社会開発協力部報告書

No. 9

REPORT ON TOPOGRAPHIC MAPPING PROJECT FOR UPPER STREAM AREA OF NEGARA RIVER BASIN SOUTH KALIMANTAN, REPUBLIC OF INDONESIA

(FIRST YEAR WORK)

AERIAL PHOTOGRAPHY
GROUND CONTROL POINT SURVEY
(NNSS Observation & Leveling)

FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

REPORT ON TOPOGRAPHIC MAPPING PROJECT
FOR
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JAPAN INTERNATIONAL COOPERATION AGENCY

LETTER OF TRANSMITTAL

February, 1984

Mr. Keisuke Arita
President
Japan International Cooperation Agency

We take pleasure in forwarding our report on the First year work of the Topographic Mapping Project of the Upper Stream Area of the Negara River Basin, South Kalimantan, Indonesia as commissioned by the Japan International Cooperation Agency and carried out during the period of July 1983 - February 1984.

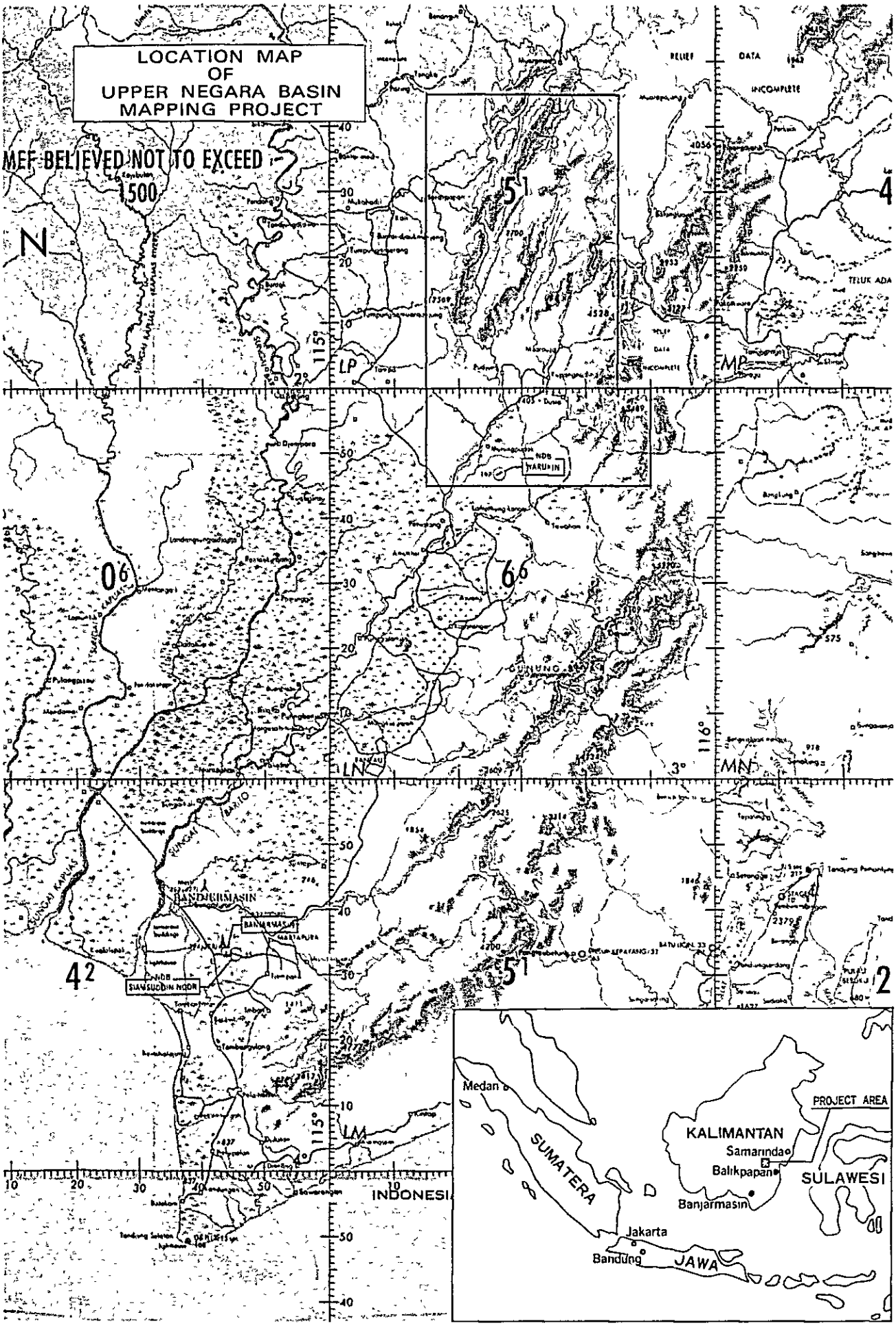
The report describes in detail the First Year work (aerial photography and ground control point survey) conducted under the Project.

We feel certain that, in the course of the work, we have not only fulfiled the basic role to the work commissioned but made a considerable contribution to the development of surveying techniques in Indonesia.

We would like to express our deep appreciation to the officials concerned of the Directorate General of Water Resources Development, Ministry of Public Works, BAKOSURTANAL, South Kalimantan Provincial Government of Indonesia, the Embassy of Japan in Jakarta, Japan International Cooperation Agency, and other governmental organizations for their collaboration extended to our survey work.

It is our sincere wish that the project will proceed on smoothly in the subsequent phases to come.

Eiji Gojo
Leader of Survey Team for
Topographic Mapping Project
for Upper Stream Area of the
Negara River Basin in
South Kalimantan,
International Engineering
Consultants Association


LOCATION MAP
OF
UPPER NEGARA BASIN
MAPPING PROJECT
MEF BELIEVED NOT TO EXCEED
1500
N
LP
MP
LN
MN
LM
INDONESI
BANDJARMASIN
BANJARMASIN
MARTAPURA
SUNGAI BARITO
SUNGAI KAPUAS
NDB
SYAMSUDDIN NOOR
NDB
WARUWIN
GUNUNG
TELUK ADA
RELIEF
DATA
INCOMPLETE
Medan
SUMATERA
KALIMANTAN
Samarinda
Balikpapan
Banjarmasin
PROJECT AREA
SULAWESI
Jakarta
Bandung
JAWA

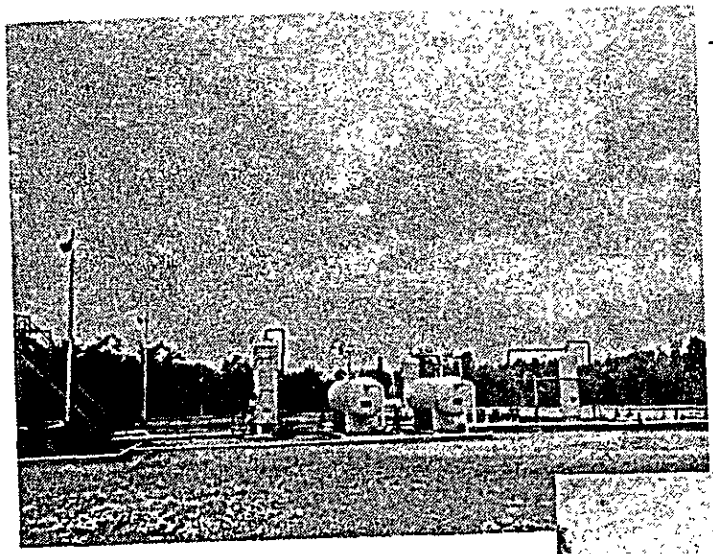
Meeting with DGWRD staff at DPU (July '83, Jakarta)

Signing the contract of aerial photography with P.T. EXSA international Co., Ltd. (July '83, Cibogo)

Meeting with DPU staff at South Kalimantan Provincial Government (July '83, Banjarmasin)

Main street and Mosque in Tanjung
Pasar (market) opens every Saturday along this street

Local houses



PERTAMINA facilities
in Tanjung oil field

Paddy field in
Tanjung area

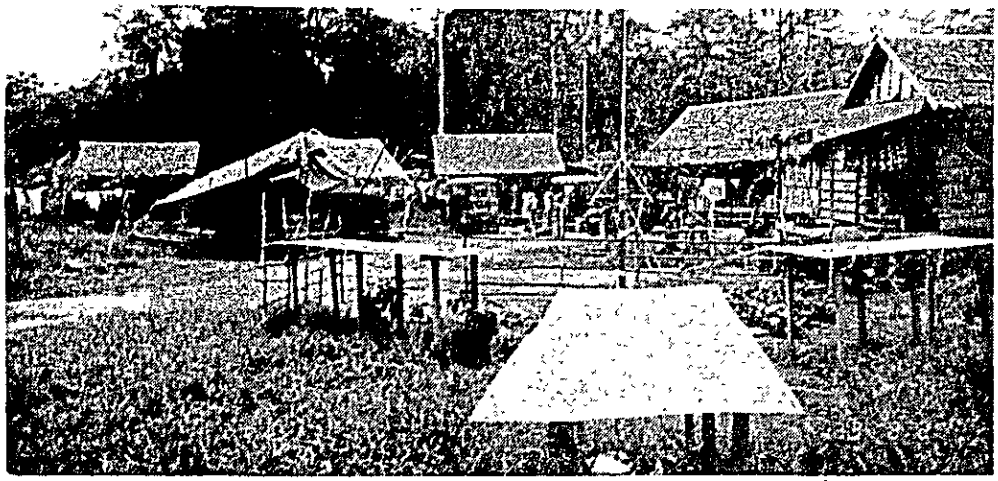
After lambering, jungle
sometimes changes into
the scene like the photo

Shifting agriculture, which
produces tapioca, banana,
maize, etc.
Smoke from burning forests
sometimes causes trouble
in aerial photography

Intersection of National Highway in Tanjung, which leads to Samarinda, East Kalimantan and Buntok, Central Kalimantan

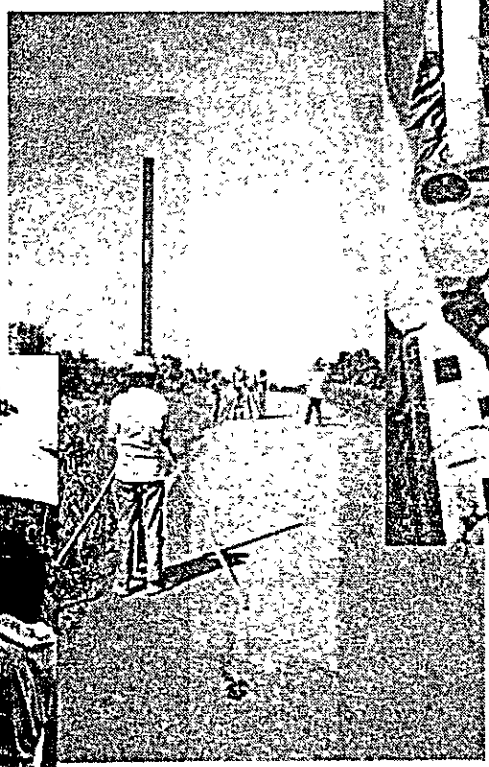
Section of National Highway to Samarinda

