### 4.6.3. Provincial Workshops

Provincial workshops are in the near of the Province Capitals and belong to DPUP.
The tasks of the Provincial workshops are similar to those of the base workshops, however the type of work is much more closely related to field works.

Repairs are either minor or medium, and the maintenance, inspection and lubrication of the equipment is the much more important task.
Provincial work-shops, in the case of shortage of spare parts required, purchase from either private workshops or submit requests to the base workshop concerned.

Provincial workshops, in all Provinces, are almost all of a standard size.
The area is mostly 3 - 5 ha, and the repair house nearly 14 m x 100 m.

The number of persons employed in each Provincial work-shop is 50 - 100, excluding operators and drivers.

The organization chart is shown in Fig. 4.6.3., the list of facilities in the repair house in Table 4.6.3., the repair house drawing in Fig. 4.6.4., and the equipment list in Table 4.6.4.

Fig. 4.6.3 Typical Organization of a Provincial Workshop

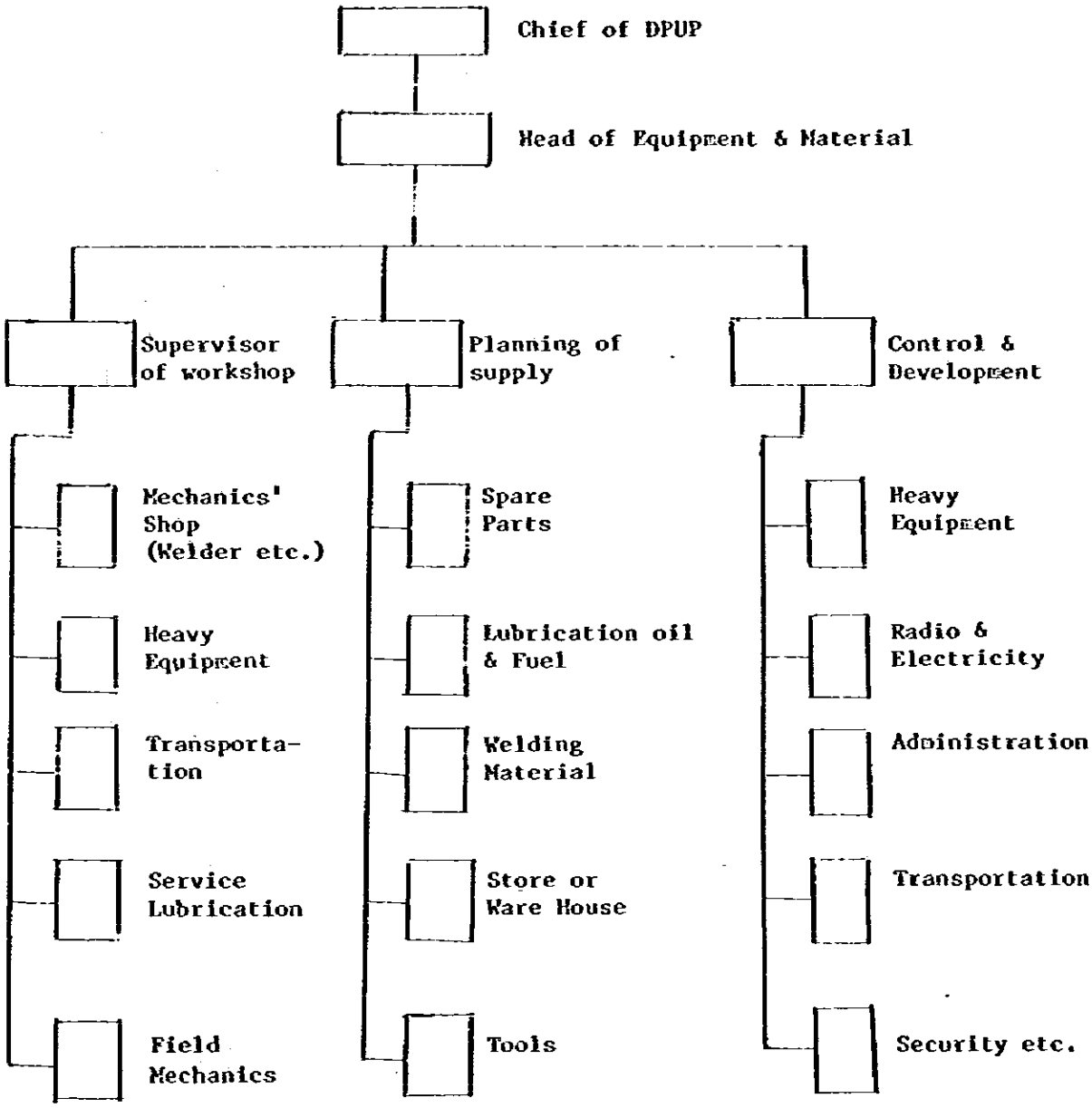


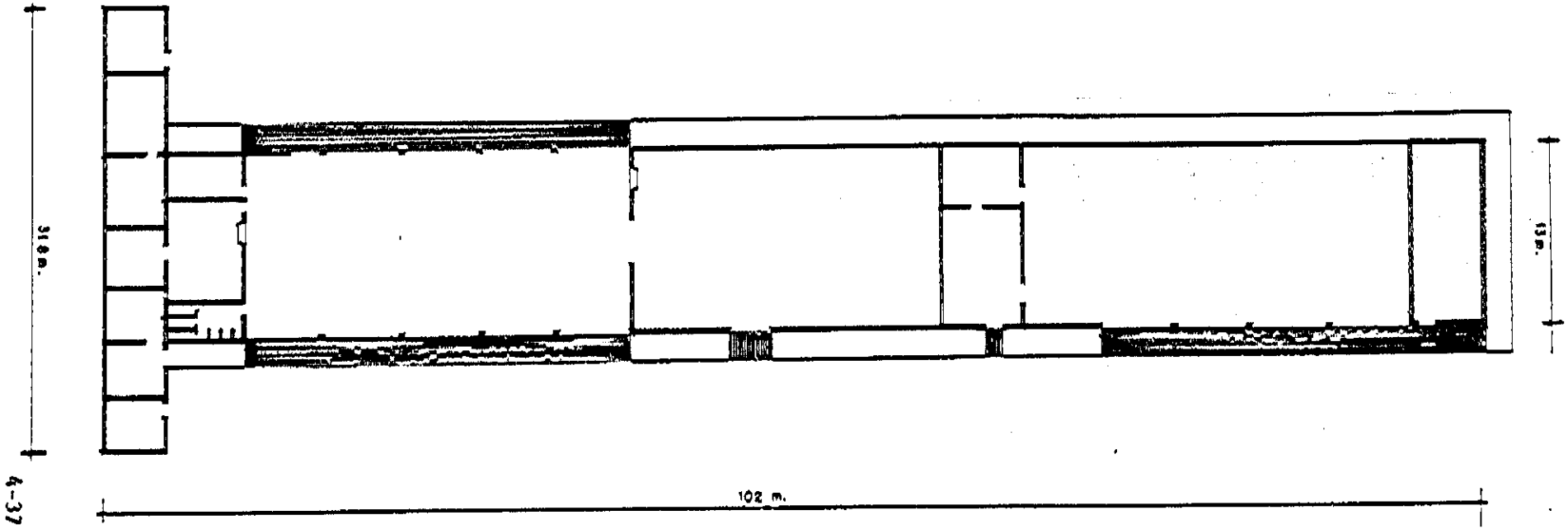
Table 4.6.3. Facilities of Provincial Workshop

(Riau Province)

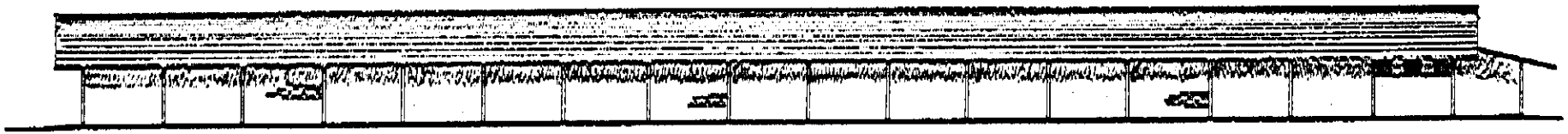
| Facilities | Qt'y | Condition |
|---|---|---|
| Lathe | 1 | good |
| Generator | 3 | 2 fair<br>1 poor |
| Power Hack Saw | 1 | good |
| Fork Lift | 1 | good |
| Disc Grinder | 1 | good |
| Tool Grinder | 1 | good |
| Brake Shoe Grinder | 1 | good |
| Bench Grinder | 1 | good |
| Lubrication Plant | 1 | good |
| Mobile Crane | 1 | poor |
| Steam Cleaner | 1 | good |
| Arbor Press | 2 | good |
| Dual Wheel Dolly | 2 | 1 good<br>1 poor |
| Battery Charger | 1 | good |
| Brake Drum Lathe | 1 | good |
| Carbide Generator | 1 | good |
| Air Compressor | 2 | good |
| Water Pump | 1 | good |
| Pool Shop & Welding Group | 2 | good |
| Wheel Blancer Test | 1 | good |
| Nozzle Tester | 1 | good |
| Timing Tester | 1 | good |
| Vacuum Tester | 1 | good |
| Head Light Tester | 1 | good |
| Volt Amper Tester | 1 | good |

Continued

| Equipment | Qt'y | Condition |
|---|---|---|
| Soil Stabilizer Mixer | 1 | good |
| Chip Spreader | 2 | good |
| Asphalt Distributor | 1 | fair |
| Asphalt Sprayer | 1 | good |
| Water Tank Truck | 3 | 2 good<br>1 fair |
| Lipman Conveyor | 9 | good |
| Fork Lift | 1 | good |
| Lubrication Plant | 1 | fair |




DENAH



PANDANGAN BELAKANG

Fig. 4.6.4. Provincial Workshop

Table 4.6.4 Equipment List of Provincial Work Shop

(Riau Province)

| Equipment | Qt'y | Condition |
|---|---|---|
| Dump Truck | 51 | ( 46 good |
| | | ( 5 fair |
| Truck | 6 | ( 5 good |
| | | ( 1 fair |
| Flat Bed Crane | 2 | ( 1 good |
| | | ( 1 fair |
| Flat Bed / Unit Service | 2 | good |
| Concrete Mixer | 5 | good |
| Concrete Vibrator | 5 | good |
| Asphalt Bench Ideater | 1 | good |
| Excavator | 1 | good |
| Bulldozer | 4 | ( 2 good |
| | | ( 2 poor |
| Motor Grader | 5 | ( 4 good |
| | | ( 1 fair |
| Loader | 6 | ( 5 good |
| | | ( 1 fair |
| Road Roller | 13 | ( 9 good |
| | | ( 3 fair |
| | | ( 1 poor |
| Road Roller Tandem | 2 | good |
| Road Roller Pneumatic | 2 | good |
| Stone Crusher | 1 | good |
| Mobile Crane | 1 | good |

### 4.6.4. Workshop in Kabupaten

Kabupatens (DPUK) are not yet provided with workshops in the real sense, but only with a car pool.

Kabupatens cannot repair their own equipment and vehicles and so repairs are carried out by private repair-shops in the neighbourhood.

## 4.7. Survey of Quarries

According to our field survey, quarries of stone, boulders, gravel, lateratic soil and diluvial deposit are found abundance in the most parts of the Project Area.
There is no shortage of road materials for the Project, except in the O.K.I. Kabupaten, where there is no access at the present time to a potential quarry site near Pampangan.

In some Kabupatens, for example Lampung Utara, the hauling distance of aggregate is considerably longer than the others.

Excellent material for earthroad "Bauxite" has been utilized in Kepulauan Riau.

The crushed stone, which has been used for past support works, used to be crushed by hand. That is the reason why, past support works have used, almost exclusively, crushed stone bigger than 10 cm, the results of which give a very poor riding quality.

It is also observed, that river sand is obtained by laborious manual dredging from river beds.

In some Kabupatens, namely in Kepulauan Riau, L.I.O.T. and Lampung Utara there are some private industries producing crushed stone. Their Capacity is however considered to be insufficient for the Project, so they are ignored in the study report.
Fig. 4.7.1. shows an example of a good model quarry site map.
Table 4.7.1. gives an assumption of kinds and quantities of quarries and average hauling distances in each Kabupaten, for the purpose of determining the necessary number and types of equipment, as well as the preliminary cost estimate in this study report, based on the Inventory Survey.

In Table 4.7.1 , gravel from the river means " gravel with a maximum size of 5 cm or less ", crushed stone from the river means " crushed stone

made of cobbles and boulders without blasting ", and crushed stone from mountain rock means " crushed stone made by crushers with use of dynamite ". Therefore, soft lime stone is classified into "crushed stone from river", because it does not require blasting.

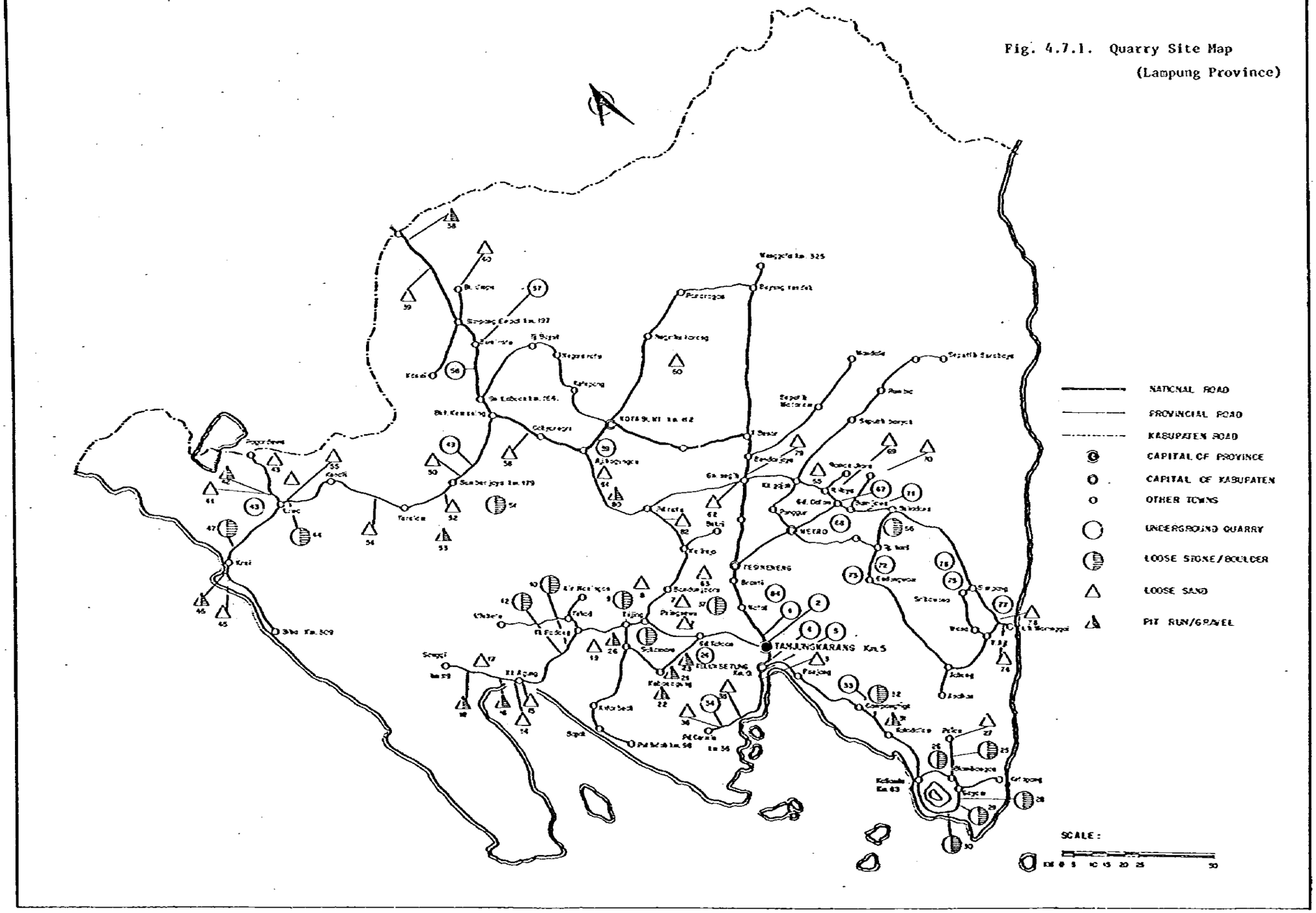
For the subgrade soil and eventualy for shoulder soil, suitable lateritic soil or similar one is used to be found within average hauling distance of 5 km or less in all Kabupatens.

Table 4.7.1. Kind of Aggregate and their Proportion assumed to be Used in Each Cabupaten

| Province | Kabupaten | Share of each kind of aggregate: Selected Material | Gravel from river | Crushed Stone from river | Crushed Stone from mountain rock | Total |
|---|---|---|---|---|---|---|
| RIAU | Kampar | - | 1/3 (5) | 2/3 (5) | - | 1.0 |
| | Kepulauan Riau | 2/3 (5) Bauxite | - | - | 1/3 (5) Basalt | 1.0 |
| SUMATRA SELATAN | Lahat | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| | O.K.I. | - | - | - | 1.0 (10) (30) Granite | 1.0 |
| | O.K.U. | - | 1/3 (10 | 2/3 (10) | - | 1.0 |
| | LIOT | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| LAMPUNG | Lampung Utara | - | - | - | 1.0 (20) Basalt | 1.0 |
| | Lampung Selatan | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| NUSA TENGGARA TIMUR | Manggarai | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| | Belu | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| SULAWESI UTARA | Bolaang Mongondow | - | 1/5 (5) | 3/10 (5) | 1/2 (5) Limestone | 1.0 |
| | Gorontalo | - | 1/5 (5) | 3/10 (5) | 1/2 (5) Limestone | 1.0 |
| SULAWESI SELATAN | Takalar | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| | Bone | - | 1/3 (5) | 2/3 (5) | - | 1.0 |
| | Sidrap | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| | Pinrang | - | 1/3 (10 | 2/3 (10) | - | 1.0 |
| | Polmas | - | 1/3 (10) | 2/3 (10) | - | 1.0 |
| | Enrekang | - | 1/3 (10) | - | 2/3 (10 sandstone | 1.0 |
| | Jeneponto | - | 1/3 (10) | 2/3 (10) | - | |
| SULAWESI TENGGARA | Kendari | - | 1/5 (10) | 3/10 (10) | 1/2 (10) sandstone | 1.0 |
| | Buton | - | 1/3 (5) | 2/3 (5) | - | 1.0 |

Figures in the paranthesis show the assumed average hauling distance in kilometer.

Fig. 4.7.1. Quarry Site Map
(Lampung Province)



## 4.8 Inventory of Local Contractors

Until now, the only item of work being undertaken by DPUK (Kabupaten Public Work) is minor maintenance with its own labour force.

The support works of Kabupaten roads by Inpres, and a substantial part of the maintenance work, has been carried out almost exclusively by local contractors who can supply labour and local materials. Where the local contractors have inssuficient numbers and types of equipment, they can borrow them on a rental basis from the local government or lease companies.

There are many small local contractors in each Kabupaten, some of whom do not have any construction equipment but can supply manpower only.

Our understanding is that the contractor does not keep the equipment in good condition.

Accordingly, there is no long list of local contractors at the Kabupaten level.

In the case of Provincial level, there are standardized prequalification forms for the contractors in three major fields of Public works, namely irrigation, housing and building, and roads and bridges.

These standards are well suited to the needs of evaluation, prequalification and ranking of general contractors for road and bridge constructon.

The ranking of contractors during prequalification, utilized the weighing of capability factors (personnel, construction plan and equipment, financial condition, capacity and prior experience) by a jury system of representatives appointed from various agencies engaged in the province's Development programs.

Table 4.8.1. shows an example of the ranking of contractors is the case of Lampung Province.

Table 4.8.1. Prequalification of Contractors in Lumping Province (1979/1980)

| Qualification | Number of Contractors | | | |
|---|---|---|---|---|
| | Bina Marga (Roads & Bridges) | Pengairan (Irrigation) | Cipta Karya (Housing) | Survey & Design |
| Class A | 26 | 24 | 17 | ± 7 |
| Class B | 65 | 54 | 25 | |
| Class C | 115 | 33 | 111 | |
| Class D | 33 | 27 | 69 | |

## 5. THE PROJECT

### 5.1. Purpose of the Project

The Local Roads Support Works are based on the "1978 Principle Development Guidelines (GBHN 1978)", which emphasizes:

1) To secure equity on Development and their Product in the whole country.

2) To achieve sufficient economic growth and

3) To get National Stability.

The Local Roads Support Works are to be implemented with the same targets, which are formulated in the highway development plan in Pelita III.

1) Deletion of critical roads. Make the critical roads passable in the wet season, at least on unstable (not sufficiently-stable) roads (by support works).

2) Emphasis on the functioning of minimum standard.
Not only geometric features, but also structural soundness including the provision of good drainage systems.

