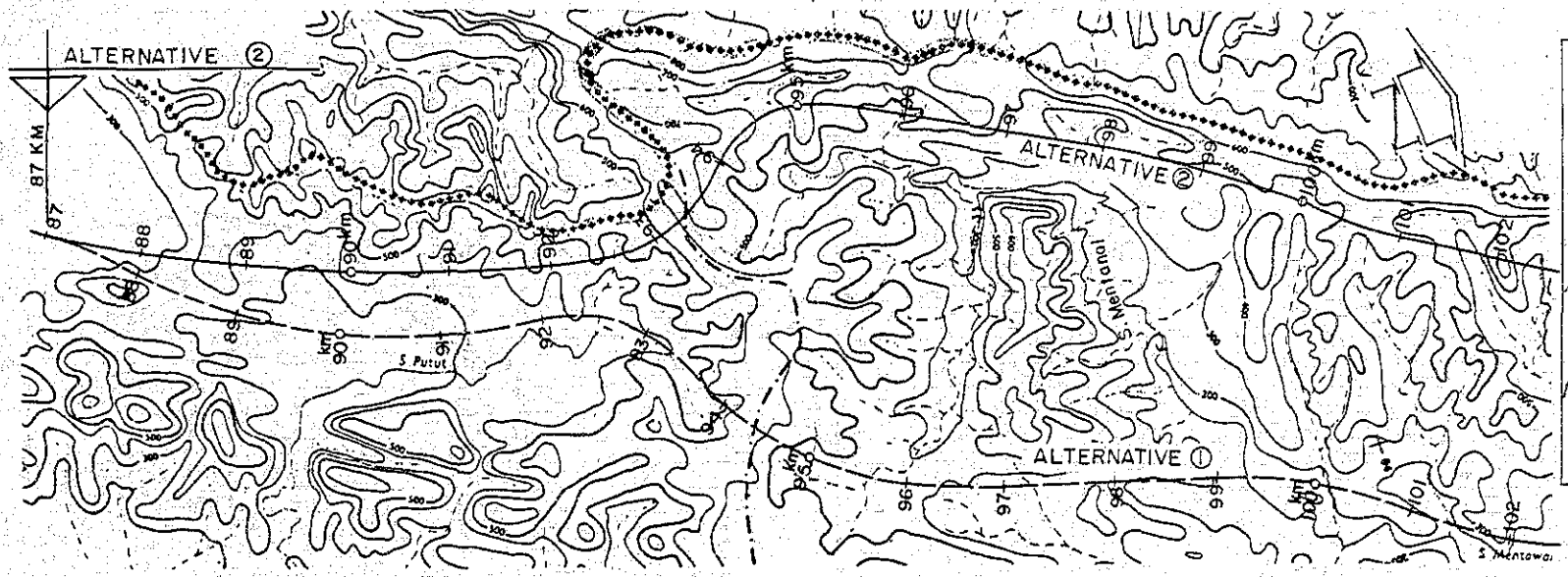
VERTICAL SCALE 1 : 1,000

: BRIGE

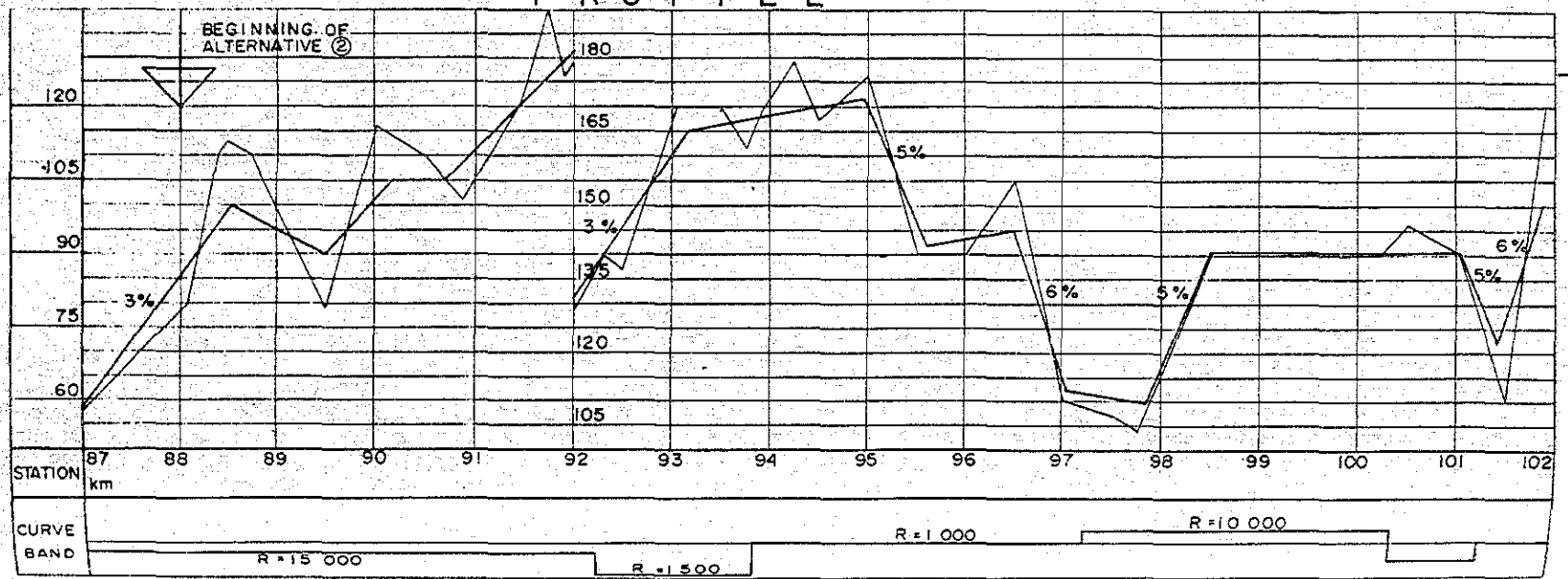
±10% : GRADIENT OF RECOMMEDED

: EXSTING GROUND

Fig. 10-5 PLAN AND PROFILE (4)