Company road for timber transportation



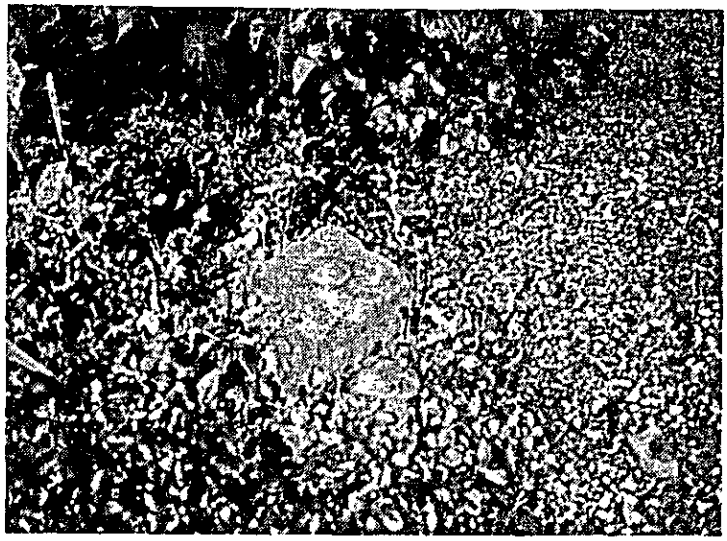
NNSS observation site at NS No.9, where observation was made in the hut (center of background)

Observation work →



Second order leveling on the flat section of the route (mostly undulated)

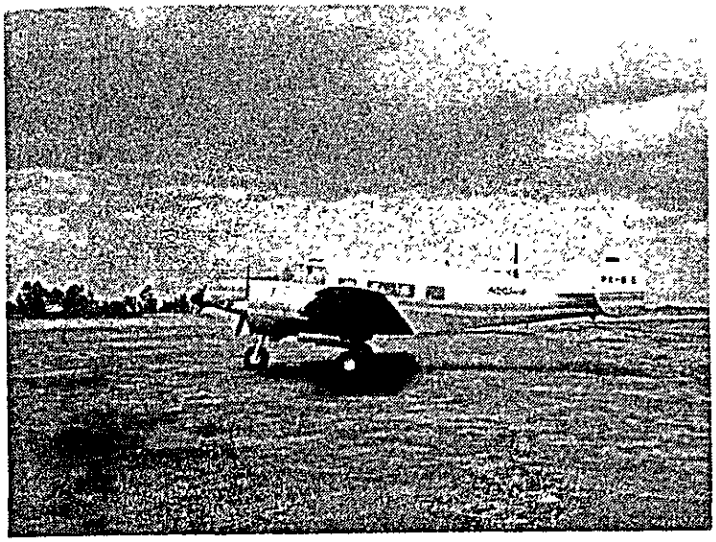
← Third order leveling on Company road section



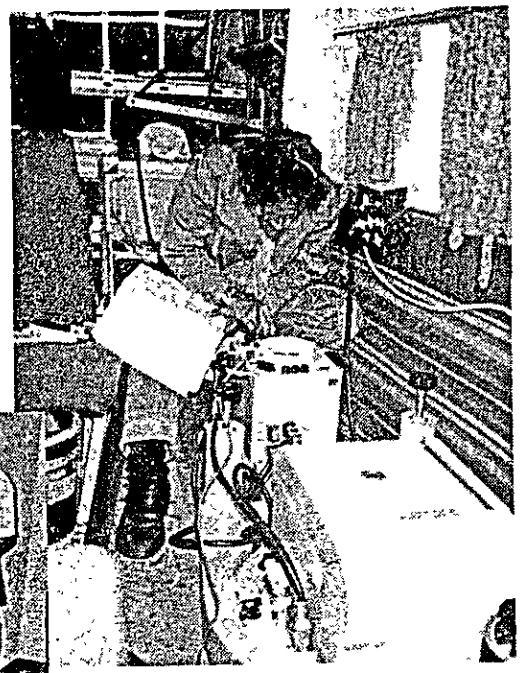
Existing bench mark (PUTL BM-18) in Tanjung, monumented by Indonesian side

Monument (NS No.9) installed by Indonesian side at the first year work

Bench mark monumented by Indonesian side at the first year work



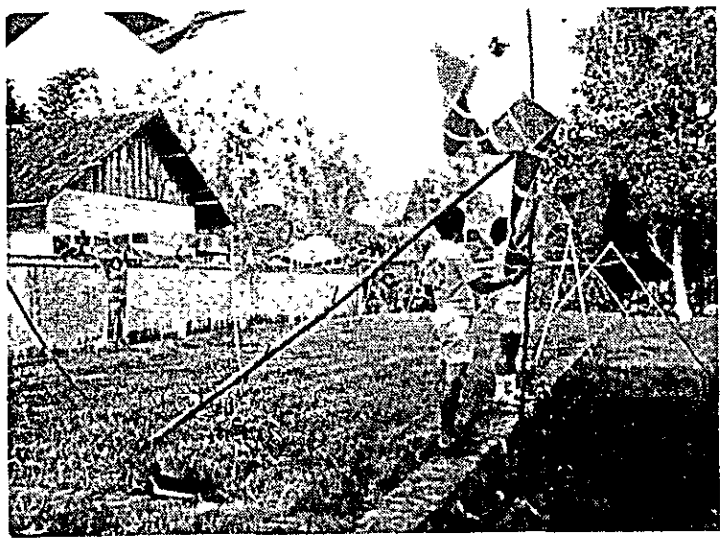
Aircraft for aerial photography at Banjarmasin Airport (Beechcraft Super H-18)

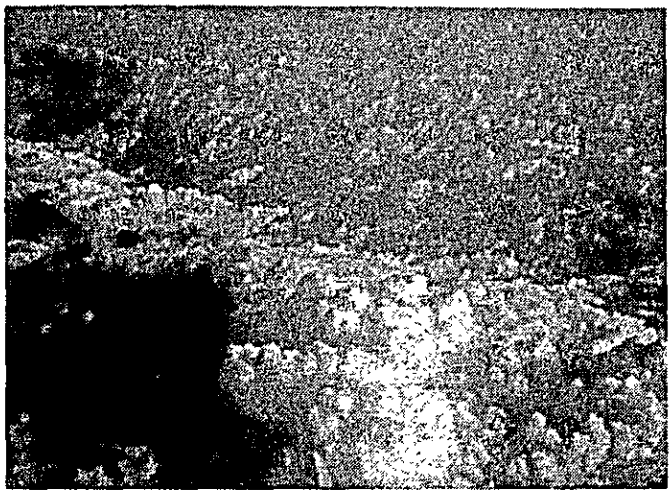


Inside of the aircraft and camera (Zeiss/Jena MRB-A)

Temporary check and photo orientation

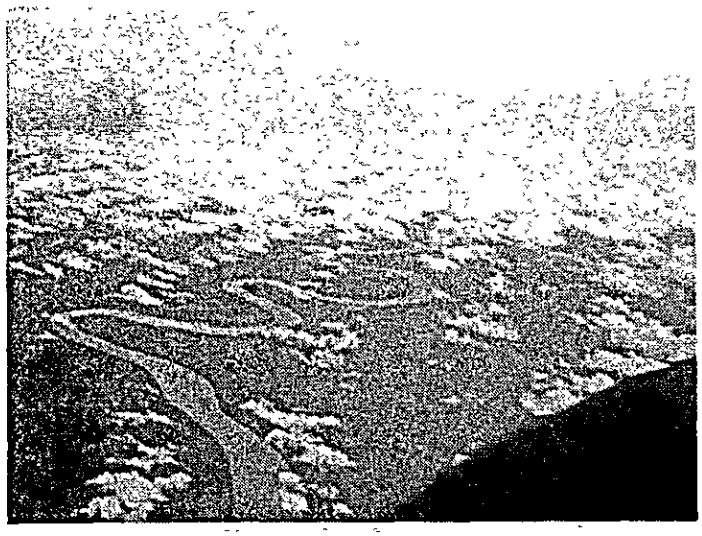
Drying films



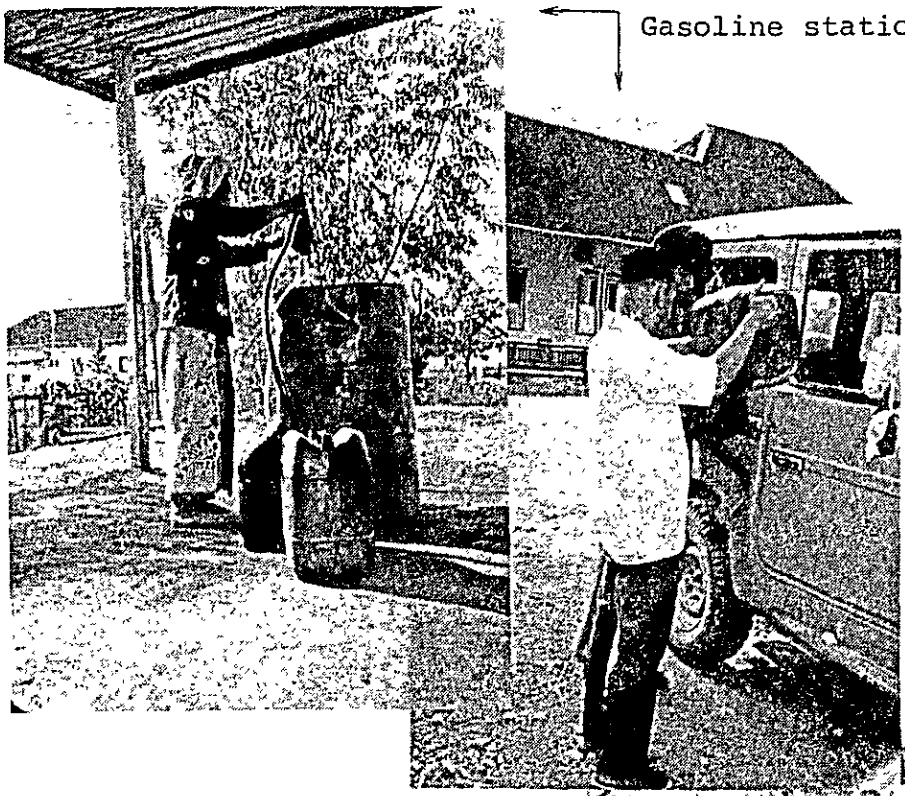


Clouds arising in the northern mountain range flow south-wards and spread over the flat area