3) Accelerated completion of road works to avoid unbalanced disbursement due to time consuming construciton.

4) Road works should show economic benefit not only after completion but even during construction.

## 5.2. Outline of the Project

### 5.2.1. Technical Standards of Kabupaen Roads

There is a technical guideline for the implementation of the support work program of Kabupaten roads and bridges available.

Table 5.2.1. shows a summary of technical stadards for Kabupaten roads.

### 5.2.2. Concept of Support Work

The support work is defined as follows.

Support work are those works required to sustain the traffic condition on roads whose running surfaces cannot be kept in that condition by routine (predictable and modest) maintenance expenditures and which do not qualify for betterment, or which have been approved for betterment, but require interim treatment until betterment is completed.

Support works are also defined, in Chapter 2, Section 4.

A support programme is a short term programme (3 years ±) for road sections and bridges, which are not in good condition before the programme is implemented, with the object of keeping the traffic moving on these roads even if maintenance work is not sufficient.

It is proposed that the support works in the Project (support works in the narrow sense) will consist of the following work items:

1) Graveling (or aggregating)
2) Shouldering
3) Side Ditching

Table 5.2.1. Technical Standards of Kabupaten Roads.

| Class | I | | | II | | | III | | | IV | | | V | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Traffic volume (A.D.T) | 10 | | | 10 - 50 | | | 50 - 200 | | | 200 - 500 | | | 500 | | |
| Average volume of truck (10%) | 1 | | | 1 - 5 | | | 5 - 20 | | | 20 - 50 | | | 50 | | |
| Topography | Flat | Rolling | Mountains | Flat | Rolling | Mountains | Flat | Rolling | Mountains | Flat | Rolling | Mountains | Flat | Rolling | Mountains |
| Speed Estimate Km/H | 40/70 | 30/40 | As it Possible | 40/70 | 30/40 | As it Possible | 80 | 70/80 | 40-As it Possible | 80 | 70/80 | 40-As it Possible | 80 | 70/80 | 40-As it Possible |
| - Gradients | | | | | | | | | | | | | | | |
| - Recommended | - | 5% | 12% | - | 5% | 12% | - | 5% | 8% | - | 5% | 8% | - | 5% | 8% |
| - Maximum | - | 12% | 18% | - | 12% | 15% | - | 8% | 15% | - | 7% | 10% | - | 7% | 10% |
| Distance of visibility Minimum (m) | 120 | 100 | 60 | 120 | 100 | 60 | 120 | 100 | 60 | 120 | 100 | 60 | 150 | 120 | 60 |
| Width Pavement (2) | | | | | | | | | | | | | | | |
| - Minimum (m) | 3.0 | 3.0 | 3.0 | 4.0 | 4.5 | 3.0 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 6.0 | 6.0 | 6.0 |
| - Recommended | - | - | - | - | - | 4.5 | - | - | - | - | - | 6.0 | - | - | - |
| Width Road Bed | | | | | | | | | | | | | | | |
| - Minimum (m) | 4.0 | 4.0 | 4.0 | 5.5 | 5.5 | 4.0 | 5.5 | 5.5 | 5.5 | 6.0 | 6.6 | 5.5 | 7.0 | 7.0 | 7.0 |
| - Recommended | 8.0 | 8.0 | 8.0 | 10.0 | 10.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | - | - | - | - | - |
| Road Class | IV | IV | IV | IV | IV | IIIA | IIIA | IIIA | III | III | III | III | III | III | III |
| Type of beginning of Road | KR/LS | KR/LS | KR/LS | KR | KR | KR | KR/EDST | KR/EDST | KR/EDST | EDST | EDST | EDST | EDST | EDST | EDST |
| Sloping & Superelevation. | | | | | | | | | | | | | | | |
| Minimum | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% | 4% |
| Maximum | 8% | 8% | 8% | 8% | 6% | 6% | 6% | 6% | 6% | 5% | 5% | 5% | 5% | 5% | 5% |
| Width of Bridge Span<6m | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Span 6 - 35m | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Span 35m or more | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 7.0 | 7.0 | 7.0 |
| Bridge standard | IIIA | IIIA | IIIA | IIIA | IIIA | IIIA | III | III | III | II | II | II | II | II | II |

Note : 1. Vehicle 4 axles
2. Min. shoulder = 0.5 m
LS = Stabilization of limestone
EDST = Extented Double Surface Treatment.
KR = Gravel or crushed stone.

4) Provision of Box and Pipe Culverts

5) Maintenance

The support works exclude the support work of bridges. (replacement or new construction).

However, it is proposed to include the reinforcement of existings bridges in the Project as far as it is necessary for the transportation of equipment for the support works.

Any proposed replacement, or new construction, of bridges are to be implemented simultaneously with the Project, when such replacements, or new constructions, are found to be necessary for the transportation of the equipment.

Since graveling is the main work item of the Project, the basic concept has already been defined.

Thickness of aggregate (gravel in wide sense)

The thickness of aggregate is fundamentaly 10 cm, which is the minimum thickness of mechanized construction. (It should be noted that the standard thickness of 5 cm is justifiable in the case of applying the Macadam construction method, but not for the mechanized construction system).

Where the existing Kabupaten roads are heavily damaged and big size cobbles do not allow for the leveling of the existing surface, 15 cm thick aggregate is proposed, (including leveling course).

However, where the existing Kabupaten roads are only lightly corrugated, it is proposed to use 5 cm thick overlay.

However, while the AWCAS is to be followed immediately by permanent paving, the graveling of the Project cannot always be followed by permanent type paving.

There is no doubt that the aggregate of 10 cm thickness will require further regraveling in a few years (3 years more or less), because such support works generate traffic even on those Kabupaten roads on which the present traffic volume is quite light.

Width of gravel (carriageway)

Since the support work is not in itself a betterment it will not contain any improvement of geometric figures including the widening of carriageways.

Therefore it is proposed that the graveling width be kept the same as the existing carriageway, except where the width of the existing carriageway is less than 3 meters (as that is the minimum width by Indonesian Standards), the proposed minimum graveling width is therefore to be 3 meters.

Material of gravel

For graveling, due to its better performance, curshed stone is preferable to river sand and gravel.

However, due to the relatively high cost of crushing, a comparative study of the use of crushed stone, river sand and gravel and diluvial deposit should be made.

And example of such a comparative study is illustrated in Appendix B . (for a good reference of detailed design of the Project).

It is assumed in study report that four different kinds of aggregate are to be used.

1) River sand and gravel with smaller size.
2) Diluvial deposits consisting of granular material with smaller size
3) Crushed stone from cobbles and boulders
4) Crushed stone from rocks

The maximum preferable size of gravel is 40-50 mm for 10 cm thick graveling and 25 mm for 5 cm thick overlay.

It is strongly recommended, for this project, that the use of bigger size cobbles and boulders, which are quite often used on existing Indonesian public roads, are eliminated for mechanised graveling purposes.

### 5.2.3. Principle of Scheduling of the Project

It is proposed to apply the following basic principle of scheduling of the Project.

1) The Project is divided into two stages.

   The first stage will treat those Kabupaten Roads, the Inventory Survey of which is already completed until March 1980.
   The second stage will support the remaining Kabupaten Roads.

2) The main support works, that is, graveling, shouldering, side ditching and the replacement of box and pipe culverts, is to be completed in three (3) years.

   In 7 Kabupatens, namely, O.K.I., Manggarai, Belu, Bolaang Mongondow,Gorontalo, Kendari and Buton, a six (6) years schedule is proposed considering that fact;

   a) The length of surveyed Kabupaten Roads is long,
   b) Quarry sites are unfavourably located (hauling distance is long),
   c) Topographic condition is severe,
   d) The work capacity of the local agencies is relatively weaker than the average etc.

3) It is proposed to start the mechanized maintenance of sets of graders and dump trucks, together with available Macadam rollers, from the beginning of the Project i.e. in the Fiscal Year 1981/1982.

Table 5.2.2. shows a summary of the schedule of support works in the Project.

However, it is strongly proposed to revise the schedule proposed in Table 5.2.2. taking the following considerations into account.

1) There are many Kabupatens which are planning to improve their Kabupaten Road Networks, and accordingly increasing the total length of Kabupaten Roads.

In the case of Lampung Utara, for example, there are 4 Kecamatans out of a total 24 which are not covered by any Kabupaten road, in spite of rather developed economic conditions.

Therefore, it is proposed to review the lengths of the second stage (especialy too short lengths), only after confirmation of the Kabupaten Road Network based on reasonable criteria.

2) It will be very desirable to transfer a part of Kabupaten Roads from the first stage to second stage, when the length of first stage is much greater than that of the second stage, for example, Gorontalo.

3) For those Kabupatens, whose lengths of Kabupaten Roads for the second stage are too short after getting final figures of total lengths, it is strongly recommended that the possibility of transfer of a part of their equipment to other Kabupatens, to maximize the efficiency of equipment, should be studied.

Table 5.2.2. Lengths of Kabupaten Roadsin Work Items and Stage

| Province | Kabupaten | First Stage (those completed an inventory survey) | | | | | Second Stage (Inventory Survey will be completed |
|---|---|---|---|---|---|---|---|
| | | Main Support Work | | | Maintenance | | |
| | | Length to be supported (Km) | Proposed period of main support | Yearly length of main support | 1981/82 1983/84 | * 1984/85 | |
| Riau | Kampar | 213 | 3 | 71 | 413 | 502 | 311 |
| | Kep. Riau | 241 | 3 | 80 | 331 | 411 | 62 |
| Sumatra Selatan | Lahat | 139 | 3 | 46 | 209 | 255 | 70 |
| | O.K.I | 187 | 6 | 31 | 286 | 317 | 78 |
| | O.K.U | 135 | 3 | 45 | 212 | 257 | 204 |
| | L.I.O.T | 131 | 3 | 44 | 236 | 280 | 186 |
| Lampung | Lamp. Utara | 223 | 3 | 74 | 187 | 261 | 328 |
| | Lamp.Selatan | 65 | 3 | 22 | 203 | 225 | 123 |
| Nusa Tenggara Timur | Manggarai | 130 | 6 | 22 | 310 | 332 | 76 |
| | Belu | 218 | 6 | 36 | 246 | 282 | 5 |
| Sulawesi Utara | Bolaang Mongondow | 261 | 6 | 45 | 429 | 474 | 117 |
| | Gorontalo | 697 | 6 | 116 | 831 | 947 | 0 |
| Sulawesi Selatan | Takalar | 69 | 3 | 23 | 169 | 192 | 0 |
| | Bone | 163 | 3 | 54 | 241 | 295 | 17 |
| | Sidrap | 139 | 3 | 46 | 192 | 238 | 76 |
| | Pinrang | 76 | 3 | 25 | 243 | 268 | 76 |
| | Polmas | 81 | 3 | 27 | 125 | 152 | 22 |
| | Enrekang | 79 | 3 | 26 | 114 | 140 | 97 |
| | Jeneponto | 173 | 3 | 58 | 219 | 277 | 85 |
| | Kendari | 361 | 6 | 60 | 490 | 550 | 0 |
| | Buton | 312 | 6 | 52 | 353 | 405 | 175 |
| T o t a l | | 4,093 | 3-6 | 22-116 | 6,057 | 7,060 | 2,108 |

* In case of a 6 years plan, the fiscal year shall be replaced with 1987/88.

## 5.3. Proposed Support Works and Maintenance Level of Kabupaten Roads.

### 5.3.1. Main Support Works

Main support works apply to the improvement of carriageways of earth and gravel roads, including the replacement of culverts and the reinforcement of bridges.

Design of graveling was classified into 9 different categories, in accordance with the type of the paving (surface) and the present condition as described below. Table 5.3.1. shows a summary of the design categories.

Table 5.3.1 A Summary List of Design Categories

| Kind of Road | Earth Road | | | Gravel Road | | |
|---|---|---|---|---|---|---|
| | Fair | Poor | Damaged | Fair | Poor | Damaged |
| Condition | lightly corrugated | lightly damaged or bearing capacity more or less insufficient | heavily damaged or bearing capacity insufficient | lightly corrugated | lightly damaged or bearing capacity more or less insufficient | heavily damaged or bearing capacity insufficient |
| Number of Design. Category | (5) | (6) (7) (10) | (8) (11) | (3) (4) | (6) (7) (10) | (8) (9) (10) |

Note ) Numbering of design category will be explained on the next page.

(1) Proposed Project Design Procedure of Graveling, shouldering and side ditching.

1. Surface type 4 (dressing with asphalt) type 5 (asphalt penetration Macadam) and type 6 (asphalt concrete), are excluded from the support work project, because any restoration of such type of paving can be carried out either manually or by asphalt plant.
   Surface type 2 (gravel) and type 3 (Macadam, cobble and Telford) both in good condition are expected to remain so until 1983.
   Concequently, they are excluded from the main support work.

2. Those road sections, which are excluded from the following design of graveling of the Project, will be supported by the Inpres 1980/81, because the earliest possible date for the support work of the Project is the beginning of 1981/82.

3. Lightly corrugated surface type 3 (Macadam, cobble and Telford) is to be overlayed by 5 cm thick gravel or crusher-run (with maximum size 25 mm or less on its one third (1/3) length), assuming that the one third (1/3) length of this type of paving which is lightly corrugated in 1980 will become more corrugated by 1983. This item is hereinafter called "design category 3".

   The selective of gravel or crusher-run will be determined by a comparison of crushing cost, transportation cost and volume of quarries.
   Besides the above mentioned overlay, side ditching with two passes of motor grader is to be included. Shouldering is excluded.

a) Volume of aggregate V ($m^3$)

$$V = \frac{1/3\ A \times 0.05}{0.95} = 0.0175\ A$$

Where;

A = Area of surface type 3 lightly corrugated ($m^2$)

0.95 = compaction factor of aggregate.

b) Hauling distance of aggregate $L_A$ (Km)

Shall be determined in accordance with the locations of quarry sites.

c) Ditching length $L_D$ (m)

$L_D$ of each segment can be read directly from the results of the inventory survey, and will not be classified in accordance with the condition of roads. Accordingly, $L_D$ will be calculated separately from design categories.

4. Surface type 2 (gravel), which is lightly corrugated, is to be overlayed by 5 cm thick gravel or crusher-run with maximum size 25 mm or less on half (1/2) its length. The item is hereinafter called "design category 4" (example as follows).

The selective use of aggregate is the same as described in the foregoing item (3).

a) Area of leveling with grader, $A_L$ ($m^2$)

$$A_L = 1/2\ A \qquad (2)$$

Where;

A = Area of surface type 2, lightly corrugated ($m^2$)

b) Volume of aggregate V ($m^3$)

$$V = \frac{1/2\ A \times 0.05}{0.95} = 0.0263\ A \qquad (3)$$

Where;

A = Area of surface type 2, lightly corrugated ($m^2$)

0.95 = compaction factor of aggregate.

c) Hauling distance of aggregate $L_A$ (Km), refer to (3) b

d) Ditching length $L_D$ (m), refer to (3) c.

5. Surface type 1 (earth), which is lightly corrugated is to be overlayed by 5 cm thick gravel or crusher-run with maximum size 25 mm or less or by laterite of good quality over its whole length.
The selective use of aggregate is the same as discribed in item (3).

a) Area of leveling with grader $A_L$ ($m^2$)

$$A_L = A \qquad (4)$$

Where;
A = Area of surface type 1, lightly corrugated ($m^2$)

b) Volume of aggregate V ($m^3$)

$$V = \frac{A \times 0.05}{0.95} = 0.0526\ A \qquad (5)$$

Where;
A = Area of surface type 1, lightly corrugated ($m^2$)
0.95 = compaction factor of aggregate

c) Hauling distance $L_A$ (Km), refer to (3) b)

d) Ditching length $L_D$ (m), refer to (3) c)

6. Surface types 1 (earth), 2 (gravel) and 3 (Macadam, cobble, Telford) which are heavily corrugated are to be excavated and leveled with bulldozer, and then overlayed by 10 cm thick gravel or crusher-run or laterite of good quality on their whole length.
The selective use of aggregate is the same as described in item (3).

Shouldering is necessary in this case. However, the volume of shoulder is calculated as a triangle cross section to get steeper transverse gradient for better drainage.

a) Area of excavation and leveling with bulldozer $A_E$ ($m^2$)

$$A_E = A \qquad (6)$$

Where;

A = Area of surface type 1, 2 and 3 heavily corrugated ($m^2$)

( Note: Average depth of excavation is assumed to be 10 cm )

b) Volume of aggregate V ($m^3$)

$$V = \frac{A \times 0.10}{0.95} = 0.1053\ A \qquad (7)$$

Where;

A = Area of surface type 1, 2 and 3, heavily corrugated ($m^2$)

0.95 = compaction factor of aggregate

c) Hauling distance $L_A$ (Km), refer to (3) b)

d) Volume of soil for shouldering Vs ($m^3$)

$$Vs = \frac{Bs \times L \times 0.10 \times 1/2}{0.90} = 0.0556\ BsL \qquad (8)$$

Where;

Bs = width of shoulder (sum of both sides) (m)
in case the width of existing road is zero (0), 1 m is to be used instead of 0.

L = Length of road segment (m)

0.90 = compaction factor of soil

e) Hauling distance of soil Ls (Km)

It shall be determined in accordance with the locations of borrow pits.

7. Surface types 1 (earth), 2 (gravel) and 3 (Macadam, cobble, Telford), which are lightly damaged with potholes are to be leveled by grader, and then overlayed by 10 cm thick gravel or crusher-run or laterite of good quality on their whole length.
For leveling work, a certain amount of sand and gravel is assumed to be necessary.

a) Area of leveling with grader $A_L$ (m)

$A_L = A$

Where;

A = Area of surface type 1, 2 and 3, lightly damaged with potholes.

b) Volume of additional sand and gravel (or crusher-run eventually) for leveling with grader Vg ($m^3$)

$$Vg = \frac{0.20 \times A \times 0.05}{0.95} = 0.0105\ A \qquad (9)$$

Where;

A = Area of surface type 1, 2 and 3, lightly damaged with potholes ($m^2$)

0.95 = compaction factor of aggregate

c) Hauling distance of sand and gravel Lg, refer to (3) b)

d) Volume of aggregate V ($m^3$), refer to (6) b) equation (7)

$$V = \frac{A \times 0.10}{0.95} = 0.1053\ A \qquad (7)$$

Where;

A = area of surface type 1, 2 and 3, lightly damaged with potholes ($m^2$)

0.95 = compaction factor of aggregate

e) Hauling distance of aggregate $L_A$ (Km), refer to (3) c)

f) Volume of soil for shouldering Ls ($m^3$), refer to (6) d) equation (8)

g) Hauling distance of soil Ls (Km), refer to (6) e)

h) Ditching length $L_D$ (m), refer to (3) c)

8. Surface types 1 (earth) and 2 (gravel), which are heavily damaged, are to be excavated with bulldozer to a 10 cm depth on average, then mixed in situ with grader and additional sand and gravel (20% in volume), and overlayed by 10 cm thick gravel or crusher-run or laterite of good quality on their whole length.

a) Volume of excavation with bulldozer $V_A$ ($m^3$)

$$V_A = 0.10\ A \qquad (10)$$

Where;

A = Area of type 1, 2 and 3, heavily damaged ($m^2$)

b) Volume of additional sand and gravel (or crusher-run eventually) in situ mixing Vg ($m^3$)

$$Vg = 0.20\ V_A = 0.02\ A \qquad (11)$$

Where;

A = Area of type 1, 2 and 3, heavily damaged ($m^2$)

c) Hauling distance of sand and gravel Lg, refer to (3) b)

d) Volume of aggregate V ($m^3$), refer to (6) equation (7)

e) Hauling distance of aggregate $L_A$ (Km), refer to (3) b)

f) Volume of soil shouldering Vs ($m^3$), refer to (3) b)

g) Hauling distance of soil Ls (Km), refer to (6) e)

h) Ditching length $L_D$ (m), refer to (3) c)

9. Surface type 3 (Macadam, cobble and Telford), which is heavily damaged is to be overlayed by 15 cm thick gravel, or crusher-run, or laterite of good quality on the whole length.
Leveling with grader is impossible, so it is excluded.

a) Volume of aggregate V ($m^3$)

$$V = \frac{A \times 0.15}{0.95} = 0.1579\ A \qquad (13)$$

b) Hauling distance of sand and gravel $L_A$, refer to (3) b)

c) Volume of soil for shouldering Vs ($m^2$), refer to (6) d) equation (8)

d) Hauling distance of soil Ls (Km), refer to (6) e)

e) Ditching length $L_D$(m), refer to (3) c)

10. Surface types 1 (earth), 2 (gravel) and 3 (Macadam, cobble and Telford), the bearing capacity of which are more or less insufficient, are to be leveled with graders, filled by 10 cm thick good soil (sandy soil, laterite, bauxite, etc) and then overlayed by 10 cm thick gravel or very good laterite.

a) Area of leveling with graders $A_L$ ($m^2$), refer to (5) a) equation (4)

$$A_L = A \qquad (4)$$

Where;

A = Area of surface type 1, 2 and 3, with less bearing capacity

b) Volume of embankment (fill) $V_E$ ($m^3$)

$$V_E = \frac{A \times 0.10}{0.90} = 0.1111\ A \qquad (13)$$

Where;

A = Area of surface type 1, 2 and 3, with less bearing capacity.