PROFILE



HORIZONTAL ALIGNMENT

SCALE 1 : 50,000

: CENTER LINE

: BRIGE

VERTICAL ALIGNMENT

HORIZONTAL SCALE 1 : 50,000

VERTICAL SCALE 1 : 1,000

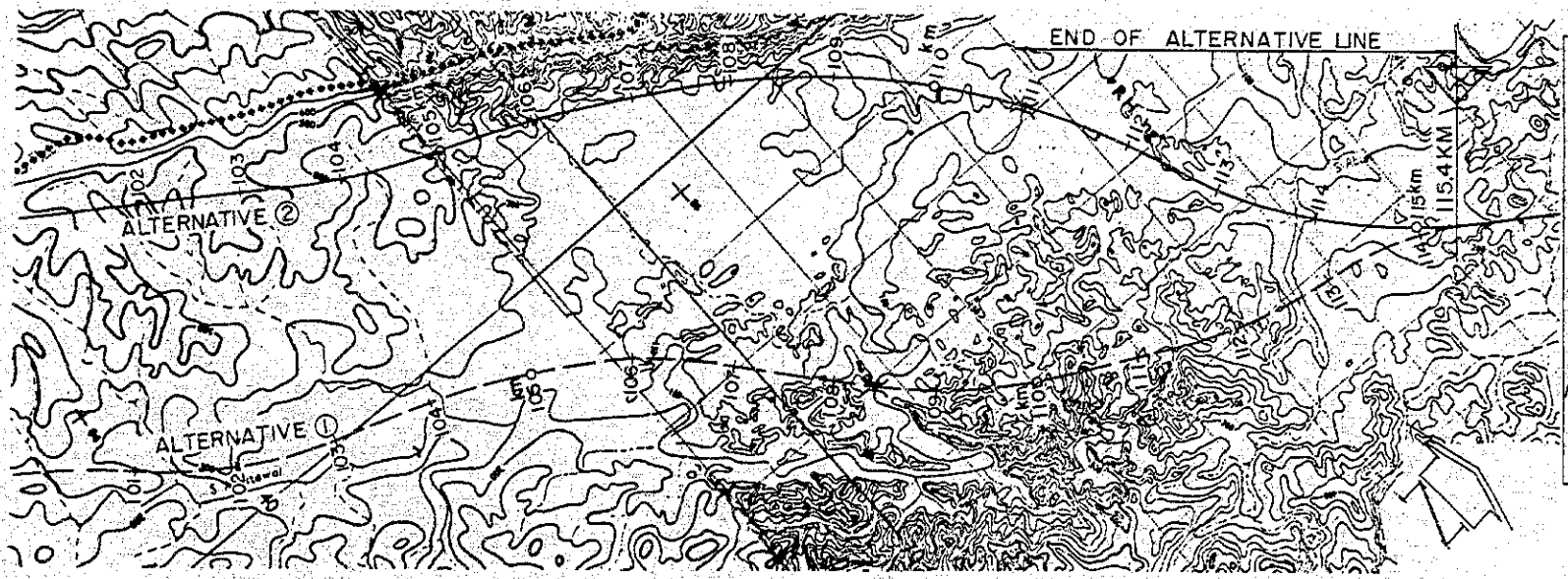
: BRIGE

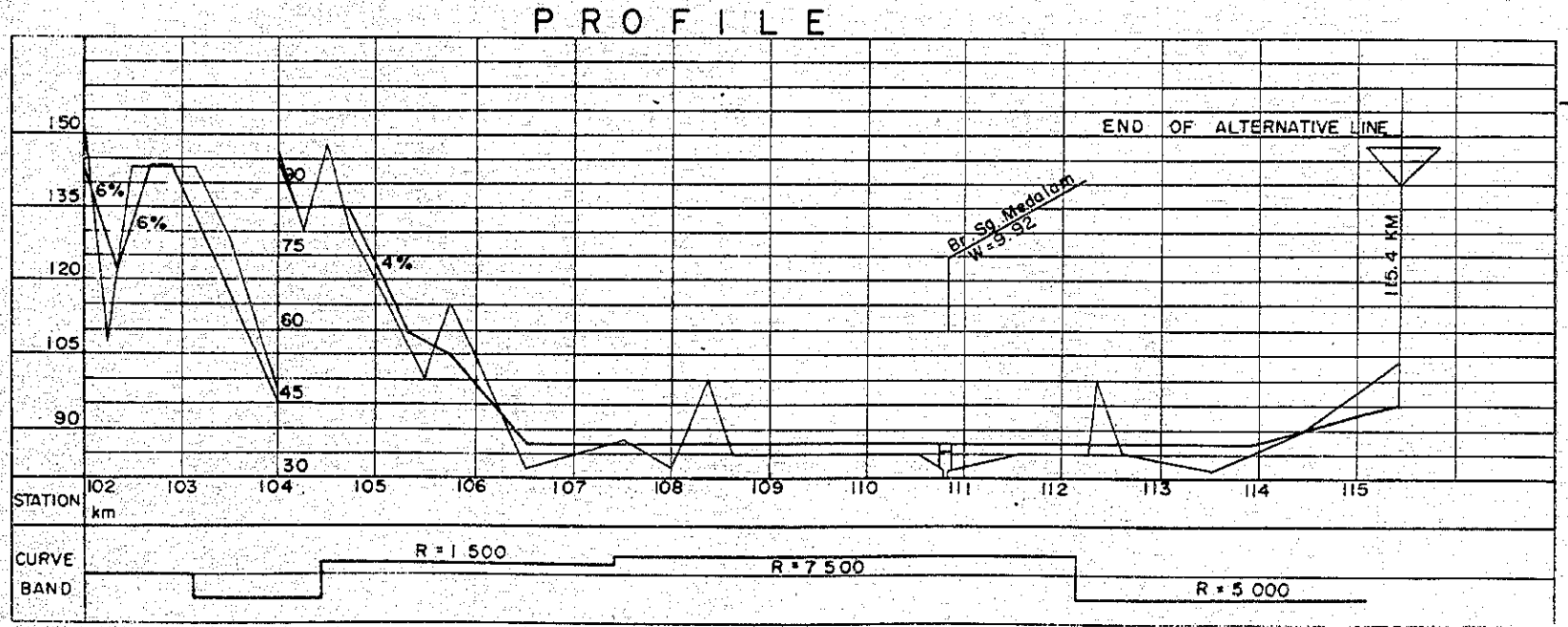
+1.0% : GRADIENT OF RECOMMEDED

: EXSTING GROUND

× × × × × : INTERNATIONAL BOUNDARY

Fig. 10-6 PLAN AND PROFILE (5)





HORIZONTAL ALIGNMENT

SCALE 1 : 50,000

: CENTER LINE

: BRIGE

VERTICAL ALIGNMENT

HORIZONTAL SCALE 1 : 50,000

VERTICAL SCALE 1 : 1,000

: BRIGE

+1.0% : GRADIENT OF RECOMMEDED

: EXSTING GROUND

x x x x x : INTERNATIONAL BOUNDARY