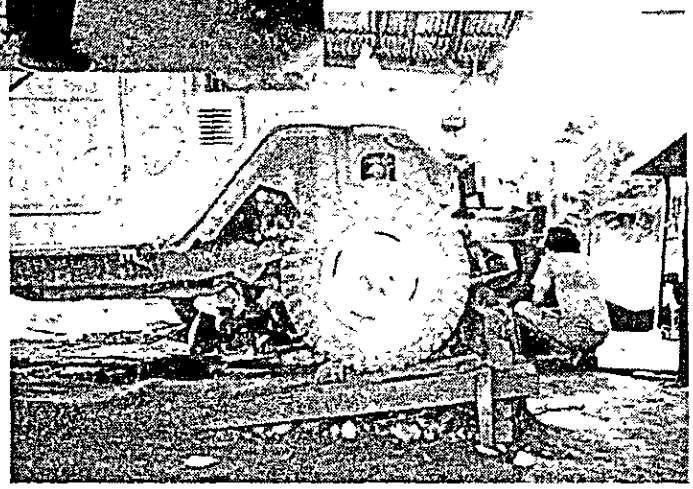
Barito River ⟶

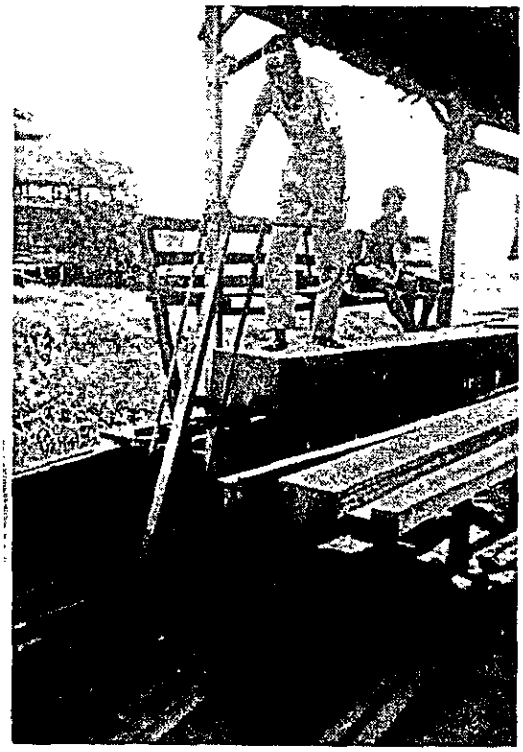


Gasoline station (Tanjung)

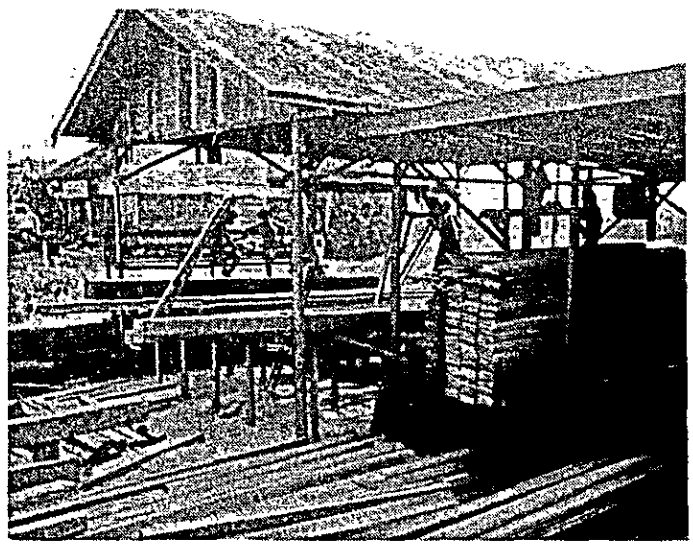


Repair shop (Tanjung)





Sawmill (Banjarmasin)



Pasar in Tanjung

← Dry fishes

Rice →

Vegetables
and fruits →

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Appendices

1. Background

The Government of Indonesia has been promoting regional development programs based on the idea of transmigrating its inhabitants from over-populated areas.

In the South Kalimantan Province, the basin of the Negara Revir, tributary of the Barito, has been selected for the program, the basin being considered as having relatively higher potentiality for development, where development of water resources, agriculture and others are included in the regional development plan. Planned migration has already been made in certain parts of the basin for rubber plantation. However, the basic and useful materials required for promoting the program such as national geodetic controls, basic maps etc. have been not available for the region, and it is now felt urgent to provide the region with such essential materials.

Under the circumstances, the Governemnt of Indonesia has requested to the Government of Japan cooperation for the topographic mapping project of upper stream area of the Negara River basin in South Kalimantan.

The preliminary survey was carried out for the project by the Japan International Cooperation Agency (JICA) for about fifty days of February - April, 1983.

During the preliminary survey, a series of meetings was held with the Directorate General of Water Resources Development,

Ministry of Public Works, and the Scope of Work* was signed on the 14th of April, 1983 between both Governments.

This project will, based on the Scope of Work, be carried out for the period of three years beginning from the fiscal year 1983 to 1985, consisting of the following major work:

Aerial photography :	Scale,	1/60,000**
	Area	coverage approx. 10,000 km^2
Topographic mapping:	Scale	1/50,000
	Area	coverage approx. 6,500 km^2

Note: * Topographic mapping project of downstream area of the Negara River Basin is also set forth in this Scope of Work.

** As described in the Paragraph 4-1-1 of this Report, the scale of aerial photography has been changed to 1/50,000

2. Outline of Work

2 — 1 Purpose

The first year work includes aerial photography and ground control point survey (i.e., NNSS observation and leveling) for the period of July - October, 1983, proce-sing of the data obtained and preparation of the report.

2 — 2 Outline of Project Area

The project area is in the South Kalimantan Province for the most part, and at the southern end of the Kalimantan (Borneo) Island. The Kalimantan Island, the third largest Island in the world, lies roughly at the centre of the Malay Islands and belongs to the Great Sunda Islands. With the equator almost at its center, the Kalimantan Island is in region of high temperature and high humidity and has annual average temperature of 30°C, annual range of 2 - 4°C and annual precipitation exceeding 3,000 mm. The terrain features of the island with such high temperature and humidity are mountainous on the northern and eastern part of the equator, and low and wet vast swamps formed by rivers such as the Barito, Kapuas etc. extend on the southern and western part of it.

The South Kalimantan Province is divided in the east-west direction by the range of mountains extending in the north-south direction which include Aurbunak, Besar, Lumut, Sarempaka and others with an elevation of 1,000 - 1,800 m. The project area lies to the west of the mountain range. Out of the mountainous area flow many rivers and streams which join to form the

Barito River pouring into the Java Sea. The river Tabalong flows south-ward from the project area, having small streams as it originates in Sarempaka mountains, and joins the Barito river at Marabahan, changing its name on the way to Negara river. In rather dry area in the basin of these rivers are villages such as Tanjun, Amuntai, Banjarmasin.

For about 250 km from Banjarmasin to Tanjun, leads north-ward a national highway which has been maintained in a comparatively good condition. The highway branches off in Tanjun in the project area; one road leads over the mountain range to Samarinda in the East Kalimantan, and the other leads to Buntok in the Central Kalimantan. This is the only one national highway available. They have an enterprize road called "Company Road" of timber company and Petroleum Corporation, which leads to the jungle area and hill area.

Villages in the project area other than Tanjun are Haruai, Muarauya, Kelua, Tanta etc. all scattered along the highway. The most parts in the northern mountainous area are virgin jungle without villages at all. Briefing the terrains, vegetation etc. of the project area, it is hilly terrains generally flat with dense brushwoods and grass and also flat swamp alluvial low lands from the southern to northwesten part, and in the eastern part, it is mountainous area changing to jungle in north.

2 — 3 Work Period

Aerial Photography and Others:

19th of July, 1983 (From departure of HQ Group)

29th of October, 1983 (Till returning home of HQ Group)

Ground Control Point Survey:

26th of July, 1983 (From departure of Field Work Group)

22nd of October, 1983 (Till returning home of Field Work Group)

2 — 4 Organization of Survey Team

Leader	Mr. Eiji Gojo	19/7 - 31/7 (13 days) and 9/11 - 20/11 (12 days)	
Deputy Leader	Mr. Hiroshi Kimura	19/7 - 29/10	(103 days)
Supervisor of Aerial Photography	Mr. Mamoru Murata	ditto	
Chief Surveyor	Mr. Yoshiaki Ohtoku	ditto	
Photo Processing	Mr. Tsutomu Shimizu	19/7 - 22/10	(96 days)
NNSS Observation Leveling	Mr. Nobuo Shimizu	26/7 - 22/10	(90 days)
ditto	Mr. Hiroo Morita	ditto	
ditto	Mr. Shigenori Uchimura	ditto	
Levelling	Mr. Mikio Togashi	ditto	
ditto	Mr. Eisei Tsutsumi	ditto	
NNSS Observation Leveling	Mr. Tokuhei Matsuo	ditto	
ditto	Mr. Toshio Osato	ditto	
ditto	Mr. Keiji Ishihara	ditto	

2 — 5 Amount of Work

(1) Aerial Photography

Scale	1:50,000
Area	approx. 8,500 km^2
Course	17 Courses
No. of photo	461 Sheets

(2) Ground Control Point Survey

i)	NNSS Observation	10 Sta.
	Monumentation	10 Sta.
ii)	Second Order Leveling	70 km.
	Monumentation	17 Sta.
iii)	Third Order Leveling	113.69 km
	Monumentation	13 Sta.
iv)	Indirect Leveling	21.87 km

2 — 6 Plan and Results

		Amount of Work	
		Plan	Results
NNSS observation		10 Sta.	10 Sta.*
Second Order Leveling	Distance	70 km.	70 km.
	Monumentation		17 Sta.**
Third Order Leveling	Distance	80 km.	113.69 km
	Monumentation		13 Sta.**
Indirect Leveling		70 km.	21.87 km.

* Observation was also made at one supplementary control point (7') which was monumented.