0.90 = compaction factor of soil

c) Hauling distance $L_E$, refer to (6) e)

d) Volume of aggregate V ($m^3$), refer to (6) b) equation (7)

$$V = \frac{A \times 0.10}{0.95} = 0.1053\ A \qquad (7)$$

Where;

A = Area of surface type 1, 2 and 3, with less bearing capacity

e) Hauling distance $L_A$ (Km), refer to (3) b)

f) Volume of soil for shouldering Vs ($m^3$), refer to (6) d) equation (8)

g) Hauling distance of soil Ls (Km), refer to (6) e)

h) Ditching length $L_D$ (m), refer to (3) c)

11. Surface type 1 (earth), 2 (gravel) and 3 (Macadam, cobble and Telford), the bearing capacity of which are insufficient are to be leveled with graders, filled by 20 cm thick good soil (sandy soil or good laterite), and then overlayed by 10 cm thick gravel, or crusher-run, or very good laterite.

a) Area of leveling with graders $A_L$ ($m^2$), refer to (5) a) equation (4)

b) Volume of embankment (fill) $V_E$ ($m^3$)

$$V_E = \frac{A \times 0.20}{0.90} = 0.2222\ A \qquad (14)$$

Where;

A = Area of surface type 1, 2 and 3, with insufficient bearing capacity.

0.90 = compaction factor of soil

c) Hauling distance $L_E$ (Km), refer to (6) e)

d) Volume of aggregate V ($m^3$), refer to (6) b) equation (7)

e) Hauling distance $L_A$ (km), refer to (3) b)

f) Volume of soil for shouldering $V_s$ ($m^3$), refer to (6) d) equation (8)

g) Hauling distance of soil $L_s$ (km), refer to (6) e)

h) Ditching length $L_d$ (m), refer to (3) c)

(2) Calculation of quantities of culvert

a) Replacing length of culvert $L_c$ (m).

$L_c$ of each segment can be read from the results of the Inventory Survey, and will not be classified in accordance with the condition of the roads. Accordingly, $L_c$ will be calculated separately from design categories.

b) Numbers of inlets and outlets; n

$$n = \frac{Lc}{4.5} \times 2$$

Where,

4.5= average length of culvert (m)

c) Type of culverts

In this study, pipe culverts of a diameter of 80 cm, made of reinforced concrete, is used for cost estimate. It is of course advisable to design box culverts wherever they are found to be more advantageous than pipe culverts.

(3) Reinforcement of Bridges

As is described in the foregoing paragraph 5.2.2., only the reinforcement of floor and slab systems of existing bridges, the condition of which is indicated as "damaged", are included in the Project.

The quantity of reinforcing work of bridges necessary for cost estimate, is computed by using the length of bridges $L_B$ (m) in damaged condition in the Bridge Inventory Survey

(4) Quantity of the Main Support Work.

Table 5.3.2. shows a summary of work volume in each item of the main support work.

The total length, total area of graveling, total volume of aggrerate including granular material, total volume of soil, total length of side ditch, total length of culvert to be replaced and, the total length of bridges to be reinforced with their floor systems are estimated as 4,093 km, 15,720,000 $m^2$, 1,774,000 $m^3$, 717,000 $m^3$, 8,180 km, 22,500 m and 6,300 m respectively.

Classified quantities in detail according to design category are given in Appendix E.

Note: 1) Design Category; refer to Design Procedure
2) L = Total length of Kabupaten roads surveyed
3) A = Total area of Kabupaten road carriageway surveyed

Table 5.3.2 Quantity of Main Support Work (Excluding Maintenance)

| Province | Kabupaten | Length (1) m | Area (2) ($m^2$) | Leveling | | Bulldozer work (Excavation, Level) VA ($m^3$) | Soil (Fill, Shoulder) VE+Vs ($m^3$) | Granular Material Vg ($m^3$) | Aggregate V ($m^3$) | Side Ditch Lp (m) | Replacement of Culvert Lc (m) | Bridge Support Work LB (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Grader AL ($m^2$) | Bulldozer AE ($m^2$) | | | | | | | |
| Riau | Kampar | 213,306 | 656,341 | 346,283 | 7,375 | 28,991 | 11,515 | 9,171 | 67,579 | 426,000 | 258 | 1,078 |
| | Kep. Riau | 241,222 | 922,993 | 526,954 | 106,850 | 24,971 | 34,113 | 7,819 | 86,785 | 482,000 | 321 | 565 |
| Sumatera Selatan | Lahat | 139,297 | 520,287 | 213,880 | 7,500 | 12,007 | 16,801 | 3,739 | 60,140 | 278,000 | 370 | 8 |
| | O.K.I | 186,788 | 1,001,511 | 444,201 | 24,334 | 54,276 | 11,312 | 15,517 | 106,553 | 373,000 | 256 | 605 |
| | O.K.U | 134,976 | 528,725 | 79,350 | 36,000 | 37,558 | 16,842 | 8,251 | 55,769 | 269,000 | 572 | 121 |
| | LIOT. | 130,750 | 445,500 | 204,621 | 32,950 | 13,463 | 14,520 | 4,436 | 44,871 | 261,000 | 413 | 505 |
| Lampung | Lampung Utara | 222,528 | 675,540 | 39,235 | 600,000 | 2,028 | 14,205 | 406 | 71,970 | 445,000 | 496 | 121 |
| | Lamp. Selatan | 64,778 | 194,350 | 115,275 | 19,350 | - | 10,529 | 1,098 | 23,151 | 129,000 | 221 | 134 |
| Nusa Tenggara Timur | Manggarai | 129,865 | 501,782 | 178,343 | 38,355 | 15,248 | 14,253 | 4,490 | 36,360 | 259,000 | 3,966 | 76 |
| | Belu | 218,410 | 822,016 | 495,263 | 29,486 | 29,727 | 77,361 | 7,570 | 85,451 | 436,000 | 1,538 | 38 |
| Sulawesi Utara | Bolaang Mongondow | 260,439 | 829,561 | 391,394 | 83,095 | 32,157 | 41,099 | 8,384 | 83,201 | 521,000 | 3,007 | 323 |
| | Gorontalo | 697,075 | 2,694,985 | 1,118,453 | 199,248 | 134,463 | 52,829 | 35,652 | 272,300 | 1,394,000 | 4,463 | 248 |
| Sulawesi Selatan | Takalar | 68,985 | 265,137 | 220,371 | 2,500 | 1,777 | 4,735 | 2,426 | 27,911 | 139,000 | 59 | 107 |
| | Bone | 163,240 | 690,799 | 466,866 | 10,666 | 12,392 | 38,109 | 5,780 | 72,622 | 326,000 | 372 | 86 |
| | Sidrap | 138,780 | 505,978 | 259,119 | 126,396 | 5,014 | 21,747 | 1,361 | 42,180 | 277,000 | 325 | 51 |
| | Pinrang | 76,029 | 347,550 | 81,135 | 123,908 | 7,459 | 6,236 | 2,070 | 36,530 | 152,000 | 225 | 34 |
| | Polmas | 81,040 | 352,061 | 253,579 | 37,552 | 1,958 | 14,706 | 1,467 | 30,964 | 162,000 | 400 | - |
| | Enrekang | 79,031 | 280,840 | 98,271 | 4,800 | 14,987 | 3,348 | 3,336 | 26,415 | 158,000 | 1,743 | 22 |
| | Jeneponto | 173,238 | 829,096 | 137,000 | - | 69,210 | 14,080 | 15,281 | 87,304 | 346,000 | 1,093 | 227 |
| | Kendari | 360,613 | 1,551,387 | 798,073 | 74,673 | 62,557 | 123,825 | 15,285 | 140,238 | 721,000 | 697 | 1,535 |
| | Buton | 312,443 | 1,093,415 | 860,350 | 3,900 | 18,508 | 174,559 | 5,270 | 117,278 | 624,000 | 1,673 | 357 |
| Total | | 4,093,233 | 15,719,854 | 6,903,415 | 1,544,604 | 510,437 | 717,046 | 158,709 | 1,615,372 | 8,178,000 | 22,470 | 6,241 |
| Design Category | ( 3 ) | 38,975 | 156,736 | | | | | | | | | |
| | ( 4 ) | 39,445 | 151,643 | | | | | | | | | |
| | ( 5 ) | 237,936 | 943,877 | | | | | | | | | |
| | ( 6 ) | 466,687 | 1,568,938 | | | | | | | | | |
| | ( 7 ) | 1,046,762 | 4,139,399 | | | | | | | | | |
| | ( 8 ) | 1,471,659 | 5,826,776 | | | | | | | | | |
| | ( 9 ) | 202,383 | 758,095 | | | | | | | | | |
| | (10.) | 113,586 | 406,434 | | | | | | | | | |
| | (11 ) | 475,800 | 1,767,936 | | | | | | | | | |

### 5.3.2. Maintenance in Support Works

Maintenance is the keeping of the road, so that it is always passable without any difficulty, by repairing damage of the surface, regravelling, compacting and keeping the drainage functioning on the surface, side ditches and outlet ditches.

1) Reshaping with Grader

In reshaping work, no material is involved. For this work, it will be assumed that a grader and a roller will suffice.
It is also assumed that the reshaping grader operation is carried out 3 times a year.

2) Regravelling

This operation consists of the replacement of lost gravel, grading to proper cross - falls and compacting.
It is assumed that gravel is to be added at the approximate rate of 10 $m^3$/km annually.

3) Shoulders and Drainage

This heading will include:

a) Grass cutting on shoulders (3 to 4 times a year)

b) Cleaning and minor repair to roadside drains and culverts (4 times a year)

c) Embankment repair

4) Length of Maintenance

Lengths of maintenance in the first stage are estimated in Table 5.3.3.

The yearly length of maintenance in the period of the first stage is shown in column (4), it is equal to the total length of Kabupaten Roads of the first stage (column (1)) minus the yearly length of main support work (column (3)).

Table 5.3.3 Estimate of Yearly Length of Maintenance.

| Province | Kabupaten | (1) Total Length of Support Works in the First Stage *(km) | Main Support Work (2) Proposed Period of Main Support (Yen) | Main Support Work (3) Yearly Length of Main Support (km) | Maintenance (-) =(1)-(3 1981/82-83/8 (3 years plan 1981/82-88/8 (6 years plan |
|---|---|---|---|---|---|
| Riau | Kaspar | 502 | 3 | 71 | 431 |
| | Kepulauan Riau | 411 | 3 | 80 | 331 |
| Sumatra Selatan | Lahat | 255 | 3 | 46 | 209 |
| | O.K.I | 317 | 6 | 31 | 286 |
| | O.K.U. | 257 | 3 | 45 | 212 |
| | LIOI | 280 | 3 | 44 | 236 |
| Lampung | Lampung Utara | 261 | 3 | 74 | 187 |
| | Lampung Selatan | 225 | 3 | 22 | 203 |
| Nusa Tenggara Timur | Manggarai | 332 | 6 | 22 | 246 |
| | Belu | 282 | 6 | 36 | 246 |
| Sulavesi Utara | Bolaang Mongondow | 474 | 6 | 45 | 429 |
| | Gorontalo | 947 | 6 | 116 | 831 |
| Sulavesi Selatan | Takalar | 192 | 3 | 23 | 169 |
| | Bone | 295 | 3 | 54 | 241 |
| | Sidrap | 238 | 3 | 46 | 192 |
| | Pinrang | 268 | 3 | 25 | 243 |
| | Polmas | 152 | 3 | 27 | 125 |
| | Enrekang | 140 | 3 | 26 | 114 |
| | Jeneponto | 277 | 3 | 58 | 219 |
| Sulavesi Tenggara | Kendari | 550 | 6 | 60 | 490 |
| | Buton | 405 | 6 | 52 | 353 |
| | Total | 7,060 | 3-6 | 22-116 | 6,057 |

* It is same as the length of Kabupaten Roads, the Inventory Survey of which is completed until March 1980.

## 5.4 Proposed Criteria for Deciding the Execution Priority of Individual Kabupaten Road.

### 5.4.1 General

In executing the project in a Kabupaten, deciding the priority of the various roads is one of the most important to be studied. Although the support works will eventually be executed on every Kabupaten Road in the coming years, it is very important to decide which roads are to be supported in the early stages as this will greatly affect the social and economic development. It is desirable to achieve Maximum development benefit with the limited funds and skills available.

In this chapter, criteria for setting the priority of individual road will be proposed.

### 5.4.2. Criteria for Priority Setting of Kabupaten Roads

In setting the priorities, in other words in giving the order of execution of support works, criteria have been developed which follow the government policy as noted in chapter 3.1.

Special attention has been paid to the engineering aspects, in order to ensure the successfull execution support works.

Criteria for setting the prirority of roads are proposed to be as follows:

(1) Social and Economic Development Fields.
Priority should be given to those roads from which

(i) Increased economic development benefits are expected.
(more agricultural fields and/or more agricultural production than others; more industrial production than others).

(ii) More social development benefits are expected.
(more population than others)

(2) Engineering Fields

Priority should be given to the roads in which:

(i) There are expected to be no difficulties in finding good quality of surfacing materials within an accpetable distance.

(ii) No difficulties are expected in finding local labour, operators, etc.

(iii) There will be no difficulties for access from the main office and/or to get support from the main office.

(iv) In case the quarry site is very much limitted, for example, in case of O.K.I, it is strongly advisable to give extraordinarily high priority to those links near to the quarry sites, so that the hauling cost can be minimized.

(3) Local and National Level Needs

Priority should be given to the roads which have special needs from the view-point of;

(i) Social stability such as to access to an isolated area

(ii) Relation with national priority projects such as transmigration.

(iii) National security.

(iv) Rehabilitation of damage caused by natural disasters.

5.4.3 Social and Economic Development Evaluation

(1) Methodology

In setting the priority of roads in each Kabupaten, a certain method is required to evaluate the social and economic development for each link of road.

To decide the priorities of each link, it is proposed to derive indices which represent the social and economic development effect although basic data is limited.

In order to derive the Development Effect Index and Effect/Cost Ratio Index, several studies were conducted.
To theoretically get the Development Effect Index, the following expressions are proposed.

Development Effect Index
= Social and Economic Development Potentiality Index @ Road Improvement Level Index

Where

Development Effect Index
: An Index which shows the development effect in the influential sphere of the road link.

Social and Economic Development Potentiality Index
: An Index which shows the size of population which is the resource of the social and economic development .

Effect . Cost Ratio Index

$$= \frac{\text{Development Effect Index}}{\text{Support Work Cost}}$$

Where

Effect. Cost Ratio Index

: Index which shows the ratio of Development Effect of the road link to support work cost of the road link.

(2) Development Potentiality Index

It may reasonably considered that the social development resouces are in proportion to the population and the economic development resources are in proportion to the amount of production in the influential sphere of the road link.

In a social development study,various kinds of data should be collected relating to items such as schools, hospitals, and other welfare facilities.

But given the limited data and human resources available,the data of population has been adopted as more suitable for this study.

In an economic development study, various kinds of data and forecast should be collected such as the amount of production and the cultivated areas in the present and the coming years. It is difficult to get the above mentioned data for the influential sphere of each road link. Again it is proposed to utilise the population along the road links as the relevant data. This is not an unreasonable assumption because if the people share equally the area of cultivation and the yield rate is equal in all cultivated fields, the economic index can be theoretically represented by the population along the road links.

(3) Road Level Improvement Index

To derive the Index of Development Effect, the improvement ratios relative to the current social and economic levels have been represented by Indices.

It was conceived that the Road Level Improvement Index could be used to represent the influence ratio of the current development level to the new development level along the roads.

Table 5.4.1. Vehicles Operating Cost and its Improvement Ratio by the Support Work

| Surface Conditions | Gravel Road | | | | Earth Road | | | |
|---|---|---|---|---|---|---|---|---|
| | Good | Fair | Poor | Damaged | Good | Fair | Poor | Damaged |
| Rp/Passenger - Km | | | | | | | | |
| Motor Cycle | 13.1 | 15.1 | 19.7 | 24.6 | 13.2 | 15.9 | 19.7 | 24.5 |
| | (1.00) | (1.15) | (1.50) | (1.88) | (1.01) | (1.21) | (1.50) | (1.87) |
| Light Bus | 8.9 | 10.1 | 15.2 | 26.1 | 9.0 | 11.0 | 17.9 | 25.9 |
| | (1.00) | (1.13) | (1.71) | (2.93) | (1.01) | (1.24) | (2.01) | (2.91) |
| Rp/Ton - Km | | | | | | | | |
| Light Truck | 93.8 | 104.9 | 142.0 | 297.2 | 95.5 | 113.6 | 161.1 | 294.2 |
| | (1.00) | (1.12) | (1.51) | (3.17) | (1.02) | (1.21) | (1.72) | (3.14) |
| Medium Truck | 26.5 | 29.5 | 39.4 | 63.0 | 27.7 | 32.2 | 39.2 | 60.8 |
| | (1.00) | (1.11) | (1.49) | (2.38) | (1.05) | (1.22) | (1.47) | (2.29) |

( ) : The improvement ratio of the vehicles operating cost, as a result the support work.

It was also conceived that it may be proportional to the ratio of transportation cost of the goods.

In the study in chapter 8.3, the vehicles operating costs have been estimated according to the surface conditions of the roads. ( See Table 8.3.1)

From the result of Table 8.3.1 , the Table 5.4.1 was prepared showing the operation cost of vehicles per passenger-Km and per ton-Km for freight,according to the surface condition of the Roads.

In the Table 5.4.1 the improvement ratio of the operating cost by the support work has been shown.

In calculating the improvement ratio of operating cost for each link, it is proposed to use the cost of the goods carried by the light trucks.

Since major transport of goods is being handled at present by Light Trucks, this proposal seems reasonable.

In calculation of the Road Level Improvement Index, each link of Kabupaten Roads in the Inventory Output of Table 5.4.2 (for an example, O.K.I, Sumatra Selatan adopted) has been amended into the same surface type categories shown in Table 5.4.3 (For an example, O.K.I, Sumatra Selatan adopted,refer to link No. in figure 5.4.1). Link numbers within each Kabupaten are shown in the Maps of appendix C-1. Road Level Improvement Indices have been calculated by multiplying each length of surface type by the improvement ratio of operating cost from Table 5.4.1 (Rp/Ton-Km, Light Truck)

This figure is then devided by the total length of each link, as given in Table 5.4.3

Fig. 5.4.1. Link Number Map of Kabupaten Road in the First Inventory Survey

Province : Sumatra Selatan
Kabupaten : O. K. I.

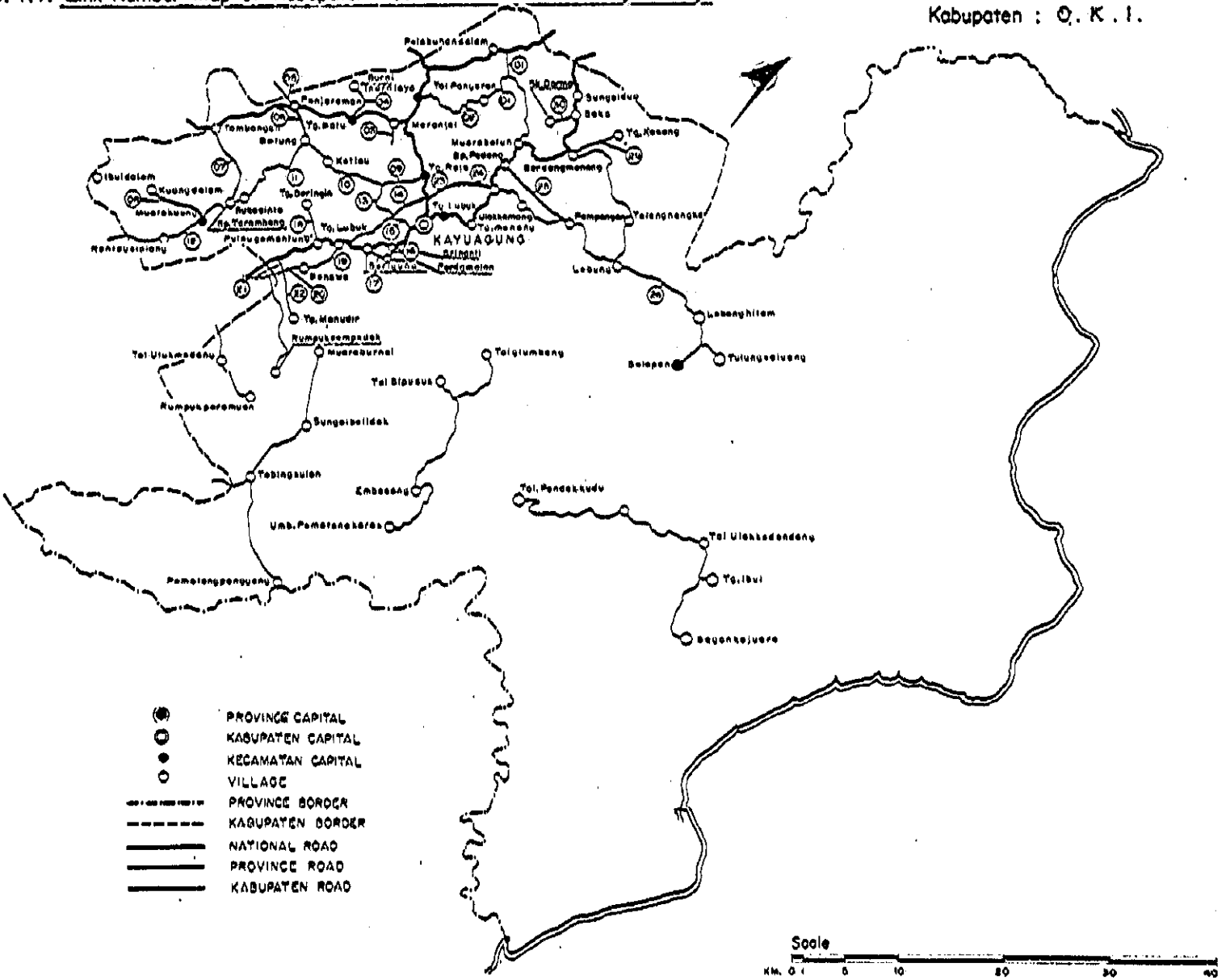


Table 5.4.2. An Example of Inventory Survey Output

- Condition of Roads -

Page: 1

Ministry of Public Works

Directorate General of Highways

Division of Kabupaten Road Planning

PROVINCE : SUMATRA SELATAN

KABUPATEN: O.K.I

Inventory of Kabupaten Road

Dimension of Road

| Code Prov. | Code Kab. | Link No. | Segment No. | No.of seg. | Length of Seg. | Length of Link | Width of Carriage way | Width of Shoulder | Poor Alignment | Less 10% | More 10% | Surface type | Good Condition | Blooding Asphalt | Lightly Damaged | Heavyly damaged | Lightly Corrug. | Heavily Corrug. | Less bearing capacity | Insufficient bearing Capacity | Page |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (Km) | (Km) | (Cm) | (Cm) | (Km) | (m) | (m) | | ($m^2$) | ($m^2$) | ($m^2$) | ($m^2$) | ($m^2$) | ($m^2$) | ($m^2$) | ($m^2$) | |
| 15 | 2 | 1 | 1 | 3 | 5 | 17 | 700 | 0 | 0 | 0 | 0 | 1 | 22400 | 0 | 5600 | 7000 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 1 | 2 | 3 | 5 | 17 | 440 | 0 | 0 | 0 | 0 | 1 | 11200 | 0 | 3000 | 7800 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 1 | 3 | 3 | 7 | 17 | 500 | 0 | 0 | 0 | 0 | 1 | 21100 | 0 | 4100 | 9800 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 2 | 1 | 2 | 10 | 15 | 700 | 0 | 0 | 0 | 0 | 1 | 70000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 2 | 2 | 2 | 5 | 15 | 700 | 0 | 0 | 0 | 0 | 1 | 35000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 3 | 1 | 1 | 3 | 3 | 400 | 183 | 5 | 0 | 0 | 2 | 6800 | 0 | 4000 | 1200 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 4 | 1 | 2 | 5 | 11 | 600 | 0 | 10 | 150 | 0 | 1 | 24600 | 0 | 4800 | 600 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 4 | 2 | 2 | 6 | 11 | 600 | 0 | 12 | 200 | 0 | 1 | 24400 | 9000 | 3000 | 0 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 5 | 1 | 1 | 10 | 10 | 700 | 0 | 16 | 1325 | 0 | 1 | 43400 | 0 | 18200 | 8400 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 6 | 1 | 1 | 7 | 7 | 400 | 625 | 14 | 1300 | 0 | 2 | 18000 | 0 | 7200 | 2800 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 7 | 1 | 2 | 7 | 17 | 700 | 0 | 6 | 650 | 0 | 2 | 12600 | 0 | 4200 | 25200 | 0 | 7000 | 0 | 0 | 1 |
| 15 | 2 | 7 | 2 | 2 | 10 | 17 | 700 | 0 | 0 | 475 | 0 | 1 | 20200 | 0 | 7700 | 34100 | 0 | 8000 | 0 | 0 | 1 |
| 15 | 2 | 8 | 1 | 1 | 0 | 9 | 500 | 0 | 9 | 1250 | 0 | 1 | 27500 | 0 | 12500 | 5000 | 0 | 0 | 0 | 0 | 1 |
| 15 | 2 | 9 | 1 | 1 | 0 | 9 | 900 | 0 | 18 | 0 | 0 | 1 | 66600 | 0 | 13500 | 900 | 0 | 0 | 0 | 0 | 1 |

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Table 5.4.3. Road Surface Conditions of Priority Setting Study

| Link No. | Length of Link | Asphalt. | | | | Gravel | | | | Earth | | | | Road Level Improvement Index | Direct Support work Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Good | Fair | Poor | Damaged | Good | Fair | Poor | Damaged | Good | Fair | Poor | Damaged | | |
| | Km | Km | Km | Km | Km | Km | Km | Km | Km | Km | Km | Km | Km | | mil. Rp |
| 1 | 17 | | | | | - | - | - | - | 9.97 | - | 2.30 | 4.73 | 1.70 | 43.73 |
| 7 | 17 | | | | | - | - | - | - | 4.68 | - | 3.98 | 8.47 | 2.24 | 77.41 |
| 11.12 | 39 | | | | | - | - | - | - | 14.22 | - | 8.51 | 16.27 | 2.06 | 153.07 |
| 13.14. 15 | 23 | | | | | - | - | - | - | 3.08 | - | 4.97 | 14.95 | 2.52 | 126.02 |
| 18.19. 20.21. 22 | 28 | | | | | - | - | - | - | 6.62 | 0.03 | 7.30 | 14.10 | 2.27 | 132.34 |
| 23.24 | 17 | | | | | 1.00 | 0.00 | 8.00 | 1.00 | 1.22 | - | 3.49 | 2.29 | 1.80 | 81.05 |
| 25.26 | 72 | | | | | - | - | - | - | 19.28 | - | 21.22 | 31.50 | 2.15 | 320.75 |

Table 5.4.4

Reference Table of Categories of Inventory and Table 5.4.3

| Inventory Category | Surface type for table 5.4.3 |
|---|---|
| 1. Earth | Earth |
| 2. Gravel | Gravel |
| 3. Stone | Gravel |
| 4. Asphalt Surface Dressing | Asphalt |
| 5. Penetration Asphalt | Asphalt |
| 6. Asphalt Concrete | Asphalt |
| Good Condition | Good |
| Asphalt Bleeding | Fair |
| Lightly Damaged with holes | Poor |
| Heavily Damaged with holes | Damaged |
| Lightly Corrugated | Fair |
| Heavily Corrugated | Poor |
| Less Bearing Capacity | Poor |
| Insufficient Bearing Capacity | Damaged |

Table 5.4.5 Total Lenth & Direct Construction Cost
(By Support Work Category)

| Category | Length | Direct Construction Cost |
|---|---|---|
| | (Km) | (Thousand) |
| ( 3 ) | 38.9 | 45,500 |
| ( 4 ) | 39.4 | 53,900 |
| ( 5 ) | 237.9 | 601,600 |
| ( 6 ) | 466.6 | 2,180,900 |
| ( 7 ) | 1046.7 | 5,479,600 |
| ( 8 ) | 1471.6 | 9,289,900 |
| ( 9 ) | 202.3 | 1,216,300 |
| (10 ) | 113.5 | 705,700 |
| (11 ) | 475.8 | 3,802,200 |
| Total | 4,093.2 | 23,373,100 |

Table 5.4.6 Direct Construction Cost per km (by Type & Condition)

| Type | Condition | Category | Length | Direct Construction Cost | Unit Cost |
|---|---|---|---|---|---|
| | | | (Km) | (Thousand Rp) | (Thousand Rp/Km) |
| GRAVEL | Fair | 3 | 38.9 | 42,500 | |
| | | 4 | 39.4 | 53,900 | 1,230 |
| | | Total | 78.4 | 96,500 | |
| | Poor | 6 | 233.3 (½) | 1,090,400 | |
| | | 7 | 523.3 (½) | 2,739,800 | |
| | | 10 | 56.7 (½) | 352,800 | 5,140 |
| | | Total | 813.5 | 4,183,100 | |
| | Damaged | 8 | 735.8 (½) | 4,644,900 | |
| | | 9 | 202.3 | 1,216,300 | |
| | | 11 | 237.9 (½) | 1,901,100 | 6,600 |
| | | Total | 1,176.1 | 7,762,400 | |
| EARTH | Fair | 5 | 237.9 | 601,600 | 2,530 |
| | | Total | 237.9 | 601,600 | |
| | Poor | 6 | 233.3 (½) | 1,090,400 | |
| | | 7 | 523.3 (½) | 2,739,800 | |
| | | 10 | 56.7 (½) | 352,800 | 5,140 |
| | | Total | 813.5 | 4,183,100 | |
| | Damaged | 8 | 735.8 (½) | 4,644,900 | |
| | | 11 | 237.9 (½) | 1,901,100 | 6,720 |
| | | Total | 973.7 | 6,546,000 | |

(4) Development Effect Index

Development Effect Index represents the social and economic development effect index, but in this study only population percentage of each road link has been used to represent both the social and economic development index. Development Effect Index has been calculated by multiplying the weight of population along each road link with the Road Level Improvement Index.

(5) Support Work Cost

In calculating the support work cost, unit prices per Km have been calculated according to the surface conditions of road links. In calculation of the unit price, total prices for each category have been utilized.

The procedures of this calculation are shown in table 5.4.5 and table 5.4.6.

It should be noted that support work cost estimated here does not include the cost of the Bridges and of indirect costs such as administration cost.

(6) Effect . Cost Ratio Index

Develpoment Effect/Cost Ratio Index can be calculated by dividing the Development Effect Index by the Support Work Cost.

(7) Priority Setting

Following the above procedure it now becomes possible to set the priorities. In setting the priorities to the Road Links, generally two methods can be applied. The first is the maximum effect method.

This aims at the maximum amount of effect. In this way priorities is given to the road links with the largest figures of Development Effect Index .

The second method is the maximum Effect . Cost Ratio method. It aims at the most effective investment of the fund. In this way priority is given to the road links with the largest figures of the Effect Cost Ratio Index.

In this study both methods of setting priority were applied. In other words priority setting was conducted after figuring the average of two kinds of tentative priorities.

5.4.4 Engineering Evaluation of the Priorities

After setting draft priorities from the Social and Economic Development Evaluation, the Engineering Evaluation is needed to lead the project to a successful execution.

In setting the Kabupatens, the more desirable Kabupatens have been selected through the Engineering Criteria (see chapter 3.2)
Thus at Kabupaten level the critical hindrance has been avoided in the engineering field.

In executing the Project any kind of engineering obstacles should be avoided as far as possible especially at the early stage of support work. The executing capability will be improved through the experiences of the support work execution, and thus the successful operation in the early stages will help to build self-confidence in the execution.

As noted in chapter 5.4.2, any difficulties should if possible be avoided and these include problems such as low accessibility to surfacing materials, poor availability of operators and labour, low accessibility to the main office and poor availability of support from the main office.

### 5.4.5 Local and National Level Needs

To finalize the priorities of road links after social and economic evaluation and engineering evaluation, the Local and National Level Needs were studied from the various sides of the project. Since the social and economic evaluation and engineering evaluation do not cover the special local and/or national needs, these matters were scrutinized and amendment of the priorities conducted.

### 5.4.6 Priority setting for the Roads of the Project.

Deciding priority for the roads in the project was carried out using the above procedures and Table 5.4.7 (for an example)

The result to set the priority for the 21 Kabupatens in this form are given in appendix D-1.

In this work the surface conditions of all kinds of Roads were evaluated utilizing the data of Table 5.4.2 in the first instance. The number of Road Links was then decreased by deleting the links of which major portions are in good or fair conditions already, or the portions in which the poor/damaged surface conditions are insignificantly small . Also the road links, of which the lengths are 2 Km or less, were omitted to rationalize the study. In selecting the road links for the priority setting study, grouping of links was conducted in cases where links were suitable to be studied as one group.

In one case links were grouped as one as they consist of one continuous route. In another case links were grouped as one as they form the road network servicing the total area.

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Table 5.4.7. An Example of Priority Setting of the Road Links

| Link No. (1) | Length (2) | Population (Pi) (3) | Total Development Potentiality Index (4) | Road Level Improvement Index (5) | Development Effect Index (6)=(4)@(5) | Support Work Cost (7) | Effect Cost Ratio Index (8)=(7)/(6) | Priority From (6) (9) | Priority From (8) (10) | Priority Average of (9)&(10) (11) | Priority Priority (12) | Engineering Remarks (13) | Local & National Level Remarks Trans-Emigration (14) | Approach to Isolated Area (15) | Damaged by Natural Disaster (16) | Others (17) | Proposed Priority (18) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 17 | 16,400 | 9.8 | 1.70 | 16.66 | 43.73 | 0.38 | 5 | 1 | 3 | 3 | | | | | | 3 |
| 7 | 17 | 8,500 | 5.1 | 2.24 | 11.42 | 77.41 | 0.15 | 7 | 7 | 7 | 7 | | | | | | 7 |
| 11.12 | 39 | 19,500 | 11.7 | 2.06 | 24.07 | 133.07 | 0.16 | 4 | 3 | 4.5 | 5 | | | | | | 5 |
| 13.14.15 | 23 | 24,800 | 14.9 | 2.52 | 37.55 | 126.02 | 0.30 | 2 | 2 | 2 | 1 | | | | | | 2 |
| 18.19.20 21.22 | 28 | 20.000 | 12.0 | 2.27 | 27.24 | 132.34 | 0.21 | 3 | 4 | 3.5 | 4 | | | | | | 4 |
| 23.24 | 17 | 12.000 | 7.2 | 1.80 | 12.96 | 81.05 | 0.16 | 6 | 5 | 5.5 | 6 | Improved | | | | | 6 |
| 25.26 | 72 | 64.900 | 39.0 | 2.15 | 83.85 | 320.75 | 0.26 | 1 | 3 | 2 | 1 | | | * | | | 1 |

As to the population of the influential sphere of the road links, the figures were given by the officials of Kabupatens in a few cases but in most cases the figures were assumed from the data of population densities of Kecamatans, and the link maps.

The priorities, derived from social and economic development evaluation and engineering evaluation, were amended by local and/or national level needs to some extent. The extent of the amendment can be seen in appendix D-1.

After priority setting of the Road Links shown in Table 5.4.7, the priority lists of the road links of each Kabupaten were formed as shown in Table 5.4.8 ( as an example , O.K.I, Sumatra Selatan) and the result are shown in appendix D-2.

In some Kabupatens, modified alternative priorities have been proposed, taking into consideration the execution program including the mobilization schedule of the equipment and the rationalization of transport of equipment.

And also priority lists have been reviewed from the viewpoint of road network balance, including the sequense of the priority links to the arterial roads to ensure maximizing the function of each road link.

Some comments have been noted concerning these matters in the form of table 5.4.8. The out-come of the study is shown in appendix D-2. With limited time and data the relative priority of the various links have been established. Generally the results seem reasonable, but it is desirable to review the tables before execution.

Table 5.4.8. An Example of Priority of the Road Links for the Support Work

| Province | Kabupaten | Link Number of the major Support Work | | | Remarks |
|---|---|---|---|---|---|
| | | First Priority Links | Second Priority Links | Third Priority Links | |
| Sumatera Selatan | O.K.I | 25.26<br><br>13.14.15<br>1 | 18.19.20.21.22 | 11.12<br>23.24<br>7 | 1.Link No.25&26 to be improved in around three years with one fleet of equipment allocated.<br>2. In improving the inventory survey, many new links are supposedly needed to be improved, in relation with transmigration Scheme. |

## 5.5 Equipment to be procured and their Specifications.

### 5.5.1. General.

Since the Support Works in the Project will be fundamentaly carried out by force account, as well as the mechanized construction method, the necessary numbers and types of equipment have been studied, the procedure for which is stated below.

(1) Considering the nature of support works in the Project, bulldozers, wheel loaders, graders, tyre rollers, dump-trucks and portable crushing plants are proposed as the Project's main equipment.

(2) The calculation of numbers of main equipment, based on the main support work volume, average distance and main-support work period (3 or 6 years).

(3) The calculation of numbers of graders and dump trucks, based on the length of roads requiring maintenance.

(4) The period (time span) of main support work is proposed to take either 3 years or 6 years based on the condition of

a) Total length of Kabupaten Roads to be supported in the first stage.

b) Limit of number of dump trucks (in other words, limit of trafficability on hauling roads).

c) Execution capacity of DPUK (Public Works Kabupaten).

(5) The sum of the numbers calculated above is adjusted, based on engineering judgement, for example,2 units are proposed as the minimum number necessary in the equipment governs the whole work.

(6) In addition, some minor, but necessary, types of equipment,

such as mobile workshops and fuel tank trucks are listed.

In the calcutation of numbers of equipment the following conditions and considerations were applied.

(1) Limit of weight of equipment.

Considering the low bearing capacity, and narrow width of bridges and poor geometric figures of Kabupaten Roads in mountainous areas , the figure of about 10 tons is proposed as the maximum weight of equipment in transportable condi - tion, except for portable crushing plants.
The weight of a portable crushing plant of 20 - 30 t/h capacity, is 13 ton, so it might be necessary to transport it in two separate units.

(2) Work efficiency of equipment.

A rather low work efficiency has been used for bulldozers, wheel loaders and graders, but ordinary work efficiency for tyre rollers and dump-trucks, taking into account the existing technical level of mechanised construction in the Kabupatens.

(3) Daily working time.

Seven hours has been used in the study.

(4) Numbers of workable days in a year.
The numbers of workable days were based on the local weather condition. Please see chapter 4 section 1.

(5) Bulldozers.

Bulldozers are assumed to work

a) at quarry sites,

b) for the leveling of and excavation of cobble roads.

c) on earth works in a limited number of Kabupatens.

During the actual work, it is proposed to work bulldozers on the roads when they are not being used at quarry sites.

(6) Portable crushing plant.

It is proposed to use a portable crushing plant at all Kabupaten.
Crushing plants can be used to obtain the appropriate aggregate size even in those Kabupatens where river gravel is prevalent.

(7) Hydraulic excavator, with hydraulic breaker

Some of the uses to which hydraulic excavators, with hydraulic breaker can be put are as follows :-

They can work effectively on the pre-crushing of boulder or soft rock, for the preparation of crushing plants at quarry sites, instead of using explosion and also for trenching, loading and miscellaneous excavating tasks.

(8) Equipment for road maintenance.

A set of one grader, three dump trucks together with an available Macadam roller (not yet procured) are proposed as the basic unit of the maintenance equipment fleet.
In some Kabupatens, where cobbles are predominantly being used on existing roads grader work is impossible, and so bulldozers are proposed in lieu.

5.5.2. Proposed Numbers and Types of Equipment

Table 5.5.1 shows the number of equipment in every Kabupaten for graveling and maintenance work.

Table 5.5.2 shows the numbers and types of equipment for every Kabupaten.

5.5.3. Main Specification of Equipment

General specifications of Equipment to be procured, are listed below.

(1) Bulldozer : Operating weight 11 - 12 t, 100-110 PS diesel engine driven, direct driven, hydraulic operating angle dozer, tilt adjustment 300-400 m/m by manual, standard crawler, with canopy.

(2) Motor Grader : Operating weight 9-10 t, 110 PS diesel engine driven, blade length about 3.1 m, Front 2 wheel, Rear Tandem 4 wheel, with scarifier, tyre size front and rear 11.00-20 10 PR, power control hydraulic, with canopy.

(3) Tyre Roller : Operating weight empty 8-8.5 t, ballasted 15-15.5 t, 90-95 PS diesel engine-driven, number of Tyres in front 4-5 rear 5-6, tyre sizes 8.25-20 12 PR or 9.00-20 10 PR all smooth tread, max. speed over 20 km/h, with canopy, with water tank (for ballast) and powered sprinkler, and with compressor for charging with air.