** The points were selected by Japanese Team and monumentation was made by Indonesian Team

2－7 Major Equipment

The main equipment and apparatus used in the first year work are as follows:

(1) Aerial Photography

1) Aircraft	:	Beechcraft Super H-28	
		Registration No. PK-BIE	
2) Aerial Camera	:	Zeiss/Jena MRB-A 9/2323	
		No. 243898/B	
3) Film	:	Kodak Plus-X Aerographic 2402	

(2) Photo Processing

1) Developer	:	Morse Co. Processing Kit	
		(Rewind type)	
2) Contact Printer	:	Log Electronic Co.	
		Electronic Printer	

(3) NNSS Observation

1) Observation Instrument	:	JMR-4 Surveyor	1 set
		JMR-3	3 sets
2) Meteorological Instrument	:	Ohta Keiki Co. Meteorograph	3 units
3) Computer	:	Univac Vangurd 1100/60	
		computer	

(4) Direct Leveling

1) Level	:	Nikon Autolevel AS	1 set
		with micrometer	
		Sokkisha Autolevel BIC	2 sets
		with micrometer	

		Topcon Autolevel AT-F3	1 set
		with micrometer	
2) Staff	:	Wild Invar Rod	1 set
		Mikasa Folding Staff	2 sets

(5) Indirect Leveling

1) Theodolite	:	Wild T2 Transit	1 set
2) Distance Meter	:	Sokkisha RED-1A	1 set

2 — 8 Survey Schedule

The survey schedule for the first year work is shown in the Appendix.

2 — 9 Supervision of work

At the beginning and end of the first year work, the Japan International Cooperation Agency sent a Supervisory Group for meetings with the Directorate General of Water Resources Development, Ministry of Public Works, the Provincial Government of South Kalimantan and for supervisory work as follows:

Mr. Kazuo Komaki, Deputy Director of 2nd Geodetic Division, Geodetic Department, Geographical Survey Institute, (G.S.I.), Ministry of Construction	19/7 - 31/7 (13 days) and 9/11 - 20/11 (12 days)
Mr. Akira Ukiya, Senior Staff, Social Development Cooperation Bureau, JICA	19/7 - 31/7 (13 days)
Mr. Yoshiharu Mawatari, First Training Division, Training Affairs Department, JICA	9/11 - 20/11 (12 days)

2－10 Meetings with Indonesian Side

At the end of July when the field work was launched and in the middle of November at its termination, meetings were held with the Indonesian side (See the Minutes of the Meetings attached).

2-10-1 Meeting at the beginning of the field work (21/7, 23/7, 28/7, 29/7)

Proposed plan of operation was explained about by the Japan Side and followed by discussion out of which the following were agreed upon:

(1) Photographic scale was changed from 1/60,000 to 1/50,000.

(2) Partial modifications were agreed to be made on the specifications of aerial photograph including overlap and others.

(3) The NNSS points were agreed to be signalized.

(4) The results of NNSS observation were agreed to be converted to the Indonesian Coordinate system (Padang Datum which adopts GRS-67 ellipsoid).

(5) The NNSS observation mode was discussed.

(6) It was agreed that both horizontal and vertical control points will be monumented by the Indonesian side.

(7) Agreement was reached on the matter of cooperations to be offered from the side of Indonesia which includes participation in the field work by the counterparts

2-10-2 Meeting at the end of field work (12/11, 17/11, 19/11)

At the meeting, the Japanese side reported the results of the first year field work and also explained of the tentative plan for the second year work of the project. It was agreed as follows:

(1) The numbering was decided for NNSS points and bench marks.

(2) Concerning the computation of the NNSS observation results, it was agreed that the Japan side would compute them using broadcast ephemeris; recomputation using precise ephemeris would be carried out by the Indonesian side. The other relevant procedures were also agreed upon.

(3) The clearance for taking the aerial photographs out of Indonesia was discussed.

(4) Request was made for the participation in the proposed second year field work by the Indonesian consultant.

2-11 Cooperation of Indonesian Counterparts

During the first year work, smooth and efficient execution of the work was realized through sincere collaboration of the following Indonesian counterparts:

(1) Mr. Supardi F., Jakarta DPU

(2) Mr. Hendarsyam, "

(3) Mr. Abdurahman, "

(4) Mr. Suwoto, Banjarmasin DPU

(5) Mr. Nana Nasuha, Banjarmasin DPU

(6) Mr. Syamsul Bachri Noor, "

(7) Mr. Tendy Suryantono, "

(8) Mr. Didy Sukardi, "

(9) Mr. Jure Sinaga, " (Temporary)

(10) Mr. Agus Susanto, " (")

2—12 Visit of Indonesian Counterpart to Japan

The Indonesian official (counterpart) listed below visited Japan on the 24th of January, 1984 carrying the aerial photographs of the Negara basin. The purpose of his visit is for security of the photographs and study of photogrammetry.

For some forty-five days till early March, technological training and study tour will be performed at Japan International Cooperation Agency, Geographic Survey Institute, Ministry of Construction, International Engineering Consultants Association and otherprivate firms concerned.

The name of the counterpart:

Mr. Beddi Juwadi
Staff of Dit. Planning and
Programming, DGWRD, DPU

3. Preparation for Field Survey

3 — 1 Survey Headquarters (Base Camp)

The survey headquarters and base camp were set up at the address given below. The town of Tanjung has a population of about 20,000 and is the center of administration, economy, culture etc. for the Kabupaten of Tabalong. A few shops are available in the town. The national highway leads from Banjarmasin to Tajung, where it branches off to Central and East Kalimantan. Thus, Tanjun occupies convenient location transportation in the project area. However no modern hotels can be found in this town. The headquarters was set up in one of the local inns traditionally utilized by the travelling salesman, the selected inn being provided with comparatively good accommodation facilities.

The address of the headquarters:

PENGINAPAN TABALONG

TANJUNG, SOUTH KALIMANTAN

3 — 2 Charter of Survey Vehicles, etc.

It was not possible to charter vehicles necessary for survey activity in Tanjung, so the chartage was made in Banjarmasin. Considering the local terrain conditions which are hilly for the most part, and the roads are poor, the selection of vehicle type and driver were carefully made. Due to the limited supply both in quantity and quality in Tanjung, the necessary equipment and materials were purchased in Banjarmasin.

3 — 3 Telecommunication

Except for the District Police Station and District Office, no telephonic facilities are available and these are not open for the public but for official use only. Neither could be used wireless radios due to Indonesian rules and regulations concerned. Postal service is not good neither, and it takes about fifteen days (the slowest arrival) for a letter of reach Banjarmasin from Japan via Jakarta.

To communicate with Jakarta or Japan, it was necessary to drive up to Banjarmasin, where, due to poor telephone communication, the team member had to fly to Jakarta when urgent.

3 — 4 Traffic Permit ("Surat Jalan")

It is requested that the survey team members working in Indonesia carry the traffic permit. However, it takes time to obtain such permit. In preparing work schedule, this should have been taken into consideration.

4. Aerial Photography

4 — 1 General

4-1-1 Photographic Plan

The photographic scale and flight courses have been decided upon as follows

(1) Photographic Scale: Based upon the agreement reached in the meeting with the Indonesian side held at the beginning of the field work, the photographic scale has been changed from 1/60,000 to 1/50,000 considering the altitude of clouds in the project area, ascending and navigating abilities of aircraft, etc.

(2) Flight Course: Considering the local meteorological conditions that would cause clouds to move from the northern mountainous area towards the southern flat area, and also the trends of air current, the flight courses have been designed in the east-west direction.

4-1-2 Photographing Contract

The Indonesian rules and regulations prohibit aerial photographying made by the planes registered in foreign countries, and photographing operations should be commissioned to the Indonesian firm. Also, flight permit is essential for photographing. Several local survey firms were carefully considered for the contract referring to their photographing ability, equipment, operational records, cost, etc., and P.T. Exsa International Co., Ltd. was selected for the contract. Negotiation

for the contract commenced on the 22nd of July and contract agreement was reached on the 29th of July (See Contract Agreement in the Appendix).

4-1-3 Photographing Base

In the outskirts of Tanjung in the southern part of the project area is Warukin airfield which is for the exclusive use of Pertamina Petroleum Corporation, however the airfield is not always satisfactory to fuel supply, photographic processing, climbing hours for the plane, etc. and Siamsudin Noor airport in Banjarmasin was used.

4-1-4 Weather Conditions

The field work was in part affected by the world-wide unusual atmospheric phenomena to which Indonesia was no exception, and the field work had to suffer staggered rainy season, abnormal amount of precipitation, etc. Rainy-season-like phenomena took place every day - partial blue sky observed in the morning, but abrupt change taking place in the afternoon with squall that lasted from score of minutes to hours. General meteorological conditions were by no means good.

4 — 2 Signalization

Considering the photographic scale, difficulty expected in princking, etc., discussion was made with the Indonesian side, and the horizontal control points were agreed to be signalized.

4-2-1 Point Distribution

Signalization was distributed referring to the NNSS observation points.

4-2-2 Point Selection and Signaligation

(1) Point Selection

The following were considered in selecting points to be signalized:

a) Signalization is to be made at the NNSS observation points, or within several tens of meters from the NNSS observation point.

b) Angle of visibility to the near-by structures or crown top of the tree should be proper, and aerial visibility from the plane should be good.

b) There should be no reflective point in the vicinity nor object similar to the signal so that the signal can be clearly identified on the photograph.

(2) Signals Established

The signals have been set up in collaboration with the Indonesian counterparts in accordance with the following specifications:

a) Shape: Y-type with three rectangular vanes

b) Size of vane: 90cm x 250cm

c) Material: 5mm-thick plywood painted in white

4-2-3 Eccentric Measurement

Considering the position of the signal for the station D-A608 (NS-8) being not at the proper position of this station, and the signal being threatened with loss at some future time, photo-identifiable objects were selected in the vicinity for eccentric measurement. The work was made with a magnetic compass and a steel tape. For magnetic declination, the value

of magnetic declination shown on the existing 1/250,000 map was used. Due to non - availability of proper object and distance from station to eccentric station being more or less 100 meters at D-A602, D-A605, D-607, D-A608, eccentric measurement was conducted comprising of azimuth observation using the sun, angle measurement using a theodolite and distance measurement using a distance meter.

4 — 3 Photographing Work

4-3-1 Outline of Work:

The mountainous area in the central part of Kalimantan where the project area is situated is in a region with abundant precipitation all through rainy and dry seasons. Even in the plain area, it never fails to rain in the afternoon though it is fine in the morning. The photographing work had to be conducted with a careful attention to the weather trend. In principle, photographing operations were to be performed on a daily basis, and the flight crew were instructed to photograph any possible course so far as it could be covered without any particular trouble to follow.

Due to the scale of maps used for preparing photographing plan being too small, it was quite difficult to identify the terrain features in approaching the proposed flight course from the mountainous area.

The total distance of each flight course is approx. 85km. The photographing hours required for the coverage of one course is about 25 minutes including the hour to approach the course.

Daily operational work was much affected by early appearence of clouds peculiar phenomena to the mountainous area.

The number of photographing days and flight frequency are as follows:

Total photographing days: 49 days

Flight frequency: 47, Total flight hours: 126 hr 05 min

(Breakdown):

Flight hours for exposure: 31 hr 50 min

Return without exposure: 94 hr 15 min

4-3-2 Daily Photographing Report:

	Date	Work	Flight Time	Weather	Remarks
1	Jul 29	Photographing	Photographing contract signed with P.T. EXSA International, Co., Ltd.		
2 ~ 42	Jul 30 ~ Sep 8	Preparatory Work	Acquisition of flight permission from Ministry of Defense, Indonesia, check and adjustment of aircraft, camera, etc. and test flight by EXSA Co.		
43	Sep 9	Mobilization	11:45 ~ 15:20 3h 35 m		Kemayoran Airport to Banjarmasin Airport
44	10	Photographing	13:30 ~ 16:30 3h 00 m	fine/cloudy	heavy clouds, test flight (18 exposures)
45	11	Stand-by		cloudy/rainy	
46	12	Return	12:45 ~ 14:45 2h 00 m	fine/cloudy	heavy clouds, exposure impossible
47	13	Stand-by		cloudy	
48	14	Return	13:15 ~ 15:15 2h 00 m	"	heavy clouds, exposure impossible
49	15	"	13:45 ~ 15:00 1h 15 m	cloudy/fine	heavy clouds and returned
50	16	Photographing	13:30 ~ 16:30 3h 00 m	fine	C-14, 15, 16 & part of C-17 (38 exposures)
51	17	Return	13:00 ~ 14:30 1h 30 m	"	clouds scattered, exposure impossible
52	18	"	13:15 ~ 15:00 1h 45 m	"	" , "
53	19	Photographing	07:10 ~ 11:10 4h 00 m	"	C-11, 12, 13, 14, 15 (115 exposures)
54	20	"	07:10 ~ 11:00 3h 50 m	"	C-8, 9, 10 (88 exposures)
55	21	"	07:10 ~ 11:10 4h 00 m	"	C-4, 5, 6 (90 ")
56	22	Return	07:10 ~ 09:10 2h 00 m	"	clouds scattered, exposure impossible
57	23	"	07:20 ~ 09:25 2h 05 m	cloudy	clouds in high altitude, exposure impossible
58	24	Photographing	07:30 ~ 10:40 3h 10 m	fine	C-15, 16, 17 (56 exposures)
59	25	"	07:10 ~ 11:30 4h 20 m	"	C-2, 3, 11, 17 (99 exposures)
60	26	Return	08:00 ~ 10:30 2h 30 m	"	scattered clouds, exposure impossible
61	27	"	07:10 ~ 09:20 2h 10 m	fine/rainy	exposure impossible
62	28		07:10 ~ 07:25 13:00 ~ 15:10 2h 25 m	fine	scattered clouds, exposure impossible
63	29	"	07:10 ~ 10:00 2h 50 m	"	" , "
64	30	"	07:10 ~ 10:40 3h 30 m	"	" , "
65	Oct 1	"	07:10 ~ 10:40 3h 30 m	"	" , "
66	2	Photographing	07:10 ~ 11:10 4h 00 m	"	C-5, 6, 7, 10, 11 (63 exposures)
67	3	Return	07:00 ~ 09:05 2h 05 m	"	scattered clouds, exposure impossible
68	4	"	07:30 ~ 10:00 2h 30 m	fine/rainy	" , "
69	5	"	07:15 ~ 09:15 2h 00 m	"	" , "
70	6	"	07:00 ~ 09:35 2h 35 m	"	" , "
71	7	"	07:10 ~ 10:45 3h 35 m	"	" , "
72	8	"	07:10 ~ 10:10 3h 00 m	fine	" , "
73	9	"	07:00 ~ 09:10 2h 10 m	"	" , "
74	10	"	07:20 ~ 11:20 4h 00 m	"	" , "
75	11	"	07:00 ~ 09:30 2h 30 m	fine/rainy	" , "
76	12	"	07:15 ~ 10:15 12:40 ~ 14:40 5h 00 m	"	" , "
77	13	"	07:00 ~ 08:40 09:20 ~ 11:00 3h 20 m	"	" , "
78	14	"	07:25 ~ 10:25 3h 00 m	"	" , "
79	15	"	07:10 ~ 09:20 2h 10 m	"	" , "
80	16	"	07:10 ~ 08:55 1h 45 m	cloudy	" , "
81	17	"	07:05 ~ 10:20 3h 15 m	fine/cloudy	" , "
82	18	"	07:45 ~ 08:45 1h 00 m	fine/rainy	" , "
83	19	"	07:10 ~ 09:25 2h 15 m	"	" , "
84	20	"	08:30 ~ 10:30 2h 00 m	fine/cloudy	" , "
85	21	"	07:10 ~ 09:40 14:00 ~ 16:10 4h 40 m	"	" , "
86	22	"	07:10 ~ 09:10 2h 00 m	"	" , "
87	23	"	07:10 ~ 09:10 2h 00 m	"	" , "
88	24	"	07:05 ~ 08:45 1h 40 m	"	" , "
89	25	"	07:10 ~ 09:10 2h 00 m	"	" , "
90	26	Photographing	07:05 ~ 09:35 2h 30 m	"	C-A, C-1 (68 exposures but clouds included)
91	27	Return	07:10 ~ 08:25 1h 15 m	"	Heavy clouds, exposure impossible
92	28	"	07:15 ~ 10:15 3h 00 m	"	" , " (Termination of the contract)

4-3-3 Organization of Photographing Crew

The line-up of the photographing operation is as follows:

Supervisor : Mr. Mamoru Murata

Pilots : Mr Martono, Mr, Suparno, Mr. Tan G.P.

Mechanics : Mr. Utoyo, Mr. Turkan

Navigator : Mr. Pudjono

Photographer: Mr. Sumardi

4 — 4 Photographic Processing and Temporary Check

4-4-1 Photographic Processing Instrument and Materials:

(1) Film Processing

Developer: Morse Co. Processing Kit (Rewind Type)

Dryer : Natural drying

Processing chemicals:

a. Developer: Kodak DK-50

b. Fixer: Kodak Fixer

c. Stabilizer: Kodak Hypocleaning agent

(2) Printing :

Printer : Log Electronic Co. Electronic Printer

Processing chemicals:

a. Developer: Kodak D-72

b. Fixer: Kodak Fixer

c. Stabilizer: Kodak Hypocleaning agent

Photographic paper:

a. For orientation and temparary check:

Kodak single weight

b. For delivery:

Kodak double weight

c. Positive film:

Konishiroku Sakura Gravure

Drying : Natural drying

4-4-2 Photographic Processing and Checking Staff

The staff of photo processing and temporary check are as follows:

Inspector: Mr. Tsutomu Shimizu

Photo processing: Mr. Subaryanto

4-4-3 Outline of Work

(1) Photo processing:

The exposed films were developed by one roll and no partial development was made. Test development was following by development of the film exposed with sufficient leader trailer because of rewind development. The developed films were left to natural dry. After development, contacts prints were produced of every other photograph for photo orientation and temporary check.

(2) Temporary check

The contact prints for orientation were mosaiced by flight course and the mosaiced photographs were fixed with adhesive tape for check of overlaps, sidelaps, clouds, shadow of clouds and range of coverage to ensure the subsequent work. When coverage found deviated from the specifications, re-flight was instructed.

In photo orientation, plotting of principal points on the existing maps of 1/250,000 scale was made with difficulty due to the fact that the maps used were of old edition.

Certain photographs include parts covered by clouds. However such cloud-covered parts are samll enough to be supplemented by the photographs of adjoining course. Thus, these photographs were judged as sufficient causing no inconvenience to the work at later stage.

(3) Annotation and Photo Index Maps

The aerial photographs obtained have been annotated in accordance with the following data:

Film Roll Number	Mapping Project Name	Project Code	Date of Photograph	Photo Scale
ROL 1	NEGARA RIVER UPSTREAM	P3SA	SEPT, 1983	1:50,000

Course No	Photo Number
R.14	1 - 25

The above-listed information has been shown on both first and last sheets of the photograph, and, for the rest of the photographs, have been shown the Course No and Photo No.

The existing map of 1/250,000 have been used for producing the photo index. In the case of photographing for a course covered by two flights or more, the letters of A, B, C... have been added to each Course number beginning from western towards eastern sheets.

4 — 5 Results of Photographing

For the reasons of unusual weather conditions and others, the start of photographing operations were delayed. Every effort was made to obtain the complete scheduled coverage of the area by waiting till the 28th of October, the last day of the photographing contract. However, approximately 15% of the area to be photographed was left uncovered, the latter period of the work had the local weather changed for worse showing a sign of the arrival of rainy season. Given below are the results of the photographic operations (Please refer to Fig.-1 and Table-1):

1. Number of films : 3 rolls
2. Planned flight courses: 18 courses
3. Covered flight courses: 17 courses
4. Number of photographs : 461 sheets