Table 5.5.1. Proposed Number of Main Equipment

| Province | Kabupaten | Bulldozer | | | Motor Grader | | | Tire Roller | | Wheel Loader | | Dump Truck | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Graveling | Maintenance | Proposed | Graveling | Maintenance | Proposed | Graveling | Proposed | Graveling | Proposed | Graveling | Maintenance | Proposed |
| RIAU | Kampar | 1 | | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 9 | 6 | 15 |
| | Kepulauan Riau | 1 | | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 13 | 6 | 19 |
| SUMATRA SELATAN | Lahat | 1 | | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 16 | 3 | 19 |
| | O.K.I. | 1 | 1 | 3 | 2 | 2 | 4 | 1 | 3 | 1 | 3 | 24 | 6 | 30 |
| | O.K.U. | 1 | | 2 | 2 | 1 | 3 | 1 | 2 | 1 | 2 | 20 | 3 | 23 |
| | Liot | 1 | | 2 | 2 | 1 | 3 | 1 | 2 | 1 | 2 | 16 | 3 | 19 |
| LAMPUNG | Lampung Utara | 1 | | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 18 | 3 | 21 |
| | Lampung Selatan | 1 | | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 5 | 3 | 8 |
| NUSA TENGGARA TIMUR | Manggarai | 1 | 2 | 3 | 1 | 0 | 1 | 1 | 2 | 1 | 2 | 8 | 6 | 14 |
| | Belu | 1 | | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 17 | 3 | 20 |
| SULAWESI UTARA | Bolaang Mongondow | 1 | 1 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 7 | 6 | 13 |
| | Corontalo | 4 | 2 | 6 | 3 | 1 | 4 | 2 | 2 | 2 | 2 | 18 | 12 | 30 |
| SULAWESI SELATAN | Takalar | 1 | | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 6 | 3 | 9 |
| | Bone | 1 | | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 13 | 3 | 16 |
| | Sidrap | 1 | | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 11 | 3 | 14 |
| | Pinrang | 1 | | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 8 | 3 | 11 |
| | Polmas | 1 | | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 8 | 3 | 11 |
| | Enrekang | 1 | | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 6 | 3 | 9 |
| | Jeneponto | 1 | | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 20 | 3 | 23 |
| SULAWESI TENGGARA | Kendari | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 20 | 6 | 26 |
| | Buton | 1 | 1 | 2 | 2 | 1 | 3 | 1 | 2 | 2 | 2 | 14 | 6 | 20 |
| | TOTAL | | | 42 | | | 54 | | 43 | | 43 | | | 370 |

Table 5.5.2. List of Equipment

| Province | Kabupaten | Bulldozer 11t | Motor Grader 3.1 m | Tire Roller 8.5-15t | Wheel Loader 1 m³ | Dump Truck 3.5t | Water Tank Truck 3,500 l | Portable Concrete Mixer 0.3 m³ | Portable Crushing Plant 10-20 t/h | Portable Crushing Plant 20-30 t/h | Portable Compressor 7.0 m³/min | Leg Drill 38 φ Bit | Hand Rammer 38 φ Bit | Hydraulic Excavator 0.4 m³ w/Breker | Mobile Workshop 4t | Fuel Tank Truck 3,500 l | Service car | Number of Operator | Number of Driver |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RIAU | Kampar | 2 | 3 | 2 | 2 | 15 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 2 | 2 | 12 | 21 |
| | Kepulauan Riau | 2 | 3 | 2 | 2 | 19 | 1 | 1 | 1 | - | 1 | 1 | 2 | - | 1 | 1 | 2 | 12 | 24 |
| SUMATERA SELATAN | Lahat | 2 | 2 | 2 | 2 | 19 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 11 | 24 |
| | O.K.I | 3 | 4 | 3 | 3 | 30 | 1 | 1 | - | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 17 | 37 |
| | O.K.U | 2 | 3 | 2 | 2 | 23 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 12 | 28 |
| | L.I.O.T. | 2 | 3 | 2 | 2 | 19 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 12 | 24 |
| LAMPUNG | Lampung Utara | 2 | 2 | 2 | 2 | 21 | 1 | 1 | - | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 12 | 26 |
| | Lampung Selatan | 2 | 2 | 2 | 2 | 8 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 11 | 13 |
| NUSA TENGGARA TIMUR | Manggarai | 3 | 1 | 2 | 2 | 14 | 1 | 1 | 2 | - | 2 | - | 6 | 1 | 1 | 1 | 2 | 14 | 19 |
| | Zelu | 2 | 2 | 2 | 2 | 20 | 1 | 1 | 1 | - | 1 | - | 3 | - | 1 | 1 | 2 | 11 | 25 |
| SULAWESI UTARA | Bolaang Mongondow | 2 | 3 | 2 | 2 | 33 | 1 | 1 | 2 | - | 2 | 4 | 2 | 1 | 1 | 1 | 3 | 15 | 19 |
| | Gorontalo | 6 | 4 | 2 | 2 | 30 | 1 | 1 | - | 2 | 2 | 4 | 2 | 1 | 1 | 2 | 3 | 20 | 37 |
| SULAWESI SELATAN | Takalar | 1 | 2 | 2 | 2 | 9 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 10 | 14 |
| | Bone | 1 | 3 | 2 | 2 | 16 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 11 | 21 |
| | Sidrap | 1 | 2 | 2 | 2 | 14 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 10 | 19 |
| | Pinrang | 1 | 2 | 2 | 2 | 11 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 10 | 16 |
| | Polmas | 1 | 2 | 2 | 2 | 11 | 1 | 1 | 1 | - | 1 | - | 3 | - | 1 | 1 | 2 | 10 | 16 |
| | Enrekang | 2 | 2 | 2 | 2 | 9 | 1 | 1 | - | 1 | 1 | 2 | 1 | - | 1 | 1 | 2 | 11 | 14 |
| | Jeneponto | 1 | 3 | 2 | 2 | 23 | 1 | 1 | | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 11 | 28 |
| SULAWESI TENGGARA | Kendari | 2 | 3 | 2 | 2 | 26 | 1 | 1 | - | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 13 | 32 |
| | Buton | 2 | 3 | 2 | 2 | 20 | 1 | 1 | - | 1 | 1 | - | 3 | - | 1 | 1 | 2 | 12 | 25 |
| Number of Equipment | | 42 | 54 | 43 | 43 | 370 | 21 | 24 | 7 | 17 | 24 | 17 | 55 | 6 | 21 | 25 | 45 | 257 | 492 |

Table 5.5.3. List of Equipment in Province

| Equipment \ Province | Capacity | Riau | Sumatra Selatan | Lampung | Nusa Tenggara Timur | Sulawesi Utara | Sulawesi Selatan | Sulawesi Tenggara | Number of Equipment |
|---|---|---|---|---|---|---|---|---|---|
| Bulldozer | 11t | 4 | 9 | 4 | 5 | 8 | 8 | 4 | 42 |
| Motor Grader | 3.1 m | 6 | 12 | 4 | 3 | 7 | 16 | 6 | 54 |
| Tyre Roller | 8.5 - 15t | 4 | 9 | 4 | 4 | 4 | 14 | 4 | 43 |
| Wheel Loader | 1 m3 | 4 | 9 | 4 | 4 | 4 | 14 | 4 | 43 |
| Dump Truck | 3.5t | 34 | 91 | 29 | 34 | 43 | 93 | 46 | 370 |
| Water Tank Truck | 3,500 l | 2 | 4 | 2 | 2 | 2 | 7 | 2 | 21 |
| Portable Concrete Mixer | 0.3 m3 | 2 | 4 | 2 | 2 | 2 | 7 | 2 | 21 |
| Portable Crushing Plant | 10-20 t/h | 1 | - | - | 3 | 2 | 1 | - | 7 |
| Portable Crushing Plant | 20-30 t/h | 1 | 4 | 2 | - | 2 | 6 | 2 | 17 |
| Portable Compressor | 7.0 m3/min | 2 | 4 | 2 | 3 | 4 | 7 | 2 | 24 |
| Leg Drill | 38 ϕ Bit | 1 | 2 | 2 | - | 8 | 2 | 2 | 17 |
| Hand Hammer | 38 ϕ Bit | 5 | 10 | 4 | 9 | 4 | 19 | 4 | 55 |
| Hydraulic Excavator | 0.4 m3 w/Breaker | - | 1 | 1 | 1 | 2 | - | 1 | 6 |
| Mobile Workshop | 4t | 2 | 4 | 2 | 2 | 2 | 7 | 2 | 21 |
| Fuel Tank Truck | 3,500 l | 3 | 5 | 2 | 2 | 3 | 7 | 3 | 25 |
| Service Car | | 4 | 9 | 4 | 4 | 5 | 14 | 4 | 45 |
| Number of Operator | | 24 | 52 | 23 | 25 | 35 | 73 | 25 | 257 |
| Number of Driver | | 45 | 113 | 39 | 44 | 56 | 128 | 57 | 482 |

(4) Wheel Loader : Operating weight 7.6 - 10.2 t, 82 - 103 PS diesel engine driven, bucket capacity struck 1 $m^3$ over heaped 1.4 - 1.6 $m^3$ over, 2 front, 2 rear wheel, tyre size 14.00 - 24 12 PR or 18.4 - 24 10 PR, articulated frame, all wheel drive, dumping clearance (dump angle 45°) 2.6-2.8 m.

(5) Hydraulic Excavator with Hydraulic Breaker

Hydraulic Excavator : Operating weight 8.1 - 11.2 t, 79 - 90 PS diesel engine driven, buckedt capacity struck 0.33 - 0.4 $m^3$ heaped 0.4 - 0.46 $m^3$, crawler propelling, all hydraulic drive - 2 pump system, with steel cabin.

Hydraulic Braker : Operating weight 360 - 700 kg, necessary oil volume 50 - 180 l/min, oil pressure about 140 $kg/cm^2$ and blow 280 - 650 blow/min.

(6) Portable Crushing Plant (10-20t/h)

Total weight 10 t, 35-40 PS diesel engine driven, trailer mounted, crusher is one, single toggle jaw crusher (405x 255 m/m), vibrating screen double deck (900 x 1,880 m/m) belt conveyor crusher to screen belt width 400 m/m, length approx. 4.5 m belt speed approx. 40 m/min, trailer 4 wheel with screw jack, tyre size 9.00 - 20 14 PR, stocking conveyor 3 unit belt width 350 m/m, conveyor length approx. 7 m, belt speed approx. 43 m/min. and gasoline engine 3PS driven.

(7) Portable Crushing Plant (20 - 30 t/h)

Total weight approx. 13 t, 43 PS diesel engine driven, trailer mtd., crusher is one, single toggle jaw crusher (510 x 280 m/m), vibrating screen double deck (900 x 1800 m/m), belt conveyor crusher to screen belt width 450 m/m, length approx. 4.5 m, belt speed approx. 65 m/min, trailer 4 wheel with screw jack, tyre size 9.00 - 20 14 PR, stocking conveyor 3 unit, belt width 350 m/m, conveyor length approx. 7 m, belt speed approx. 43 m/min. gasoline engine 3.5 PS driven.

(8) Portable Compressor

Total weight 1.6 - 1.9 t, trailer mtd, 65 - 80 PS diesel engine driven, compressor type is vane or screw, outlet pressure 7 kg/cm$^2$, outlet volume 7 - 7.5 m$^3$/min, tyre size 5.50 - 14 6 PR or 6.00 - 14, trailer 2 wheel.

(9) Leg Drill

Weight 30 - 40 kg, cylinder bore 66 - 68 m/m, stroke approx. 68 m/m, air system, blow 1,800 - 2,400 blow/min, feed cylinder approx. 56 m/m, feed stroke 960 - 990 m/m, air pressure 5 kg/cm$^2$.

(10) Hand Hammer

Weight 13 - 15 kg, cylinder diameter 54 - 62 m/m, stroke 37 - 55 m/m, usable shank 22H x 83 - 108 m/m, air blow system, air pressure 5 kg/cm$^2$, blow 2,300 ∿ 2,100 blow/min.

(11) Portable Concrete Mixer

Total weight approx. 2 t, mixing capacity 0.3 $m^3$, gravity type, 15 PS diesel engine driven, trailer mtd.

(12) Dump Truck 3.5 t

Vehicle weight approx. 3.7 t, 135 - 160 PS diesel engine driven, vessel capacity 2.6 $m^3$, drive type 4 x 2, tyre size 7.50 - 16 14 PR and hydraulic rear dump system.

(13) Water Tank Truck 3,500 liter

Vehicle weight approx. 3.7 t, 135 - 160 PS diesel engine driven, tank capacity 3,500 liter, drive type 4 x 2, tyre size 7.50 - 16.14 PR, with powered spray system, and with adequate pumping-up pump and hose.

(14) Fuel Tank Truck 3,500 liter

Vehicle weight approx 3.7 t, 135 - 160 PS diesel engine driven, tank capacity 3,500 liter, drive type 4 x 2, tyre size 7.50 - 16 14 PR, with adequate charging and supply pump and hose.

(15) Mobile Workshop

Chassis and cab. 4 t truck chassis, total vehicle weight 9 t, 135 - 160 PS diesel engine driven, drive type 4 x 2, hydraulic crane 2 t, steel workshop. Main facility, engine generator, air compressor 0.75 kw, electric welder set 50 - 250 amp, oxy-acetylene welder set, mechanic tool sets, pneumatic tool set, electric tools set, measuring instrument set, jack and other lifting devices, clearing equipment and tools, lubricating equipment and tools, machining tools, engine repair equipment and tools, electric testing instruments,

battery service equipment and tools, tyre service equipment and tools, sheet metal equipment and tools,

(16) Service Car

Vehicle weight approx. 1.7 t, 100 - 130 PS gasoline engine drive, drive type 4 x 4, tire size 7.00 - 15 6 PR .

## 5.6. Consulting Services

Since the Project, the Local Roads Support Works in the narrow sense, is the first project of mechanized work for local Government Level II, it is proposed to use consulting services in accordance with the OECF Guidelines on the Use of Consultants.

### (1) Main Objectives of Consulting Services

The main objectives of the consulting services are:

a) to assist Bina Marga and the local agencies concerned for the co-ordination of the Project, to secure the scheduled progress of the Project.

b) to assist the local agencies to secure effective and economic construction and maintenance methods through training on four (4) model job sites.

### (2) Manner of Consulting Services

It is proposed as follows:

a) Assistance of project co-ordination and advice services. It is proposed to carry out these services with two (2) foreign and twelve (12) local engineers and other supporing staff for about three (3) years. They will be based mainly in Jakarta and from time to time in the Kabupatens concerned.

In Bina Marga, the consultants will assist with the co-ordination of the Project, and submit as necessary (proposals and advice) to the officials concerned under the sub-directorate of Local Road Development.

The consultants will conduct field surveys at the job sites, to check the progress of work and give advice to the officials concerned when necessary.

The Project Manager (1) is to be a civil or mechanical engineer with more than 20 years experience of road betterment and/or maintenance, preferably with experience in government.

The Senior Engineer (1) is to be a civil engineer or mechanical engineer with more than 15 years experience of road betterment and/or maintenance.

b) Assistance of on-job training in the four Provinces
These services will be conducted by eight (8) foreign engineers for about six (6) months, at the beginning period of the Project on 4 model job sites in Sumatra Selatan, Lampung, Sulawesi Selatan and Sulawesi Utara (or Nusa Tenggara Timur).

By setting-up model job site in each of the four Provinces, a pair of engineers (a civil engineer and a mechanical expert) will be able to give officials and operators concerned the necessary advice to lead a model project to a successful conclusion.

By preparing a model project, the officials concerned in the Province and others in near by Provinces will be invited to visit, and get the on-the-job training.

The experts will keep an office in DPU province or DPU workshops, and may also give consulting services to officials of other local road projects either in the office or on the job site.

The officials in the other Three Provinces, will get the on-the-job training at one of the Four Provinces named, and will also get consulting services from the experts of the four Provinces.

The (4) Civil Engineers are to have more than 10 years in road betterment and/or maintenance.

The (4) Mechanical Engineers are to have more than 10 years experience in construction Equipment maintenance.

(3) Cost of Consulting Services

The cost of consulting services is estimated as follows, the break down of which is attached to this report as Appendix C-4.

| | | | |
|---|---|---|---|
| a) | Foreign | 120 Man Months | ¥220,000,000 |
| b) | Local | | |
| | Engineers | 432 Man Months | |
| | Staff | 204 Man Months | Rp. 1,063,769,000 |

## 5.7 Portion of the Project requiring Foreign Assistance

In the execution of the Project, it is proposed to ask for foreign assistance for the following items ,

(1) Procurement of Equipment

Foreign currency should cover the cost of equipment and spare parts, as well as their transportation cost until the arrival at the port of entry to Indonesia.

(2) Consulting Services.

Foreign currency should cover the salaries of foreign experts including overhead and engineering fees and other reimbursible costs such as international air fare.

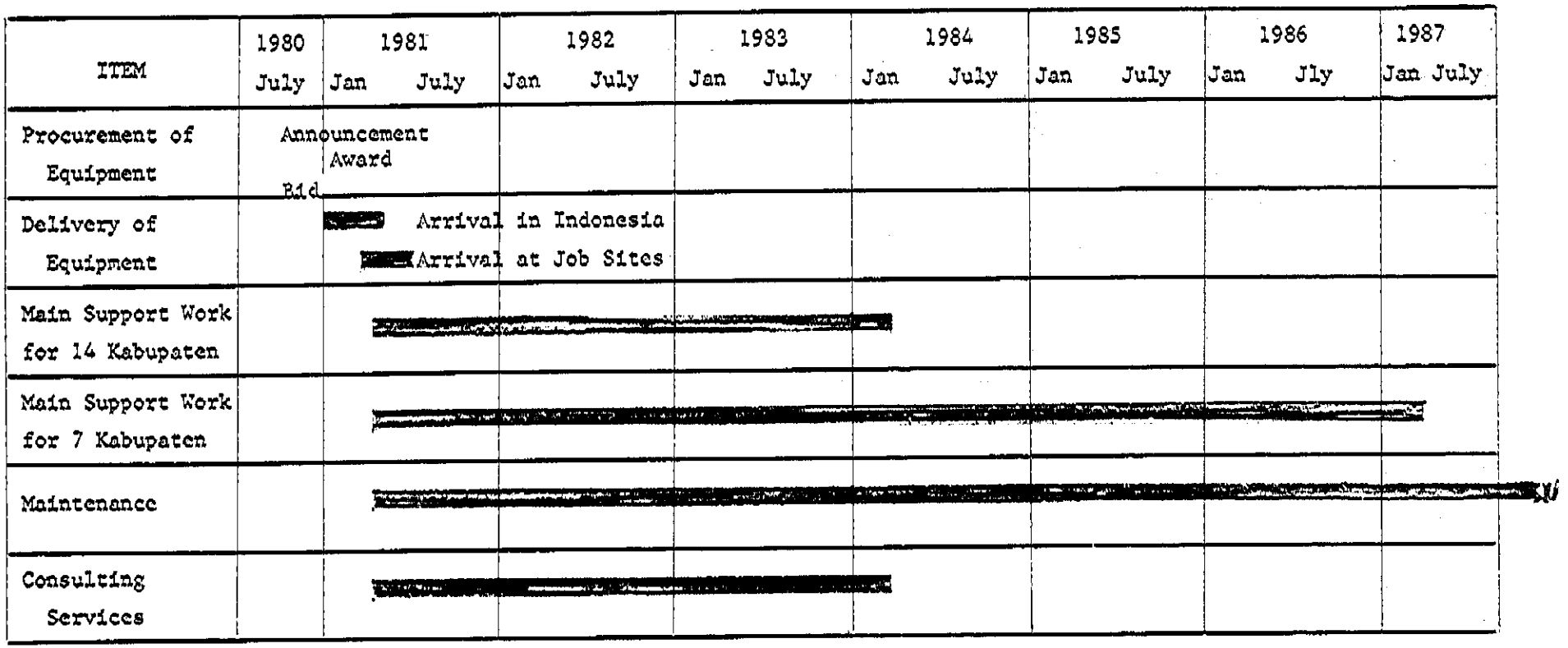
## 5.8 Execution Schedule of the Project.

The proposed overall work schedule of the Project is shown in Fig. 5.8.1.

Since the procurement and delivery of equipment will probably require 9 - 12 months, the main support work will start from the beginning of 1981/82 fiscal year. It is planned to complete the works by the end of 1983/84 fiscal year in the following 14 Kabupatens, namely, Kampar, Kepulauan Riau, Lahat, O.K.U., LIOT, Lampung Utara, Lampung Selatan, Takalar, Bone, Sidrap, Pinrang, Polmas, Enrekang and Jeneponto.

The main support work will be completed in the fiscal year of 1986/87, in the remaining 7 Kabupatens, namely O.K.I., Manggarai, Belu, Bolaang Mongondow, Gorontalo, Kendari, and Buton.

Fig. 5.8.1 Overall Work Schedule of the Project



The maintenance is planned to start at the same time as the main support work. It is also first mechanized maintenance work of Kabupaten Roads, although its level of survice is considered as the lowest one.

The time required for the delivery of equipment is so tight, that in some Kabupaten, equipment could not possibly arrive at job sites until the beginning of 1981/82 fiscal year.

It is, therefore, strongly recommended that all efforts be made to shorten the delivery time. In particular , efforts should be made to minimize the withdrawal time from the port of entry (disembarkation) a more detaild schedule for the main support work and maintenance of each Kabupaten is tentatively proposed in Figures 5.8.2. - 5.8.22, by reference to the priority of roads proposed in the section 4 of this chapter.

It is also proposed to carry out the main support work at a relatively slow speed in the first year, with the speed increasing in following years, as shown in Table 5.8.1

Table 5.8.1 Assumed Yearly Accomplishment of Main Support Work

| Year | Yearly accomplishment of Main Support Work (%) | |
|---|---|---|
| | 3 year plan | 6 year plan |
| 1st | 30 | 15 |
| 2nd | 35 | 16 |
| 3rd | 35 | 16 |
| 4th | - | 17 |
| 5th | - | 18 |
| 6th | - | 18 |
| TOTAL | 100 | 100 |

Province Riau

Kabupaten Kampar

Fig. 5.8.2 Execution Schedule of Support Works

Length of Ist stage 502 Km , Length of main support work 213 Km , Length of maintenance Ist stage 431 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 21<br>27.29<br>2<br>28<br>1.5 | 210 | 484,100 | 240,400 x 1.1<br>= 264,400 | 243,200 x 1.2<br>= 294,900 | | |
| 18<br>4<br>3 | 36 | 99,700 | | 36,800x1.1[2]<br>= 44,500 | 62,900x1.1[3]<br>= 83,700 | |
| others | 224 | 167,100 | | | 50,400x1.1[3]<br>= 67,100 | |
| | | | | | 167,100x1.1[3]<br>= 222,500 | |
| Maintenance | | | 114,376 | 125,013 | 138,395 | |
| Annual Budget ($10^3$Rp.)** | | | 372,717 | 462,217 | 508,438 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Riau

Kabupaten Kepulauan Riau

## Fig. 5.8.3 Execution Schedule of Support Works

Length of Ist stage 411 Km , Length of main support work 241 Km , Length of maintenance Ist stage 331 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 18.19 21.23 25.27.29 19.30.31 | 96 | 227.300 | 227,300x1.1 = 249,900 | | | |
| 3.4.5 6.1.2 9.10 11.12 | 159 | 405,600 | 61,700x1.1 = 68,000 | 337,100x1.1 = 407.900 | 6,800x1.1$^3$ = 9,000 | |
| 36.33 34.7.8 20.28.32 26.24.22 | 115 | 248,200 | | | 248,200x1.1$^3$ = 330,300 | |
| others | 41 | 82,200 | | | 82,200x1.1$^3$ = 109,400 | |
| Maintenance | | | 87,838 | 96,622 | 106,284 | |
| Annual Budget ($10^3$Rp.)** | | | 372,717 | 462,217 | 508,438 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Sumatra Selatan

Kabupaten Lahat

## Fig. 5.8.4 Execution Schedule of Support Works

Length of Ist stage 255 Km , Length of main support work 139 Km ; Length of maintenance Ist stage 209 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 10<br>11<br>3 | 66 | 146,000 | 128,100x1.1 = 140,900 | 17,900x1.1$^2$ = 21,600 | | |
| 13.12<br>1. 2<br>4 | 86 | 185,400 | | 131,600x1.1$^2$ = 159,300 | 53,800x1.1$^3$ = 71,600 | |
| 15.19<br>18.20<br>17 | 46 | 87,600 | | | 87,600x1.1$^3$ = 116,600 | |
| others | 57 | 8,100 | | | 8,100x1.1$^3$ = 10,800 | |
| Maintenance | | | 55,462 | 61,008 | 67,109 | |
| Annual Budget ($10^3$Rp.)** | | | 196,410 | 241,891 | 266,081 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Sumatra Selatan

Kabupaten O.K.I.

Fig. 5.8.5 Execution Schedule of Support Works

Length of Ist stage 317 Km , Length of main support work 187 Km , Length of maintenance in 1st stage 286 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local Cost of Road Link Group * | First Stage | | | | | | Second stage |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/1984 | 1984/85 | 1985/86 | 1986/87 | 1987/88 |
| | | | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT |
| 25.26 13.14.15 1 | 112 | 590,500 | 217,000x1.1 = 238,700 | 231,400x1.1[2] = 189,100 | | | | | |
| 18.19 20.21 22 | 28 | 132,300 | | | 89,300x1.1[3] = 118,900 | 40,000x1.1[4] = 58,600 | | | |
| 11.12 23.24 7 | 73 | 311,500 | | | | 205,900x1.1[4] = 301,400 | 105,600x1.1[5] = 170,000 | | |
| others | 104 | 412,600 | | | | | 154,800x1.1[5] = 249,300 | 257,800x1.1[6] = 461,200 | |
| Maintenance | | | 75,897 | 83,486 | 91,835 | 101,021 | 111,120 | 122,235 | |
| Annual Budget ($10^3$Rp.) ** | | | 314,554 | 363,511 | 399,862 | 461,019 | 536,422 | 583,467 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation.

**) Figures in this line exclude administration fee but include escalation adjustment.

Province Sumatra Selatan

Kabupaten O.K.U.

Fig. 5.8.6 Execution Schedule of Support Works

Length of Ist stage 257 Km ; Length of main support work 135 Km . Length of maintenance 1st stage 212 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 6<br>5<br>7 | 54 | 199.300 | 150,400x1.1 = 165,400 | 48,900x1.1$^2$ = 59,200 | | |
| 8<br>4<br>3<br>20 | 77 | 167,700 | | 126,600x1.1$^2$ = 153,100 | 41,100x1.1$^3$ = 54,700 | |
| 2<br>16<br>1 | 33 | 75,900 | | | 75,900x1.1$^3$ = 101,000 | |
| others | 93 | 58,300 | | | 58.3x1.1$^3$ = 77,800 | |
| Maintenance | | | 56,259 | 61,885 | 68,074 | |
| Annual Budget ($10^3$Rp.)** | | | 221,657 | 274,146 | 301,561 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Fig. 5.8.7 Execution Schedule of Support Works

Province Sumatra Selatan

Kabupaten LIOT

Length of Ist stage 280 Km , Length of main support work 131 Km , Length of maintenance Ist stage 236 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 39.38<br>34.20<br>6. 1 | 104 | 231,500 | 155,900x1.1<br>= 171,500 | 75,600x1.1$^2$<br>= 91,500 | | |
| 2. 7<br>29.31<br>36.37 | 43 | 59,500 | | 59,500x1.1$^2$<br>= 72,000 | | |
| 21.18<br>24.25<br>11.15<br>16.17 | 47 | 124,600 | | 46,800x1.1$^2$<br>= 56,500 | 77,800x1.1$^3$<br>= 103,700 | |
| others | 86 | 104,000 | | | 104,000x1.1$^3$<br>= 138,400 | |
| Maintenance | | | 62,628 | 68,891 | 75,780 | |
| Annual Budget ($10^3$Rp.)** | | | 234,091 | 288,885 | 317,828 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Lampung

Kabupaten Lampung Utara

## Fig. 5.8.8 Execution Schedule of Support Works

Length of Ist stage 261 Km , Length of main support work 223 Km , Length of maintenance Ist stage 65 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 3<br>2<br>8 | 41 | 72,900 | 72,900x1.1<br>= 80,200 | | | |
| 15<br>20 | 33 | 70,800 | 70,800x1.1<br>= 77,900 | | | |
| 19<br>14 | 8 | 41,200 | 41,200x1.1<br>= 45,300 | | | |
| others | 179 | 442,800 | 3,400x1.1<br>= 3,800 | 181,800x1.1$^2$<br>= 265,800 | 181,800x1.1$^3$<br>= 292,400 | |
| Maintenance | | | 49,624 | 54,587 | 60,045 | |
| Annual Budget ($10^3$Rp.)** | | | 256,780 | 320,437 | 352,480 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Lampung

Kabupaten Lampung Selatan

## Fig. 5.8.9 Execution Schedule of Support Works

Length of Ist stage 225 Km , Length of main support work 65 Km , Length of maintenance Ist stage 203 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 25.26 30.32 31 29 | 36 | 41,300 | 41,300x1.1 = 45,400 | | | |
| 12.13 1.2.3 33.34 | 49 | 55,400 | 9,900x1.1 = 10,900 | 45,500x1.1$^2$ = 55,000 | | |
| 7.8.10 6 9 | 29 | 40,300 | | 14,200x1.1$^2$ = 17,200 | 16,100x1.1$^3$ = 34,800 | |
| others | 111 | 33,600 | | | 33,600x1.1$^3$ = 44,700 | |
| Maintenance | | | 53,870 | 59,257 | 65,183 | |
| Annual Budget ($10^3$Rp.)** | | | 110,163 | 131,499 | 144,650 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Nusa Tenggara Timur

Kabupaten Manggarai

Fig. 5.8.10 Execution Schedule of Support Works

Length of Ist stage 332 Km . Length of main support work 130 Km . Length of maintenance in Ist stage 310 Km

| Number of Road Links | Total Length of Road Link Group | Total Local Cost of Road Link Group *) | First Stage | | | | | | Second stage |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/1984 | 1984/85 | 1985/86 | 1986/87 | 1987/88 |
| | | | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT |
| 3<br>2 | 154 | 215,900 | 67,800x1.1 = 74,700 | 72,500x1.1$^2$ = 87,700 | 72,500x1.1$^3$ =96,500 | 3,100x1.1$^4$ = 4,500 | | | |
| 1<br>4 | 100 | 105,400 | | | | 73,900x1.1$^4$ = 108,300 | 31,500x1.1$^5$ = 50,700 | | |
| 5<br>8<br>6 | 78 | 131,700 | | | | | 50,200x1.1$^5$ = 80,600 | 81,500x1.1$^6$ = 144,500 | |
| Maintenance | | | 82,266 | 90,492 | 99,541 | 109,488 | 120,444 | 132,493 | |
| Annual Budget ($10^3$Rp.) **) | | | 157,013 | 178,195 | 196,014 | 222,241 | 251,768 | 276,950 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation.

**) Figures in this line exclude administration fee but include escalation adjustment.

Province Nusa Tenggara Timur

Kabupaten Belu

Fig. 5.8.11 Execution Schedule of Support Works

Length of Ist stage 282 Km , Length of main support work 218 Km , Length of maintenance in Ist stage 246 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local Cost of Road Link Group *) | First Stage | | | | | | Second stage |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/1984 | 1984/85 | 1985/86 | 1986/87 | 1987/88 |
| | | | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT |
| 12. 9<br>5.10 | 113 | 335,800 | 103,000x1.1 = 113,300 | 109,900x1.1$^2$ = 133,000 | 109,900x1.1$^3$ = 146,300 | 13,000x1.1$^4$ = 19,000 | | | |
| 11.13<br>19.14<br>15.16 | 93 | 154,400 | | | | 103,800x1.1$^4$ = 152,000 | 55,600x1.1$^5$ = 89,600 | | |
| 20.18<br>7.2.3<br>17. 6<br>1.21 | 63 | 147,200 | | | | | 68,000x1.1$^5$ = 109,500 | 79,200x1.1$^6$ = 140,300 | |
| others | 13 | 44,500 | | | | | | 44,500x1.1$^6$ = 78,800 | |
| Maintenance | | | 65,282 | 71,810 | 78,991 | 86,884 | 95,578 | 105,139 | |
| Annual Budget ($10^3$Rp.) **) | | | 178,627 | 204,801 | 225,281 | 257,861 | 294,715 | 324,190 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation.

**) Figures in this line exclude administration fee but include escalation adjustment.

Province Sulawesi Utara

Kabupaten Bolaang Mongondow

## Fig. 5.8.12 Execution Schedule of Support Works

Length of Ist stage 474 Km , Length of main support work 261 Km , Length of maintenance in Ist stage 429 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local Cost of Road Link Group* | First Stage | | | | | | Second stage |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/1984 | 1984/85 | 1985/86 | 1986/87 | 1987/88 |
| | | | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT |
| 5.15<br>6. 4<br>1. 1 | 253 | 343,000 | 116,600x1.1 = 128,200 | 124,300x1.1$^2$ = 150,400 | 102,100x1.1$^3$ = 135,900 | | | | |
| 22.23<br>24<br>17 | 31 | 37,200 | | | 22,200x1.1$^3$ = 29,500 | 15,000x1.1$^4$ = 22,000 | | | |
| 12.11<br>18.19.20<br>21.36<br>9. 3 | 120 | 254,900 | | | | 117,100x1.1$^4$ = 171,400 | 137,800x1.1$^5$ = 221,900 | | |
| others | 70 | 142,000 | | | | | 2,100x1.1$^5$ = 3,400 | 139,900x1.16 = 247,800 | |
| Maintenance | | | 113,844 | 125,229 | 137,752 | 151,517 | 166,679 | 183,352 | |
| Annual Budget ($10^3$Rp.)** | | | 242,060 | 275,670 | 303,237 | 344,927 | 391,945 | 431,145 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation.

**) Figures in this line exclude administration fee but include escalation adjustment.

Province Sulawesi Utara

Kabupaten Gorontalo

Fig. 5.8.13 Execution Schedule of Support Works

Length of Ist stage 947 Km . Length of main support work 697 Km . Length of maintenance in Ist stage 831 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local Cost of Road Link Group* | First Stage | | | | | | Second stage |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/1984 | 1984/85 | 1985/86 | 1986/87 | 1987/88 |
| | | | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT |
| 81. 84<br>87. 95<br>73 | 121 | 385,700 | 297,200x1.1 = 326,900 | 88,500x1.1$^2$ = 107,100 | | | | | |
| 21. 22<br>114<br>188.189 | 102 | 257,900 | | 228,500x1.1$^2$ = 276,400 | 29,400x1.1$^3$ = 39,100 | | | | |
| 128.152<br>168.169<br>170.132<br>187.135<br>136 | 167 | 427,500 | | | 287,600x1.1$^3$ =382,800 | 139,900x1.1$^4$ = 204,800 | | | |
| others | 557 | 910,100 | | | | 196,900x1.1$^4$ = 288,300 | 356,600x1.1$^5$ = 574,300 | 356,600x1.1$^6$ = 631,800 | |
| Maintenance | | | 220,525 | 242,577 | 266,835 | 293,498 | 322,868 | 355,165 | |
| Annual Budget ($10^3$Rp.)** | | | 547,417 | 626,130 | 688,743 | 786,603 | 897,190 | 986,920 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation.

**) Figures in this line exclude administration fee but include escalation adjustment.

Province Sulawesi Selatan

Kabupaten Takalar

Fig. 5.8.14 Execution Schedule of Support Works

Length of Ist stage 192 Km , Length of main support work 69 Km , Length of maintenance Ist stage 169 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage 1981/82 APR JUN AUG OCT DEC FEB | First Stage 1982/83 APR JUN AUG OCT DEC FEB | First Stage 1983/84 APR JUN AUG OCT DEC FEB | Second stage 1984/85 APR JUN |
|---|---|---|---|---|---|---|
| 20.21<br>6.14<br>33 | 44 | 67,300 | 60,400x1.1 = 66,400 | 6,900x1.1$^2$ = 8,300 | | |
| 18.17<br>13.12<br>3.23.22 | 45 | 63,600 | | 63,600x1.1$^2$ = 30,100 | | |
| 5<br>8<br>1 | 22 | 22,600 | | | 22,600x1.1$^3$ = 30,100 | |
| others | 81 | 47,800 | | | 47,800x1.1$^3$ = 63,700 | |
| Maintenance | | | 44,848 | 49,333 | 54,266 | |
| Annual Budget ($10^3$Rp.)** | | | 111,283 | 134,591 | 148,050 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Sulawesi Selatan

Kabupaten Bone

Fig. 5.8.15 Execution Schedule of Support Works

Lenght of Ist stage 295 Km , Length of main support work 163 Km , Length of maintenance in Ist stage 241 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local Cost of Road Link Group *) | First Stage 1981/82 | First Stage 1982/83 | First Stage 1983/84 | Second stage |
|---|---|---|---|---|---|---|
| 12<br>25.26.27.<br>29<br>15<br>6<br>24 | 77 | 125,800 | 125,800x1.1<br>= 138,400 | | | |
| 18<br>7<br>16<br>17<br>30 | 60 | 138,200 | 15,500x1.1<br>= 17,100 | 122,700x1.1[2]<br>= 148,500 | | |
| 20<br>1<br>4<br>9<br>5 | 56 | 139,100 | | 42,200x1.1[4]<br>= 51,000 | 96,900x1.1[3]<br>= 129,000 | |
| others | 102 | 89,000 | | | 68,000x1.1[3]<br>= 90,400 | |
| Maintenance | | | 63,955 | 70,351 | 77,386 | |
| Annual Budget ($10^3$Rp.) **) | | | 219,416 | 269,859 | 296,845 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Sulawesi Selatan

Kabupaten Sidrap

Fig. 5.8.16 Execution Schedule of Support Works

Length of 1st stage 238 Km . Length of main support work 139 Km . Length of maintenance 1st stage 192 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 31.29<br>1. 2<br>11 | 72 | 92,900 | 94,100x1.1<br>= 103,500 | 5,800x1.1$^2$<br>= 7,000 | | |
| 20.21<br>17.27<br>19 | 32 | 47,500 | | 47,500x1.1$^2$<br>= 57,500 | | |
| 37. 5<br>7.12<br>30 | 33 | 56,500 | | 56,500x1.1<br>= 68,400 | | |
| others | 101 | 109,800 | | | 109,800x1.1$^3$<br>= 146,100 | |
| Maintenance | | | 50,952 | 56,047 | 61,652 | |
| Annual Budget ($10^3$Rp.)** | | | 154,465 | 188,888 | 207,777 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Sulawesi Selatan

Kabupaten Pinrang

Fig. 5.8.17 Execution Schedule of Support Works

Length of Ist stage 268 Km , Length of main support work 76 Km , Length of maintenance Ist stage 243 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 1.<br>2.<br>9.<br>19. | 49 | 46,600 | 46,600x1.1<br>= 51,300 | | | |
| 12.18<br>15. 3<br>6.16.27 | 63 | 99,300 | 23,300x1.1<br>= 25.600 | 76,000x1.1$^2$<br>= 92,000 | | |
| 14.26<br>34.11<br>22.23 | 28 | 38,100 | | 5,600x1.1$^2$<br>= 6,700 | 32,500x1.1$^3$<br>= 43,200 | |
| others | 128 | 49,100 | | | 49,100x1.1$^3$<br>= 65,400 | |
| Maintenance | | | 64,485 | 70,934 | 78,027 | |
| Annual Budget ($10^3$Rp.)** | | | 141,413 | 169,658 | 186,623 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Sulawesi Selatan

Kabupaten Polmas

## Fig.5.8.18 Execution Schedule of Support Works

Length of Ist stage 152 Km , Length of main support work 81 Km , Length of maintenance 1st stage 125 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 21. 1<br>11.23<br>6 | 41 | 58,100 | 58,100x1.1<br>= 63,900 | | | |
| 15..8<br>16. 7<br>9 | 41 | 65,300 | 8,400x1.1 = 9,300 | 56,900x1.1$^2$ = 68,900 | | |
| 19.17<br>13.20<br>22.18<br>3 | 35 | 67,800 | | 20,700x1.1$^2$ = 25,000 | 47,100x1.1$^3$ = 62,700 | |
| others | 35 | 30,600 | | | 30,600x1.1$^3$ = 40,600 | |
| Maintenance | | | 33,172 | 36,489 | 40,138 | |
| Annual Budget ($10^3$Rp.)** | | | 106,371 | 130,428 | 143,471 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee. but includes escalation adjustment.

Province Sulawesi Selatan

Kabupaten Enrekang

## Fig. 5.8.19 Execution Schedule of Support Works

Length of Ist stage 140 Km , Length of main support work 79 Km , Length of maintenance 1st stage 114 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | Second stage |
|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/84 | 1984/85 |
| | | | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN AUG OCT DEC FEB | APR JUN |
| 12<br>7<br>3 | 78 | 135,000 | 76,600x1.1 = 84,300 | 58,400x1.1$^2$ = 70,700 | | |
| 10.14.15<br>1<br>5 | 33 | 64,700 | | 31,000x1.1$^2$ = 37,500 | 33,700x1.1$^3$ = 44,800 | |
| 8<br>16<br>9 | 18 | 40,600 | | | 40,600x1.1$^3$ = 54,000 | |
| others | 11 | 15,200 | | | 15,200x1.1$^3$ = 20,200 | |
| Maintenance | | | 30,252 | 33,277 | 36,605 | |
| Annual Budget ($10^3$Rp.)** | | | 114,553 | 141,464 | 155,611 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Fig. 5.8.20 Execution Schedule of Support Works

Province Sulawesi Selatan

Kabupaten Jeneponto

Length of 1st stage 277 Km , Length of main support work 173 Km , Length of maintenance 1st stage 219 Km

| Numbers of Road Links | Total Length of Road-Link Group | Total Local* Cost of Road Link Group | First Stage 1981/82 APR JUN AUG OCT DEC FEB | First Stage 1982/83 APR JUN AUG OCT DEC FEB | First Stage 1983/84 APR JUN AUG OCT DEC FEB | Second stage 1984/85 APR JUN |
|---|---|---|---|---|---|---|
| 13 9.10.11 25.12 35 | 80 | 252,000 | 216,800x1.1 = 238,500 | 35,200x1.1$^2$ = 42,600 | | |
| 17.18.19 44.21 23.15 16. 5 | 57 | 168,200 | | 168,200x1.1$^2$ = 203,500 | | |
| 27.28.29 30.31.32 34.36. 7 8.26 | 64 | 155,700 | | 49,500x1.1$^2$ = 59,900 | 106,200x1.1$^3$ = 141,300 | |
| others | 76 | 146,800 | | | 146,800x1.1$^3$ = 195,400 | |
| Maintenance | | | 58,116 | 63,928 | 70,321 | |
| Annual Budget ($10^3$Rp.)** | | | 296,610 | 369,995 | 406,995 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation

**) Figures in this line exclude administration fee, but includes escalation adjustment.

Province Sulawesi Tenggara

Kabupaten Kendari

Fig. 5.8.21 Execution Schedule of Support Works

Length of Ist stage 550 Km , Length of main support work 361 Km , Length of maintenance in Ist stage 490 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | | | | Second stage |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/1984 | 1984/85 | 1985/86 | 1986/87 | 1987/88 |
| | | | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT |
| 31<br>32<br>33 | 150 | 603,800 | 248,500x1.1 = 273,300 | 265,100x1.1$^2$ = 320,700 | 90,200x1.1$^3$ = 120,000 | | | | |
| 1<br>3<br>34<br>15 | 118 | 337,300 | | | 174,900x1.1$^3$ = 232,800 | 162,400x1.1$^4$ = 237,800 | | | |
| 8.25. 2<br>5.24.26<br>23.14.11<br>6.29.30 | 164 | 299,700 | | | | 19,200x1.1$^4$ = 174,500 | 180,500x1.1$^5$ = 290,700 | | |
| others | 118 | 415,900 | | | | | 117,700x1.1$^5$ = 189,600 | 298,200x1.1$^6$ = 529,300 | |
| Maintenance | | | 130,033 | 143,037 | 157,340 | 173,662 | 190,380 | 209,424 | |
| Annual Budget ($10^3$Rp.)** | | | 403,382 | 463,767 | 510,143 | 585,400 | 670,633 | 737,702 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation.