Fig.-1 Index Map of Aerial Photography

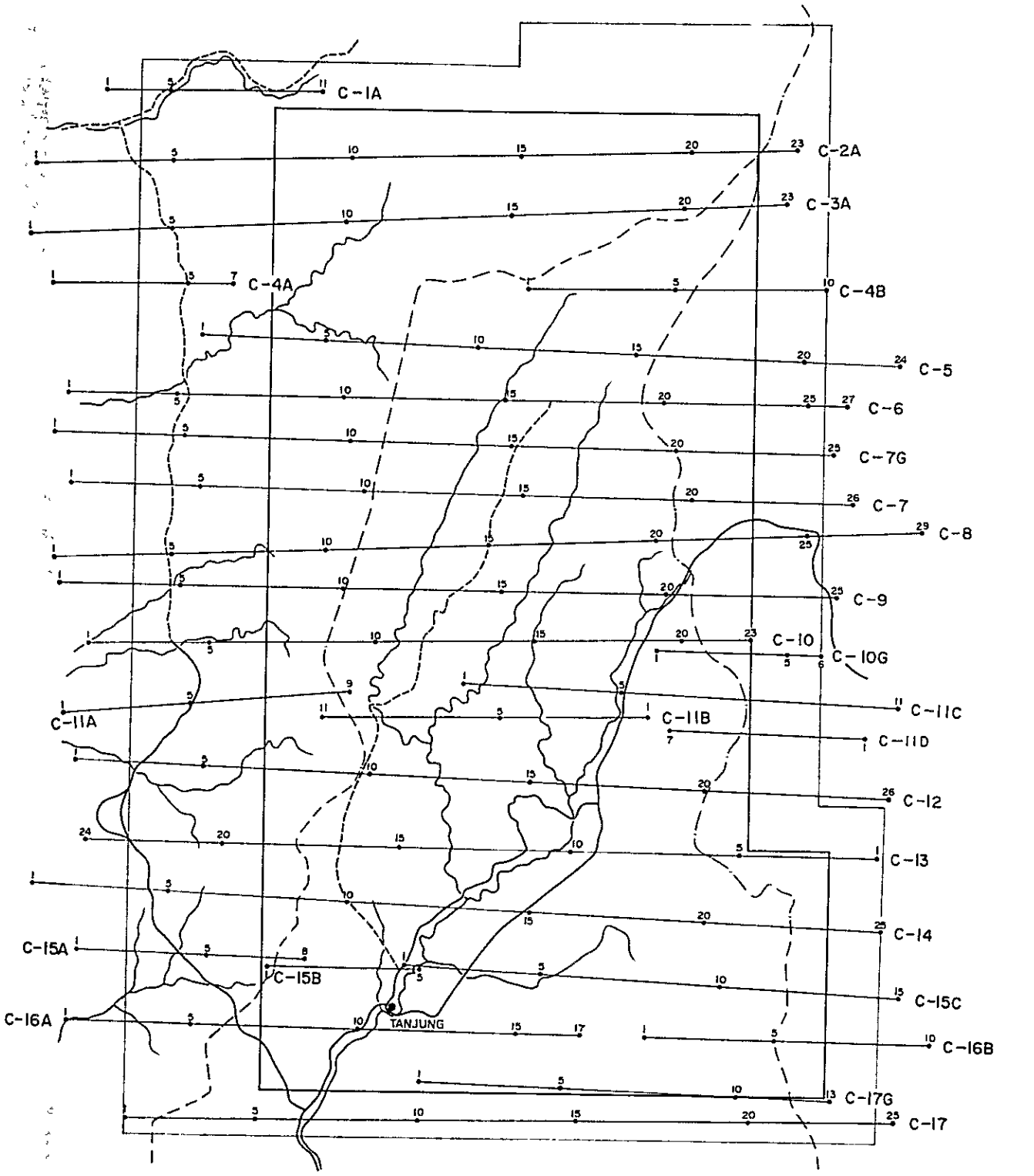


Table - 1 Number of Aerial Photographs by Course

Course No.	Counter Number	Compiled Number	Amount
1A	~	1 ~ 11	11
2A	267 ~ 243	1 ~ 21	21
3A	222 ~ 244	1 ~ 23	23
4A	~	1 ~ 7	7
4B	107 ~ 098	1 ~ 10	10
5	073 ~ 096	1 ~ 24	24
6	071 ~ 045	1 ~ 27	27
7G	414 ~ 390	1 ~ 25	25
7	019 ~ 044	1 ~ 26	26
8	035 ~ 063	1 ~ 29	29
9	034 ~ 011	1 ~ 25	25
10	~	1 ~ 23	23
10G	446 ~ 441	1 ~ 6	6
11A	221 ~ 213	1 ~ 9	9
11B	~	1 ~ 11	11
11C	212 ~ 200	1 ~ 9	9
11D	079 ~ 073	1 ~ 7	7
12	~	1 ~ 26	26
13	~	1 ~ 24	24
14	~	1 ~ 25	25
15A	~	1 ~ 8	8
15B	165 ~ 169	1 ~ 5	5
15C	~	1 ~ 15	15
16A	121 ~ 137	1 ~ 17	17
16B	139 ~ 148	1 ~ 10	10
17G	161 ~ 149	1 ~ 13	13
17	178 ~ 202	1 ~ 25	25
		Total	461

5. Ground Control Point Survey

5 — 1. NNSS Observation

5-1-1 Point Distribution Plan

The observation points by the NNSS have been set up mainly for use as control points for the subsequent aerial triangulation, and the distribution thereof has been made such that enough mapping accuracy could be secured for the production of the basic maps (see Fig.-2). The control points to be newly established by the NNSS observation have been permanently monumented considering that these control points would become permanent assets for Indonesia. One of them was made as a supplementary control point for the aerial triangulation.

5-1-2 Point Selection

In selecting the NNSS points, the followings were taken into consideration:

(1) There should be not reflective objects nor attenuating sources of radio waves in the vicinity.

(2) The sites of the NNSS points to be permanently monumented should be of easy recovery and easy maintenance.

(3) The sites should be motorable considering transfer of survey equipment, camping, supply of foods and other.

At the actual point selection work, trees had to be cleared to avoid obstacle for the reception of signal at several points.

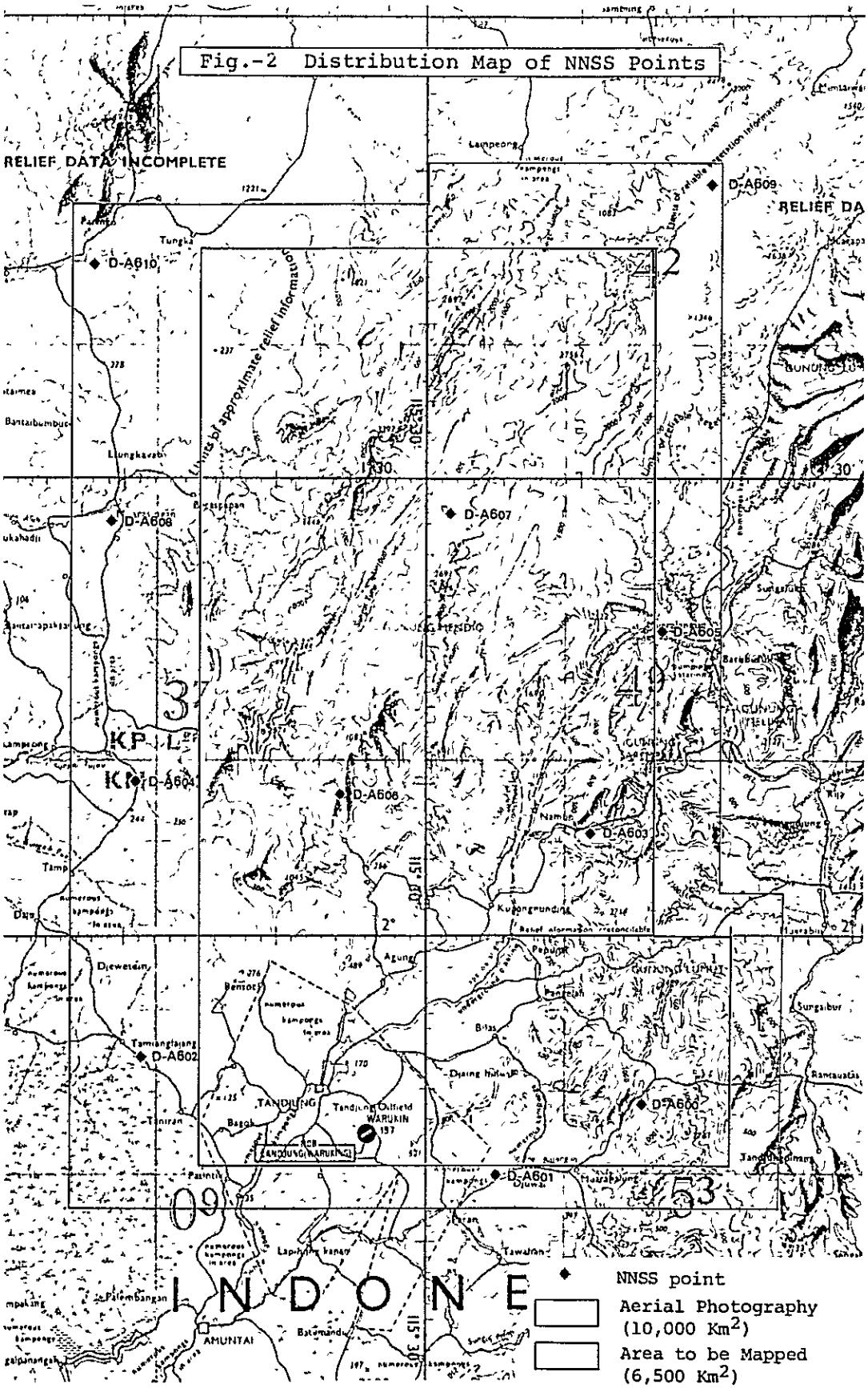
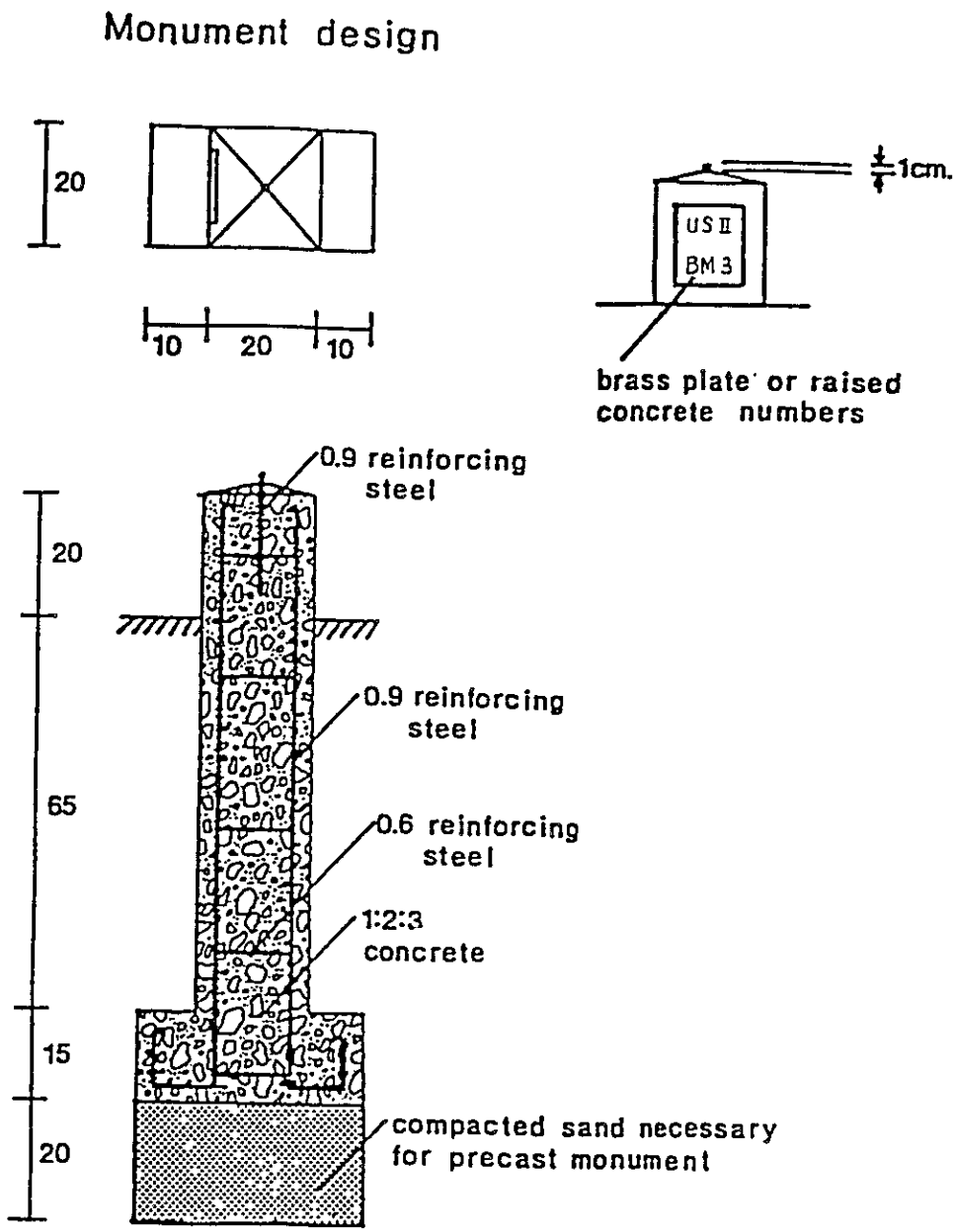


Fig.-2 Distribution Map of NNSS Points

Fig.-3 Specifications of Monument



5-1-3 Monumentation

Based upon agreement reached by discussion with the Indonesian side, monumentation of the NNSS observation points was carried out by the Indonesian counterpart, i.e., the staff of the Ministry of Public Works. The monuments were made and established at the site of each control station according to the specifications of the monument. (Please refer to the Fig. 3.)

5-1-4 Observation

Satellite observation was conducted by point positioning mode using four (4) sets of instrument; one (1) set of JMR-4, three (3) sets of JMR-3 (one set being extra instrument reserved for emergency) by auto alert method. Tents were pitched for observational purpose. However, it was feared that it would be hot and extremely damp inside the tent in which the observation instruments were set up, specifically where no protective features from the heat of the sun were available nearby. To avoid such hot temperature and high humidity in the tents which may cause operational trouble of the instrument, every effort was made to borrow the local houses or huts, wherever found, in the vicinity. Where no such buildings were available, temporary housings made of veneer was constructed for observation. Even with such preventive arrangements, the survey team had to face frequent trouble with the cassette reader and others, which, at the time of signal reception and monitoring, led the team to shift to manual operation, thus the observation was performed on a twenty-four hour basis. The road conditions were poor, and a lot of time had to be consumed in approaching to and moving from the

observation sites. The supply of food was also affected by this as well. The observation period and observed passes of the NNSS observation at each station are listed in the Table-2 below:

Table-2 Period and Volume of NNSS Observation

Observation Points	Observation Period	Number of Observed Passes
D-A600 (NS-1)	Aug. 24 ∿ 29, 1983 (6 days)	50 passes
D-A601 (NS-2)	Sep. 9 ∿ 15, " (7 ")	57
D-A602 (NS-3)	Aug. 13 ∿ 20, " (8 ")	49
D-A603 (NS-4)	Sep. 2 ∿ 7, " (6 ")	49
D-A604 (NS-5)	Aug. 31 ∿ Sep. 5, 1983 (6 ")	60
D-A605 (NS-6)	Aug. 26 ∿ 31, " (6 ")	52
D-A606 (NS-7)	Sep. 2 ∿ 7, " (6 ")	57
D-A607 (NS-7')	Sep. 10 ∿ 15, " (6 ")	49
D-A608 (NS-8)	Aug. 19 ∿ 24, Sep. 10, 1983 (7 ")	46
D-A609 (NS-9)	Aug. 23 ∿ 28, 1983 (6 ")	53
D-A610 (NS-10)	Aug. 13 ∿ 20, " (8 ")	48

5 — 2 Direct Leveling

Direct leveling was conducted with the purpose to obtain the control points for the subsequent work and to adjust elevation value of the NNSS points, and was performed also so that the leveling would serve for consolidation of the second order leveling route in the South Kalimantan Province.

5-2-1 Point Distribution Plan

The second order leveling was carried out for about 70 km along the national highway, starting from the existing benchmark in Tanjun to Balikpapan.

The third order leveling was conducted on the route starts from the existing benchmark in Tanjung, the other route from the existing benchmark in Kelua, approx. 20 km southwest of Tanjung, and further, the branch line route extending from the second order leveling route. (Please refer to Fig.-4). Totally thirty (30) benchmarks were permanently established for the second and third order leveling.

5-2-2 Point Selection

For the selection of the leveling points, the followings were considered:

(1) The point should be set up at a site of easy maintenance and along the existing road.

(2) The location of the points should be of easy recovery and of easy pricking.

Due to scarcity of the object along the route, pricking was often difficult, and it is considered necessary that additional leveling should be conducted on branch lines extended from the route.

5-2-3 Monumentation

For the benchmarks, the permanent monuments of the same specifications as those of the NNSS point were established by the Indonesian counterparts, i.e., staff of the Ministry of Public Works.

The monuments were erected every four - five (4 - 5) kilometers with timber piles installed at every one kilometer as fixed points.

Regarding the third order leveling, the route between D-A602 and D-A604 was not included in the original route plan, therefore spikes were driven in structures along the route as permanent monuments and the fixed points were set up at an interval of approx. 1 km as well as other route.

5-2-4 Observation

Observation performed is duplicate line observation starting from the known point, and allowable discrepancies in difference of elevation for the first and second leveling are $5mm\sqrt{S}$ and $10mm\sqrt{S}$ (in which S denotes distance in kilometer of route) respectively.

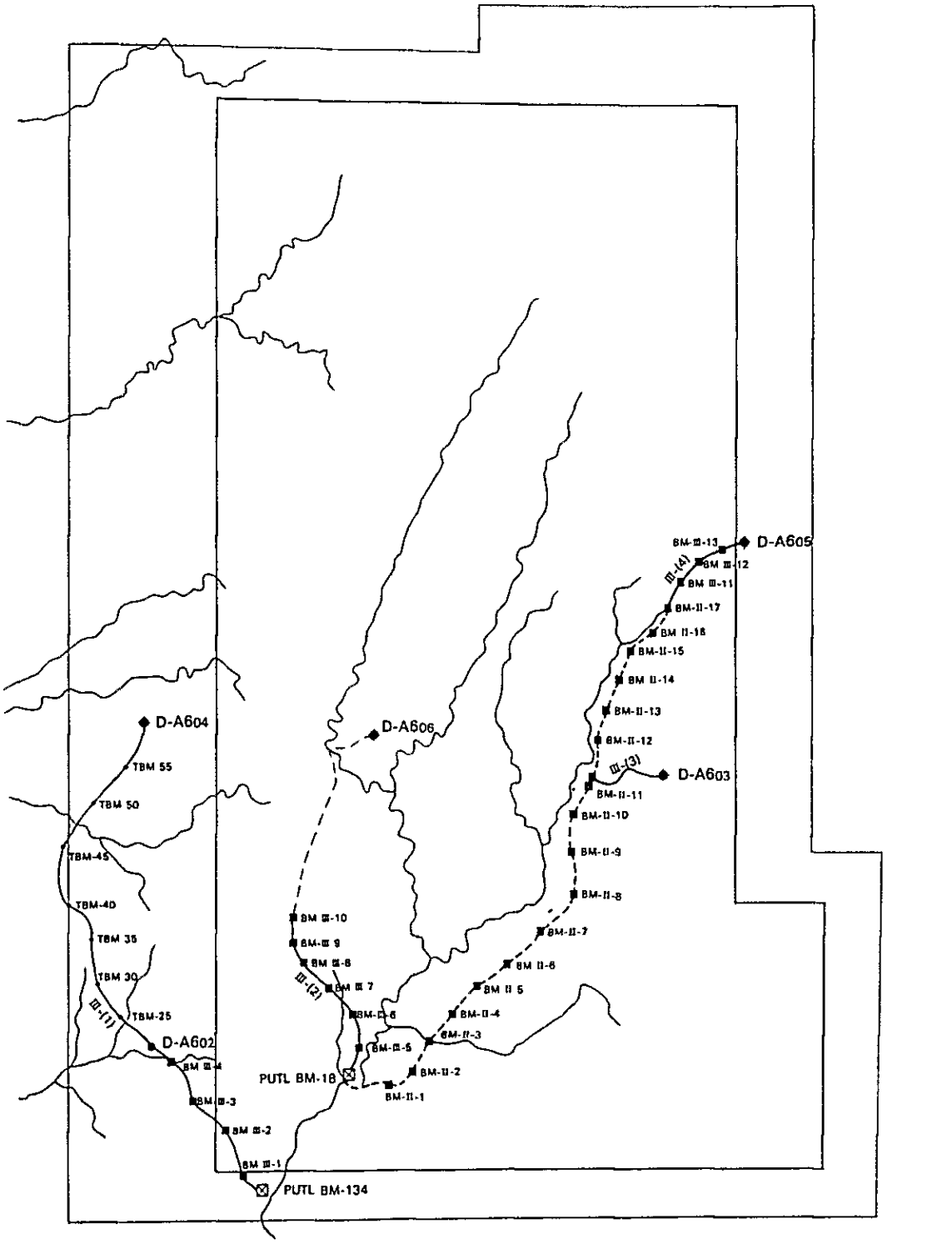
In the second order leveling, Nikon auto-level AS with micrometer and Wild invar rod were used, and in the third order leveling, auto-levels with micrometer (Sokkisha BIC : 2 ; Topcon AT-F3: 1) and wooden staffs were used.

The terrain where the second order leveling route runs is undulating for several hundred meter range and, further, the route ends on a mountain pass. These topographic features affected the operation of the leveling considerably in terms of working days. The resurvey rate of the direct leveling was approx. 3% and 6% for the second and third leveling respectively, and this was found good for the terrain conditions.

5 — 3 Indirect Leveling

The indirect leveling was carried out from U-BM-III-10 of the third order leveling route to the NNSS point of D-A606 (NS-7) covering the distance of approx. 22 km for which direct leveling was difficult. (Please see Fig.-4.)

Fig. 4 Leveling Route Map



5-3-1 Point Selection

The purpose of the indirect leveling is to obtain the control points for the subsequent aerial triangulation and plotting and to adjust the observed elevation of the NNSS points.

The leveling route runs along timber transportation road which belongs to a private company, and the followings were taken into consideration for selecting the points:

(1) The site should offer good intervisibility for vertical angle observation by a theodolite.

(2) The site should not be affected by the transport of timbers by vehicles of heavy duty.

(3) The site should be of location for easy photo-pricking.

5-3-2 Monumentation

For photo-pricking to be made in the work that follows in the next fiscal year, wooden piles were installed at the forty-one (41) fixed points.