**) Figures in this line exclude administration fee but include escalation adjustment.

Province Sulawesi Tenggara

Kabupaten Buton

Fig.5.8.22 Execution Schedule of Support Works

Length of Ist stage 405 Km . Length of main support work 312 Km . Length of maintenance in Ist stage 353 Km

| Numbers of Road Links | Total Length of Road Link Group | Total Local* Cost of Road Link Group | First Stage | | | | | | Second stage |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1981/82 | 1982/83 | 1983/1984 | 1984/85 | 1985/86 | 1986/87 | 1987/88 |
| | | | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT | APR OCT |
| 1<br>2 | 81 | 167,900 | 149,600x1.1 = 164,500 | 18,300x1.1$^2$ = 22,100 | | | | | |
| 8<br>3<br>4 | 130 | 366,700 | | 141,200x1.1$^2$ = 170,900 | 159,500x1.1$^3$ = 212,300 | 66,000x1.1$^4$ = 96,600 | | | |
| 6<br>7<br>9 | 115 | 344,200 | | | | 103,500x1.1$^4$ = 151,600 | 179,500x1.1$^5$ = 289,100 | 61.2x1.1$^6$ = 108,400 | |
| others | 79 | 118,300 | | | | | | 118,300x1.1$^6$ = 209,600 | |
| Maintenance | | | 93,677 | 103,045 | 113,349 | 124,676 | 137,152 | 150,871 | |
| Annual Budget ($10^3$Rp.)** | | | 258,206 | 296,092 | 325,701 | 372,862 | 426,216 | 468,841 | |

*) Figures in this column exclude both administration fee and adjustment of price escalation.

**) Figures in this line exclude administration fee but include escalation adjustment.

## 5.9. Recommendation on the Replacement and Construction of Bridges

A major premise of the Study was that bridge replacement and construction works are excluded from the Project.

However, both the inventory survey of bridges and the field observation of the study team, clearly indicate that many bridges are missing and some are almost collapsed. The latter cannot bear the weight of the equipment used by the Support Works Project, a maximum of 10 metric tons.

On the contrary, there are many crossings of Kabupaten Roads with rivers in the flat areas, where the equipment can move over the river bed in the dry season, for example, in the major part of Sulawesi Selatan and Lampung, but not in the wet season.

It is strongly recommended that the existing, almost collapsed, bridges are replaced, and that bridges are constructed where they are missing and in order to carry out the Support Works in the Project successfuly.

The necessity for the simultaneous implementation of the replace of bridges cannot be over-emphasized, in fact advanced building would be preferable.

The effect of the replacement of bridges is not limited to the transportation of equipment.

The effects and benefits are the avoidance, of increased vehicle operating or standing costs associated with detours or ferries, of production losses from the interruption in the supply of inputs and the marketing of outputs, of time losses by users of the bridges, and the avoidance of loss of social costs associated with the failure of bridges, particularly in newly settled communities.

New bridge will have the carriageway width of 4 m and be designed by $10^t$ or more design load.

### 5.9.1. Present Status of Existing Bridges

The extensive inventory survey data of bridges, collected by Bina Marga, have not yet been summarized by the computer.

We have roughly summarized the bridge types and their condition only, as stated in Section 4.3.

More than 50% of the existing bridges are rated as damaged and in very bad condition.
These damaged sections apply to either their superstructure, substructure or both.
Most of the bridges receive no basic routine maintenance or support works.

Most of the existing bridges have a bearing capacity of less than 10 tons, therefore, those classified as dangerous or collapsed should be replaced by new ones with a 10 tons bearing capacity at least.

In the scheduling of the replacement of bridges, the topographic and meteorological conditions of the rivers, especially the possibility of crossing by heavy equipment, should be considered.

### 5.9.2. Type of Bridges and Construction

Taking advantage of the local situation and the availabilits of local material can reduce the cost of the construction of bridges. This is more important than considering their beauty.
For bridge replacement, timber of steel (I-beam and wooden floor) 3,5 m wide (4.0 m desirable) single lane bridges are recommended. The I-beam will have to be imported. However, the advantage of this method of construction is that a larger number of semi-skilled labour can be used, whether empoyed by local contractors or by the DPUK themselves.
Reinforced concrete or Bailly bridges are excellent but they are

more expensive.

### 5.9.3. Design Standard for Bridges

Loading specification for rural bridges are not clearly indicated in bridge specifications.

In loading Specification for highway bridges (1970), live load by the standard vehicle is represented in two kinds of loadings i.e., "T" load, which loads the entire carriageway and "D" loads, with loads the traffic lane.

However, it is considered that those live loads are very heavy, having approximately 1.4 times of live load of Japanese highway bridge specifications.

Taking present vehicle/traffic condition into consideration, it is recommended that a half (1/2) of the live load stipulated in the loading specifications for highway bridges (1970) should be applied to the bridges in Kabupaten roads.

If those recommended live loads are applied to 10m span and 3.5m wide one lane bridge, 14 tons truck will be able to pass on that bridges.

The DPUK have few experienced personnel (in many instance, none) in bridge and design. DPUP assistance is seldom provided and this is understandable as they are heavily committed to the Provincial and National roads programs and have little time available to support the DPUK.
Standard bridge drawings, design standard, technical specifications and/or guidance for low cost bridges such as timber or steel beam should be prepared by the Bina Marga.
They are very useful and convenient for the DPUK.

The span of timber bridges should be less than 5 m in length.

Four wooden log stringers, of about 20 cm diameter and 10 cm thickness of deck, will allow 10 tons loading for a 6 to 7 m span.

### 5.9.4. Cost Estimate

A rough cost estimate for bridge replacement, has been based on an average cost per linear meter for a one bridge, obtained from cost data available in the Directorate of Planning.

Rough unit price per meter for bridge replacement is as follows :

(Thousand Rupiah)

| | Expensive District | Medium District | Cheap District |
|---|---|---|---|
| | Riau<br>South Sumatra | South Sulawesi<br>North Sulawesi | Lampung<br>N.T.T.<br>South-East Sulawesi |
| Timber Bridge | 350 | 300 | 250 |
| Steel Bridge | 600 | 550 | 500 |

In this study, for convenience sake, two kinds of bridges, namely timber and steel, are assumed to share half and half.

A rough cost estimate for bridge construction is shown in Table 5.9.1.

Table 5.9.1. Rough Cost Estimate for Bridge Construction

| Province | Kabupaten | Wooden Bridge Construction (m) | Steel (I-beam) Bridge Con - stuction (m) | Cost (Thousand of Rupiah) |
|---|---|---|---|---|
| Riau | Kampar | 426 | 426 | 1,399,700 |
| | Kepulauan Riau | 127 | 127 | 502,500 |
| Sumatra Selatan | Lahat | 348 | 348 | 838,000 |
| | O.K.I. | 256 | 256 | 826,150 |
| | O.K.U. | 110 | 110 | 306,350 |
| | L.I.O.T. | 27 | 27 | 241,550 |
| Lampung | Lampung Utara | 16 | 16 | 60,650 |
| | Lampung Selatan | 25 | 25 | 81,000 |
| Nusa Tenggara Timur | Manggarai | 515 | 515 | 997,500 |
| | Belu | 348 | 348 | 670,700 |
| Sulawesi Utara | Bolaang Mongondow | 1,295 | 1,295 | 2,881,150 |
| | Gorontalo | 736 | 736 | 1,656,800 |
| Sulawesi Selatan | Takalar | 7 | 7 | 47,150 |
| | Bone | 208 | 208 | 473,000 |
| | Sidrap | 44 | 44 | 109,900 |
| | Pinrang | 62 | 62 | 143,500 |
| | Polmas | 181 | 181 | 389,150 |
| | Enrekang | 129 | 129 | 283,950 |
| | Jeneponto | 107 | 107 | 298,150 |
| Sulawesi Tenggara | Kendari | 143 | 143 | 655,450 |
| | Buton | 51 | 51 | 186,150 |
| T O T A L | | 5,161 | 5,161 | 13,048,500 |

## 6. FINANCING OF THE PROJECT

### 6.1 Review of the Allocated Budgets to Local Roads Development in the Last Five Years.

Table 2.5.1 in chapter 2 section 4 presents the allocated budgets to local roads by Inpres programs in the last five years.

The average cost per Km in 1979/80 ranges from 3.0 million Rps/Km to 12.5 million Rps/Km, with average of about 5.6 million Rps/Km (Table 6.1.1 refers).

From the point of view of equity, it may be said that in last five years low developed areas such as Manggarai, Belu, Enrekang etc. did not get enough of the budget.

The average construction speed per annum , ranges from about 4 Km/year in Manggarai to over 70 Km/year in Polmas, averaging about 30 Km/year in the 21 Kabupatens.

Such speed is not sufficient when considering the local road conditions and the total length involved .

Table 6.1.1 An Analysis of Inpres Budget in 21 selected Kabupatens

| Kabupaten | 1979/80 Budget | | Unit Cost (Thousand Rps. per Km | Average Construction Speed (Km/Year) |
|---|---|---|---|---|
| | Length (Km) | Budget (Thousand Rps) | | |
| Kampar | 15.435 | 80,151 | 5,193 | 18.7 |
| Kepulauan Riau | 19.067 | 150,947 | 7,917 | 20.4 |
| Lahat | 10.500 | 131,698 | 12,543 | 48.2 |
| O.K.I | 67.686 | 80,926 | 1,196 | 47.4 |
| O.K.U | 93.470 | 316,874 | 3,390 | 69.5 |
| LIOT | 44.250 | 171,900 | 3,885 | 44.1 |
| Lampung Utara | - | - | - | 40.5 |
| Lampung Selatan | 80.600 | 698,212 | 8,663 | 47.4 |
| Manggarai | 4.600 | 50,073 | 10,885 | 4.3 |
| Belu | 6.000 | 57,066 | 9,511 | 4.9 |
| Bolaang Mongondow | 17.190 | 144,159 | 8,386 | 19.0 |
| Gorontalo | 20.826 | 266,527 | 12,798 | 33.4 |
| Takalar | 10.490 | 73,101 | 7.033 | 6.2 |
| Bone | 45.805 | 324,590 | 7,086 | 36.6 |
| Sidrap | 10.700 | 98,928 | 9,246 | 53.3 |
| Pinrang | 16.747 | 148,329 | 8,857 | 16.5 |
| Polmas | 52.000 | 155,200 | 2,985 | 73.4 |
| Enrekang | 8.500 | 57,012 | 6,707 | 6.9 |
| Jeneponto | 25.250 | 110,383 | 4,372 | 10.9 |
| Kendari | 40.550 | 135,954 | 3,353 | 19.9 |
| Buton | 18.900 | 140.315 | 7,460 | 32.5 |
| Average | - | - | 5,576 | 33.9 |

## 6.2. Cost Estimates of the Project

### 6.2.1. General

Unit cost for each construction item has been established using basic cost elements such as labor, material, equipment, administrative cost, etc.

The unit prices were computed in accordance with the following criteria.

1) The estimates are made on the assumption that all construction works will be carried out by District Public Works Services (DPUK) themselves, (so called force account work operations).

2) The unit prices were computed under the economic conditions prevailing in April 1980.

3) The cost was estimated for all pay items and was classified into foreign currency (indicated in Rupiah) and local currency (indicated in Rupiah) portions.

Foreign currency and local currency components of each unit price were computed based on the following classification of basic cost elements.

The foreign currency component consists of the costs of:
- Equipment (ownership cost and spare parts )

The local currency component includes the costs of:
- Equipment (fuel, lubricant and other expenses)
- Domestic materials
- Wage of local labour
- Administrative cost
- Unloading and local transportation equipment.

4) The unit price of each work item is obtained by accummulating the labour cost, equipment cost, material cost, etc. for the item, and the result is checked against recent actual figures for construction works in Indonesia.

The rates of exchange used to convert the Indonesian Rupiah to Japanese Yen and US Dollar are;

Rp.620 = US$1 = ¥248.

6.2.2. Unit Price Analysis of Support Works

1) Material Costs

The unit material costs are based on the inventory of unit cost data which was collected by Bina Marga. These costs are shown in Appendix C.3 .

2) Equipment Costs

The estimated hourly ownership costs are calculated based on the estimated CIF unit prices at major ports and the operation costs (fuel, lubricant and other expenses) are based on the market prices in Indonesia.

Equipment cost consists of ownership, operating and indirect cost, which are calculated in accordance with "Standard Cost Analysis of Road and Bridge No. 02/ST/BM/73".

Ownership cost and an item of spare parts in operating cost are regarded as foreign currency components and the rest are local currency.
Equipment hourly cost is shown in Table 6.2.1. and calculation method and detailed breakdown are in Appendix C.1.

3) Labor Costs

The estimated local labor costs are based on the inventory of unit cost data which was collected by Bina Marga and is shown in Appendix C.3.

Estimated local labor costs

| | |
|---|---|
| Foreman | Rp.1,500/day |
| Operator | Rp.1,500/day |
| Labor | Rp.1,000/day |

Note: Operator's cost are included in operating cost of equipment

4) Adjusting factor for local currency.

Taking local price condition into consideration, local currency (local materials and labors cost) of main support work are adjusted in conclusion.

The regional districts are classified into expensive district, medium district and cheap district groups as follows;

| | Expensive district | Medium district | Cheap district |
|---|---|---|---|
| | Riau | South Sulawesi | Lampung |
| | South Sumatra | North Sulawesi | N.T.T. |
| | | | South East Sulawesi |
| Adjusting factor | 1.1 | 1.0 | 0.9 |

5) Bridge support work

Cost estimates for bridge support work are prepared by Bina Marga and are based on an average cost per linear meter of a one-lane bridge, as obtained on cost data available in the Directorates of Planning.

Cost data are as follows :

| Expensive district | medium district | cheap district |
|---|---|---|
| Rp. 350,000/m | Rp. 300,000/m | Rp. 250,000/m |

### 6.2.3. Unit Cost of Main Support Work

Detailed calculation of unit cost of main support work and maintenance are given in Appendix G.2, and have reference to basic capacities of equipment given in Appendix F.1.

The unit cost of each item is summarized in Table 6.2.2 and the averaged cost of gravelling of each design category in square meter, according to each hauling distance, is summarized in Table 6.2.3 through Table 6.2.5. Administrative cost is not included in these unit costs.

Table 6.2.1. Equipment Hourly Cost

(Unit: Rp.) in 1980

| Equipment | P.S. | Local Cost | Foreign Cost | Total Cost |
|---|---|---|---|---|
| Bulldozer 1 1t | 100 | 7,337 | 10,334 | 17,671 |
| Motor Grader 3.1 m | 110 | 6,404 | 7,914 | 14,318 |
| Tyre Roller 8.5-15$^{t}$ | 95 | 5,633 | 6,605 | 12,238 |
| Wheel Loader 1 m$^3$ | 100 | 6,028 | 7,056 | 13,084 |
| Dump Truck 3.5$^{t}$ | 100 | 2,791 | 1,830 | 4,621 |
| Water Tank Truck 3,500 l | 100 | 3,299 | 3,024 | 6,323 |
| Fuel Tank Truck 3,500 l | 100 | 3,367 | 3,183 | 6,550 |
| Portable Concrete Mixer 0.3 m$^3$ | 15 | 1,691 | 1,758 | 3,449 |
| Portable Crusher (jaw) 10-20$^{t}$/h | 40 | 6,599 | 11,081 | 17,680 |
| Portable Crusher (jaw) 20-30$^{t}$/h | 50 | 7,190 | 11,871 | 19,061 |
| Portable Compressor 7 m$^3$/min | 75 | 3,035 | 2,253 | 5,288 |
| Leg Drill 38 $\phi$ Bit | - | 614 | 430 | 1,044 |
| Hand Hammer 38 $\phi$ Bit | - | 563 | 308 | 871 |
| Hydraulic Excavator 0.4 m$^3$ | 90 | 7,106 | 10,345 | 17,451 |
| Mobile Work Shop 4$^{t}$ | 100 | 7,476 | 12,477 | 19,953 |
| Service Car (Jeep) | 135 | 3,249 | 1,767 | 5,016 |

Table 6.2.2. Summary of Unit Cost

in 1980

| Item | Unit | Unit Price (Rp.) | | |
|---|---|---|---|---|
| | | Local | Foreign | Total |
| 1. Improvement of road | | | | |
| Design Category 3: Macadam, cobble and Telford lightly corrugated | $m^2$ | 31.7 | 29.7 | 61.4 |
| " 4: gravel lightly corrugated | m2 | 47.6 | 44.7 | 92.3 |
| " 5: earth lightly corrugated | m2 | 74.9 | 70.4 | 145.3 |
| " 6: gravel, macadam, cobble and telford heavily corrugated | m2 | 69.2 | 67.9 | 137.1 |
| " 7: earth, gravel, macadam, cobble, telford, lightly damaged | m2 | 86.8 | 81.7 | 168.5 |
| " 8: earth, gravel, heavily damaged | m2 | 183.0 | 175.2 | 358.2 |
| " 9: Macadam, cobble and telford heavily damaged | m2 | 57.8 | 54.6 | 112.4 |
| " 10: earth, gravel, macadam, cobble and telford bearing capacity more or less insufficient | m2 | 151.7 | 142.6 | 294.3 |
| " 11: earth, gravel, macadam, cobble and telford bearing capacity insufficient | m2 | 151.7 | 142.6 | 294.3 |
| 2. Earth Work, Fill or Shoulder | $m^3$ | 1,009 | 962 | 1,971 |
| 3. Material, Granular borrow | $m^3$ | 878 | 1,047 | 1,925 |
| Crushed stone from river | m3 | 2,745 | 3,239 | 5,984 |
| Crushed stone from mountain rock | m3 | 3,572 | 3,795 | 7,367 |
| 4. Transportation cost for material, hauling distance | | | | |
| L = 5 km | $m^3$ | 1,142 | 749 | 1,891 |
| L = 10 km | m3 | 2,008 | 1,317 | 3,325 |
| L = 15 km | m3 | 2,878 | 1,887 | 4,765 |
| L = 20 km | m3 | 3,722 | 2,440 | 6,162 |
| L = 25 km | m3 | 4,614 | 3,025 | 7,639 |
| L = 30 km | m3 | 5,473 | 3,589 | 9,062 |
| 5. Concrete pipe culvert (Ø = 80 cm) | m | 21,124 | - | 21,124 |
| 6. Inlet and outlet for pipe culvert | each | 25,000 | - | 25,000 |
| 7. Side ditch | km | 13,379 | 15,825 | 29,204 |
| 8. Maintenance of road | km | 241,248 | 62,888 | 304,136 |