5-3-3 Observation

Distance measurement by electronic distance meter and vertical angle observation by theodolite were conducted. For vertical angle observation, Wild T2 was used and angle observation was made in two pairs, and the maximum allowable double angle difference for each pair was set within 10'. The indirect leveling route runs over undulating terrain with thick mixed-forest and, due to the unpaved road, intervisibility was generally poor and affected by sand and dust raised by vehicles.

5 — 4 Computation

5-4-1 NNSS Observation

After observation was completed, temporary geodetic computation was made by each received pass in the field using the micro-computer built in the processor of JMR-3 and JMR-4 based upon the reference ellipsoid of WGS-72, and results obtained were used as reference for confirming convergence of the observed values.

In Japan, the final computation was made on the observational data recorded on the cassette by a large-sized computer with JMR-prepared SP-2P program and broadcast ephemeris. Separately from this, the observational data obtained by this survey work will be used for computation using precise ephemeris by BAKOSURTANAL of Indonesia. The standard deviation of NNSS at each observation point obtained by the computation is listed below:

Table-3 Standard Deviation of NNSS Observation Results

Station	Latitude	Longitude	Height	Remarks	
				Number of observed passes	Number of adopted passes
D-A600 (NS-01)	1.18m	2.10m	1.26m	50	35
D-A601 (NS-02)	1.66	2.55	1.76	57	27
D-A602 (NS-03)	1.12	1.77	1.20	49	40
D-A603 (NS-04)	1.38	2.33	1.41	49	37
D-A604 (NS-05)	0.57	0.89	0.60	60	43
D-A605 (NS-06)	1.71	2.79	1.80	52	32
D-A606 (NS-07)	1.37	2.23	1.48	57	32
*D-A607 (NS-07')	2.24	3.75	2.42	49	17
D-A608 (NS-08)	1.33	2.00	1.44	46	36
D-A609 (NS-09)	0.77	1.14	0.80	53	32
D-A610 (NS-10)	1.10	1.77	1.22	48	39

* To be used as supplementary point for aerial triangulation.

The reference ellipsoid adopted for the local coordinate system by the Republic of Indonesia is ID-1974(GRS-67). The elements thereof are:

a = 6,378.160.0, f = 1/298.25

Padan Datum:

Latitude : S 0° 56' 38" 414

Longitude: E 100° 22' 08" 808

Elevation: $3^m.19$ (from reference ellopsoid)

$14^m.0$ (from MSL)

and, translation parameters from NWL-9D, on which precise ephemeris depends, to ID-1974 are as follows:

$\Delta x = +2^m.691$

$\Delta y = -14^m.757$

$\Delta z = +0^m.224$

Geodetic computation under SP-2 program in Japan use broadcast ephemeris. Based upon results of the Meeting with the Indonesian side, the present computation in Japan has used the following formula which disregards systematic difference between broadcast ephemeris and precise ephemeris for the transformation into Indonesian Coordinate System, ID-1974:

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}_{\text{Padan datum}} = \begin{pmatrix} x \\ y \\ z \end{pmatrix}_{\substack{\text{Broadcast} \\ \text{ephemeris}}} + \begin{pmatrix} -2^m.691 \\ +14^m.757 \\ -0^m.224 \end{pmatrix}$$

The results of the transformation are as shown in Table-4.

Table 4 Transformation of NNSS Observed Values into Geodetic Coordinate System

Station name	WGS - 72			ID - 1974 (GRS - 67)		
	Latitude	Longitude	Height above ellipsoid	Latitude	Longitude	Height above ellipsoid
D-A600 (NS.01)	2-11-57.800 S	115-44-33.618 E	260.209 m	2-11-57.791 S	115-44-33.489 E	249.668 m
D-A601 (NS.02)	2-16-04.746	115-34-36.212	87.849	2-16-04.737	115-34-36.084	77.320
D-A602 (NS.03)	2-07-47.834	115-11-10.541	69.239	2-07-47.826	115-11-10.417	58.738
D-A603 (NS.04)	1-53-22.700	115-40-25.549	223.069	1-53-22.694	115-40-25.421	212.535
D-A604 (NS.05)	1-50-59.476	115-10-50.826	102.149	1-50-59.470	115-10-50.702	91.649
D-A605 (NS.06)	1-40-01.113	115-46-06.406	137.829	1-40-01.108	115-46-06.277	127.290
D-A606 (NS.07)	1-50-19.353	115-24-07.291	243.229	1-50-19.347	115-24-07.165	232.714
D-A608 (NS.07')	1-33-24.618	115-32-05.402	788.189	1-33-24.614	115-32-05.275	777.666
D-A609 (NS.08)	1-33-48.272	115-09-34.581	100.129	1-33-48.268	115-09-34.457	* 89.631
D-A609 (NS.09)	1-09-41.793	115-48-46.655	225.130	1-09-41.792	115-48-46.526	214.587
D-A610 (NS.10)	1-18-05.839	115-08-08.561	139.670	1-18-05.837	115-09-08.437	129.173

* Observation value at the eccentric point

The final coordinate values have been transformed into U.T.M 50 system. The final results obtained from data of the NNSS point observation are listed in Table-5 in which the elevation derives from Table-8.

Table-5 Results of NNSS Observation

Points	Geodetic Coordinate System (ID-1974)		U.T.M. Coordinates (ID-1974)		
	Latitude	Longitude	N	E	H
D-A600 (NS-1)	2°11'57"719S	115°44'33"489E	7,956,840.81 m	360,177.46 m	202.01 m
D-A601 (NS-2)	2°16'04"737	115°34'36"084	9,749,239.83	341,727.57	29.69
D-A602 (NS-3)	2°07'47"826	115°11'16"417	9,764,455.27	298,276.41	11.246
D-A603 (NS-4)	1°53'22"694	115°40'25"421	9,791,080.56	352,485.08	163.775
D-A604 (NS-5)	1°50'59"470	115°10'50"702	9,795,430.09	297,640.69	43.279
D-A605 (NS-6)	1°40'01"108	115°46'06"227	9,815,705.25	363,001.41	78.837
D-A606 (NS-7)	1°50'19"347	115°24'07"165	9,796,686.64	322,248.64	185.880
D-A607 (NS-7')	1°33'24"614	115°32'05"275	9,827,865.07	337,001.10	729.99
D-A608 (NS-8)	1°33'48"268	115°09'34"457	9,826,985.74	295,286.80	47.12
D-A609 (NS-9)	1°09'41"792	115°48'46"526	9,817,578.97	367,925.12	165.86
D-A610 (NS-10)	1°18'05"837	115°08'08"437	9,856,054.32	292,563.13	80.52

5-4-2 Leveling

(1) Direct Leveling

The field books of the direct leveling were checked on the day the leveling was made for discrepancy of relative heights, and re-survey was made in case of the discrepancy exceeded the prescribed limit. For the second order leveling, rod correction to compensate graduation error of the staff and the expansion thereof by the change of temperature, and orthometric correction were made by the following formula:

$$K = 5.29 \times \sin 2B \frac{B_1 - B_2}{\rho'} \times H$$

K : Orthometric correction

B_1 , B_2 : Latitude of starting point and terminal point (Unit in minutes)

B : (B + B)/2

H : Average elevation of leveling route

ρ' : 1/sin 1'

The orthometric correction value for the total distance of approx. 70 km of the second order leveling has been found at about 0.4 mm, and the orthometric correction value for the third order leveling has been too small to consider.

(2) Indirect leveling

The maximum discrepancy of relative height between the values of telescope normal and telescope reversed in height computation for forty-one (41) observation points was 0.12 m, therefore it is estimated the result values of the indirect leveling contain a 20 $\sim$ 30 cm error.

The results of the leveling are listed in Table-6.

Table-6 Results of Leveling

Points	Height (m)	Points	Height (m)
U-BM-II-1	17.899	U-BM-III-1	12.945
U-BM-II-2	31.238	U-BM-III-2	24.671
U-BM-II-3	32.166	U-BM-III-3	18.450
U-BM-II-4	52.800	U-BM-III-4	26.709
U-BM-II-5	56.829	D-A602	11.246
U-BM-II-6	70.485	D-A604	43.279
U-BM-II-7	52.489	U-BM-III-5	19.989
U-BM-II-8	35.675	U-BM-III-6	29.472
U-BM-II-9	55.701	U-BM-III-7	53.955
U-BM-II-10	48.515	U-BM-III-8	67.102
U-BM-II-11	55.933	U-BM-III-9	56.494
U-BM-II-12	50.933	U-BM-III-10	76.222
U-BM-II-13	73.881	D-A603	163.775
U-BM-II-14	118.377	U-BM-III-11	151.977
U-BM-II-15	92.441	U-BM-III-12	105.825
U-BM-II-16	123.029	U-BM-III-13	74.093
U-BM-II-17	266.480	D-A605	78.837
		D-A606	185.88

Table-7 Height Difference of NNSS Points

Station name	Antenna height above Ellipsoid ID-1973	Antenna height (above Monument)	Monument height by leveling (Takisong datum)	Height Difference
	m	m		
D-A600	249.668	0.48		
D-A601	77.320	0.45		
			m	m
D-A602	58.738	0.98	11.246	46.512
D-A603	212.535	0.50	163.775	48.260
D-A604	91.649	1.24	43.279	47.130
D-A605	127.290	0.79	78.837	47.663
D-A606	232.714	0.50	185.88	46.334
D-A607	777.666	0.50		
D-A608	89.631	1.38 (above Ground)		
D-A609	214.587	1.55		Mean
D-A610	129.173	1.47		47.180

(3) Elevation of NNSS Points

Using leveling results of five (5) NNSS points, the height of NNSS points has been decided by adding the correction value, i.e., -47.180 m, the average of difference between elevation of ID-1974 and leveling results to the height of other NNSS points. The results are listed in Table-8.

Table-8 Adjusted Elevation Value of NNSS Points

Station	Height of ID-1974	Leveling results	Difference	Correction value	Height
	m	m	m	m	m
D-A600 (NS-1)	249.188	-	-	-47.180	202.01
D-A601 (NS-2)	76.870	-	-	-47.180	29.69
D-A602 (NS-3)	57.758	11.246	-46.512	-	11.246
D-A603 (NS-4)	212.035	163.775	-48.260	-	163.775
D-A604 (NS-5)	90.409	43.279	-47.130	-	43.279
D-A605 (NS-6)	126.500	78.837	-47.663	-	78.837
D-A606 (NS-7)	232.214	185.88	-46.334	-	105.880
D-A607 (NS-7')	777.166	-	-	-47.180	729.99
D-A608 (NS-8)	88.251	-	-	-47.180	41,07
D-A609 (NS-9)	213.037	-	-	-47.180	165.86
D-A610 (NS-10)	127.703	-	-	-47.180	80.52