Table 6.2.3. Averaged Cost of Gravelling excluding Administration Cost in case of River Sand and Gravel

in 1980 Rp/m²

| Hauling Distance (Km) / Design Category | 5 | | 10 | | 15 | | 20 | | 30 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Local | Foreign | Local | Foreign | Local | Foreign | Local | Foreign | Local | Foreign |
| 3 | 68.9 | 62.8 | 84.8 | 73.2 | 100.9 | 83.7 | 117.3 | 93.9 | 148.6 | 115.0 |
| Total | 132 | | 158 | | 185 | | 211 | | 264 | |
| 4 | 103.5 | 94.4 | 127.5 | 110.1 | 151.6 | 126.0 | 176.4 | 141.3 | 223.5 | 173.1 |
| Total | 198 | | 238 | | 278 | | 318 | | 397 | |
| 5 | 186.8 | 169.9 | 234.7 | 201.4 | 282.9 | 232.9 | 332.5 | 263.6 | 426.7 | 327.2 |
| Total | 357 | | 436 | | 516 | | 596 | | 754 | |
| 6 | 293.0 | 266.9 | 389.0 | 329.8 | 485.4 | 393.0 | 584.4 | 454.3 | 772.9 | 581.6 |
| Total | 560 | | 719 | | 878 | | 1,039 | | 1,354 | |
| 7 | 333.0 | 300.6 | 438.6 | 369.8 | 544.6 | 439.3 | 653.6 | 506.7 | 861.0 | 646.8 |
| Total | 634 | | 808 | | 984 | | 1,160 | | 1,508 | |
| 8 | 449.4 | 412.1 | 563.7 | 487.0 | 678.4 | 562.2 | 796.3 | 635.1 | 1,020.7 | 786.7 |
| Total | 862 | | 1,051 | | 1,241 | | 1,431 | | 1,807 | |
| 9 | 393.5 | 353.1 | 537.4 | 447.5 | 682.0 | 542.2 | 830.6 | 634.1 | 1,113.3 | 825.1 |
| Total | 747 | | 985 | | 1,224 | | 1,465 | | 1,938 | |
| 10 | 627.0 | 541.6 | 723.0 | 604.5 | 819.4 | 667.7 | 918.4 | 729.0 | 1,106.9 | 856.3 |
| Total | 1,169 | | 1,328 | | 1,487 | | 1,647 | | 1,963 | |
| 11 | 878.6 | 741.8 | 974.6 | 804.7 | 1,071.0 | 867.9 | 1,170.0 | 929.2 | 1,358.5 | 1,065.5 |
| Total | 1,620 | | 1,779 | | 1,939 | | 2,099 | | 2,424 | |

Table 6.2.4. Averaged Cost of Gravelling excluding Administration Cost in Case of Crushed stone with use of explosives

In 1980 Rp/m²

| Design Category \ Hauling Distance (Km) | 5 | | 10 | | 15 | | 20 | | 30 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Local | Foreign | Local | Foreign | Local | Foreign | Local | Foreign | Local | Foreign |
| 3 | 118.4 | 113.3 | 134.3 | 123.7 | 150.4 | 134.2 | 166.8 | 144.4 | 198.1 | 165.5 |
| Total | 232 | | 258 | | 285 | | 311 | | 364 | |
| 4 | 178.1 | 170.5 | 202.1 | 186.2 | 226.2 | 202.1 | 251.0 | 217.4 | 298.1 | 249.2 |
| Total | 349 | | 388 | | 428 | | 468 | | 547 | |
| 5 | 336.1 | 322.1 | 384.0 | 353.6 | 432.2 | 385.1 | 481.8 | 415.8 | 576.0 | 479.4 |
| Total | 658 | | 738 | | 817 | | 898 | | 1,055 | |
| 6 | 591.5 | 571.4 | 687.5 | 634.3 | 783.9 | 697.5 | 882.9 | 758.8 | 1,071.4 | 886.1 |
| Total | 1,163 | | 1,322 | | 1,481 | | 1,642 | | 1,958 | |
| 7 | 661.4 | 635.6 | 767.0 | 704.8 | 873.0 | 774.3 | 982.0 | 841.7 | 1,189.4 | 981.8 |
| Total | 1,297 | | 1,472 | | 1,647 | | 1,824 | | 2,171.2 | |
| 8 | 804.7 | 774.6 | 919.0 | 849.5 | 1,033.7 | 924.7 | 1,151.6 | 997.6 | 1,376 | 1,149. |
| Total | 1,579 | | 1,769 | | 1,958 | | 2,149 | | 2,525 | |
| 9 | 841.3 | 809.8 | 985.2 | 904.2 | 1,129.8 | 998.9 | 1,278.4 | 1,090.8 | 1,561,1 | 1,281.8 |
| Total | 1,651 | | 1,889 | | 2,129 | | 2,369 | | 2,843 | |
| 10 | 925.5 | 846.1 | 1,021.5 | 909.0 | 1,117.9 | 972.2 | 1.216.9 | 1,033.5 | 1,405.4 | 1,160.8 |
| Total | 1,772 | | 1,931 | | 2,090 | | 2,250 | | 2,566 | |
| 11 | 1,177.1 | 1,046.3 | 1,273.1 | 1,109.2 | 1,369.5 | 1,172.4 | 1,468.5 | 1,233.7 | 1,657.0 | 1,361.0 |
| Total | 2,223 | | 2,382 | | 2,542 | | 2,702 | | 1,793 | |

Table 6.2.5. Averaged Cost of Gravelling excuding Administration Cost in case of crushed stone from River

Rp/m$^2$

In 1980

| Design Category \ Hauling Distance (Km) | 5 | | 10 | | 15 | | 20 | | 30 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Local | Foreign | Local | Foreign | Local | Foreign | Local | Foreign | Local | Foreign |
| 3 | 103.2 | 102.9 | 119.1 | 113.3 | 135.2 | 123.8 | 151.6 | 134.0 | 182.9 | 155.1 |
| Total | 206 | | 232 | | 259 | | 286 | | 338 | |
| 4 | 155.2 | 154.8 | 179.2 | 170.5 | 203.3 | 186.4 | 228.1 | 201.7 | 275.2 | 233.5 |
| Total | 310 | | 350 | | 390 | | 430 | | 509 | |
| 5 | 290.3 | 290.8 | 338.2 | 322.3 | 386.4 | 353.8 | 436.0 | 384.5 | 530.2 | 448.1 |
| Total | 581 | | 661 | | 740 | | 821 | | 978 | |
| 6 | 499.8 | 508.7 | 595.8 | 571.6 | 692.2 | 634.8 | 791.2 | 696.1 | 979.7 | 823.4 |
| Total | 1,009 | | 1,167 | | 1,327 | | 1,487 | | 1,803 | |
| 7 | 560.6 | 566.6 | 666.2 | 635.8 | 772.2 | 705.3 | 881.2 | 772.7 | 1,088.6 | 912.8 |
| Total | 1,127 | | 1,302 | | 1,478 | | 1,654 | | 2,001 | |
| 8 | 695.7 | 699.9 | 810.0 | 774.8 | 924.7 | 850.0 | 1,042.6 | 922.9 | 1,267.0 | 1,074.5 |
| Total | 1,396 | | 1,585 | | 1,775 | | 1,966 | | 2,342 | |
| 9 | 703.8 | 715.8 | 847.7 | 810.2 | 992.3 | 904.9 | 1,140.9 | 996.8 | 1,423.6 | 1,187.8 |
| Total | 1,420 | | 1,658 | | 1,897 | | 2,138 | | 2,611 | |
| 10 | 833.8 | 783.4 | 929.8 | 846.3 | 1,026.2 | 909.5 | 1,125.2 | 970.8 | 1,113.7 | 1,098.1 |
| Total | 1,617 | | 1,776 | | 1,936 | | 2,096 | | 2,212 | |
| 11 | 1,085.4 | 983.6 | 1,181.4 | 1,046.5 | 1,277.8 | 1,109.7 | 1,376.8 | 1,171.0 | 1,565.3 | 1,298.3 |
| Total | 2,069 | | 2,228 | | 2,388 | | 2,548 | | 2,864 | |

### 6.2.4. Cost Estimates of Main Support Work and Maintenance

Total cost estimate of the main support work and the cost of the local currency portion are shown in Table 6.2.6. and Table 6.2.7. respectively and have reference to cost estimate given in Appendix G.3.
The costs shown in both tables are those in 1980 excluding administration fee and not yet adjusted with local conditions and so Table 6.2.8. shows an adjusted local portion of the main support work.

Table 6.2.9. shows the yearly maintenance costs.

### 6.2.5. Cost Estimates for Unloading and Local Transportation of Equipment

The ports of Pakan Baru, Tanjung Pinang, Palembang, Surabaya, Bitung and Ujung Pandang are proposed for unloading of equipment. In particular Palembang, Bitung and Ujung Pandang have good port facilities and direct regular shipment.
Distances of local transportation are assumed from the ports to the capital of each Kabupaten.
50% of total cost are added for unexpected expenses.

Transportation charts, unit cost data and estimated cost are shown in Table 6.2.10, Table 6.2.11. and Table 6.2.12. respectively.

### 6.2.6. Cost Estimate of Workshops

The cost of workshops in twenty-one selected Kabupatens was estimated on the following conditions.

(1) Workshop Area 1 ha

(2) Building

| | | |
|---|---|---|
| (1) | 50 m x 8 m | Main Building |
| (2) | 8 m x 8 m | Subricating Oil House |
| (3)* | 8 m x 8 m | Generator House |

(* If Necessary)

(3) Building Specification

(1) Wooden Building
(2) Clearance from Ground to Eaves, 4 m
(3) Tiled Roof (4) Concrete Floor

(4) Main Building Partition

(1) Office Room, 8 m x 8 m
(2) Ware House (including Tool Room)
8 m x 16 m
(3) Repair Bay, 8 m x 20 m
(4) Electric Room (including Space for W.C.),
8 m x 6 m

(5) Facilities

(1) Office Room Desk and Chair 5 sets,
Book shelf 3, Long Desk 1, Chair 4,
Kitchen Set 1
(2) Ware House Spare Parts Shelf 3,
Tool Shelf 1
(3) Repair Bay Pit 1, Work Bench 3
(4) Generator House Generator 5 KVA
(Diesel Engine Driven)
(5) Fuel Tank 7,000 ℓ
(6) Loading and Washing Station 1

(6) Cost Estimate (Excluding Land Cost)

- Building
  (50 m x 8 m) + (8 m x 8 m) = 464 $m^2$
  464 $m^2$ x Rp 75,000/$m^2$ = Rp.34,800,000
- Fuel Tank
  7,000 ℓ 1 set Rp. 2,500,000
- Fence
  (100 m x 4) x 2,000 Rp/m Rp. 800,000
- Others Rp.40,000,000

Escalation (10%) 4,000,000

Total Rp.44,000,000
for each Kabupaten

(7) Grand Total

| | |
|---|---|
| Rp. 40,000,000 @ 21 | =Rp.840,000,000 |
| Plus. Price Escalation (10%) | =Rp. 84,000,000 |
| Grand Total | Rp.924,000,000 |

MAIN BUILDING

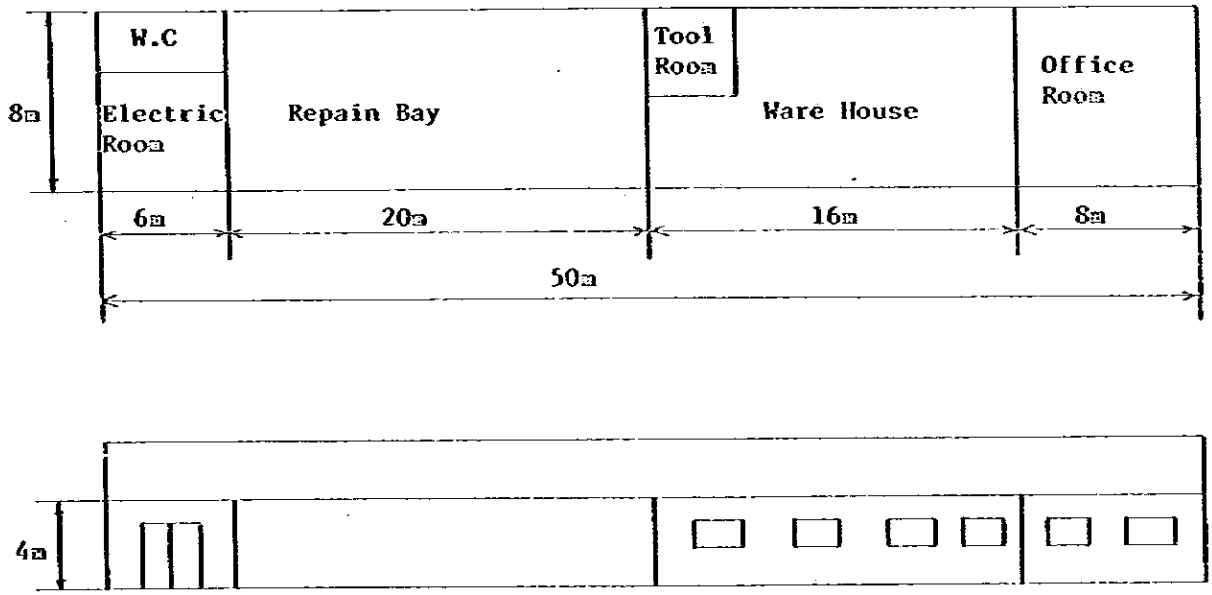


Table 6.2.6. Initial Cost of Main Support Work (Excluding Maincenance and Administractive Cost)

* All costs are estimated for a medium district (Sulawesi Utara, Sulawesi Selatan)

| Province | Kabupaten | Length (1) (Km) | Area (2) ($m^2$) | Cost of (3) Craveling ($10^3$Rp) | Cost of (4) Shouldering ($10^3$Rp) | Cost of (5) Side ditches ($10^3$Rp) | Cost of (6) Culverts ($10^3$Rp) | Total Cost(7) (3)+(4)+(5) +(6) ($10^3$Rp) | Average Cost per length(8) (7)/(1) ($10^6$Rp/Km) | Average Cost per area(9) (7)/(2) (Rp/$m^2$) | Bridge Support Work (10) ($10^3$ Rp) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Riau | Kampar | 213,506 | 656,341 | 690,301 | 46,466 | 6,235 | 8,326 | 751,328 | 3.52 | 1,140 | 377,300 |
| | Kepulauan Riau | 241,222 | 922,993 | 1,092,422 | 47,965 | 7,043 | 10,373 | 1,157,803 | 4.80 | 1,250 | 197,750 |
| Sumatra Selatan | Lahat | 139,297 | 520,287 | 671,941 | 317,628 | 4,069 | 11,980 | 725,618 | 5.40 | 1,390 | 2,800 |
| | O.K.I | 186,788 | 1,001,511 | 2,016,920 | 45,498 | 5,455 | 11,021 | 2,078,894 | 11.12 | 2,070 | 211,750 |
| | O.K.U | 134,976 | 528,725 | 691,956 | 68,210 | 3,940 | 18,491 | 782,597 | 5.80 | 1,480 | 42,350 |
| | L.I.O.T | 130,750 | 445,500 | 519,160 | 47,334 | 3,818 | 13,335 | 583,847 | 4.46 | 1,310 | 176,750 |
| Lampung | Lampung Utara | 222,528 | 675,540 | 1,138,591 | 57,530 | 6,498 | 16,022 | 1,218,641 | 5.47 | 1,800 | 30,250 |
| | Lamp. Selatan | 64,778 | 194,350 | 233,357 | 40,865 | 1,890 | 7,126 | 283,238 | 4.37 | 1,450 | 33,500 |
| Nusa Tenggara Timur | Manggarai | 129,865 | 501,782 | 645,976 | 28,481 | 3,792 | 127,787 | 806,036 | 6.20 | 1,600 | 19,000 |
| | Belu | 218,410 | 822,016 | 1,257,675 | 56,684 | 6,378 | 49,579 | 1,370,316 | 6.27 | 1,660 | 9,500 |
| Sulawesi Utara | Bolaang Mongondow | 260,639 | 829,561 | 1,063,772 | 59,580 | 7,612 | 96,957 | 1,227,921 | 4.71 | 1,480 | 96,900 |
| | Gorontalo | 697,075 | 2,694,985 | 3,238,366 | 188,244 | 20,355 | 143,598 | 3,590,563 | 5.15 | 1,320 | 74,400 |
| Sulawesi Selatan | Takalar | 68,985 | 265,137 | 299,787 | 19,176 | 2,015 | 1,933 | 322,911 | 4.68 | 1,210 | 32,100 |
| | Bone | 163,240 | 690,799 | 760,827 | 77,099 | 4,766 | 11,916 | 854,608 | 5.23 | 1,230 | 25,800 |
| | Sidrap | 138,780 | 505,978 | 515,111 | 28,139 | 4,052 | 10,409 | 557,711 | 4.01 | 1,100 | 25,300 |
| | Pinrang | 76,029 | 347,550 | 388,353 | 23,660 | 2,220 | 7,223 | 421,456 | 5.54 | 1,210 | 10,200 |
| | Polmas | 81,040 | 352,061 | 376,226 | 18,767 | 2,366 | 12,887 | 410,246 | 5.06 | 1,160 | - |
| | Enrekang | 79,031 | 280,840 | 349,762 | 14,369 | 2,308 | 56,191 | 422,630 | 5.34 | 1,500 | 6,600 |
| | Jeneponto | 173,238 | 829,096 | 1,129,548 | 57,024 | 5,059 | 35,341 | 1,226,972 | 7.08 | 1,480 | 68,100 |
| Sulawesi Tenggara | Kendari | 360,613 | 1,551,387 | 2,531,418 | 97,431 | 10,531 | 22,358 | 2,661,738 | 7.40 | 1,710 | 383,750 |
| | Buton | 312,443 | 1,093,415 | 1,784,802 | 70,142 | 9,124 | 54,052 | 1,918,120 | 6.13 | 1,750 | 89,250 |
| Total | | 4,093,233 | 15,719,854 | 21,396,271 | 1,130,493 | 119,526 | 726,905 | 23,373,195 | 5.71 | 1,490 | 1,903,350 |
| Design Category | ( 3 ) | 38,975 | 156,756 | | | | | 42,597 | 1.09 | 270 | |
| | ( 4 ) | 39,445 | 151,643 | | | | | 53,968 | 1.36 | 360 | |
| | ( 5 ) | 237,936 | 943,877 | | | | | 601,646 | 2.52 | 640 | |
| | ( 6 ) | 466,687 | 1,368,938 | | | | | 2,180,955 | 4.67 | 1,390 | |
| | ( 7 ) | 1,046,762 | 4,139,399 | | | | | 5,479,699 | 5.23 | 1,320 | |
| | ( 8 ) | 1,471,659 | 5,826,776 | | | | | 9,289,922 | 6.31 | 1,590 | |
| | ( 9 ) | 202,383 | 756,095 | | | | | 1,216,398 | 6.01 | 1,600 | |
| | (10) | 113,586 | 406,434 | | | | | 705,739 | 6.21 | 1,740 | |
| | (11) | 475,800 | 1,767,936 | | | | | 2,802,291 | 7.99 | 2,150 | |

Table 6.2.7. Initial Cost of Local Currency of Main Support Work (Excluding Maintenance and Administrative Cost)

in 1980 * All costs are estimated for a the medium district ( Sulawesi Utara, Sulawesi Selatan )

| Province | Kabupaten | Length (1) (Km) | Area (2) ($m^2$) | Cost of (3) Graveling ($10^3$Rp) | Cost of (4) Shouldering ($10^3$Rp) | Cost of (5) Side ditche ($10^3$Rp) | Cost of (6) Culverge ($10^3$Rp) | Total Cost(7) (3)+(4)+(5) +(6) ($10^3$Rp) | Average Cost per length(8) (7)/(1) ($10^3$Rp/Km) | Average Cost per Area (9) (7)/(2) (Rp/$m^2$) | Bridge (10) Support Work ($10^3$Rp) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Riau | Kampar | 213,506 | 656,341 | 347,980 | 26,295 | 2,861 | 8,326 | 385,462 | 1,805 | 0.587 | 377,300 |
| | Kep. Riau | 241,222 | 922,993 | 564,269 | 27,144 | 3,232 | 10,373 | 605,018 | 2,508 | 0.655 | 197,750 |
| Sumatra Selatan | Lahat | 139,297 | 520,287 | 349,601 | 21,295 | 1,865 | 12,980 | 385,741 | 2,769 | 0.741 | 2,800 |
| | O.K.I | 186,788 | 1,001,511 | 1,083,146 | 25,748 | 2,302 | 11,021 | 1,122,417 | 6,009 | 1,120 | 211,750 |
| | O.K.U | 134,976 | 528,725 | 358,241 | 38,602 | 1,809 | 18,491 | 417,143 | 3,090 | 0.788 | 42,350 |
| | L.I.O.T | 130,750 | 445,500 | 269,678 | 26,902 | 1,752 | 13,335 | 311,667 | 2,383 | 0.699 | 176,750 |
| Lampung | Lampung Utara | 222,528 | 675,540 | 612,321 | 32,558 | 2,982 | 16,022 | 663,883 | 2,983 | 0.982 | 30,250 |
| | Lamp. Selatan | 64,778 | 194,350 | 121,195 | 23,126 | 868 | 7,126 | 152,315 | 2,351 | 0.783 | 33,500 |
| Nusa Tenggara Timur | Manggarai | 129,865 | 501,782 | 336,591 | 16,117 | 1,740 | 127,787 | 482,235 | 3,713 | 0.096 | 19,000 |
| | Belu | 218,410 | 822,016 | 668,123 | 32,079 | 2,927 | 49,579 | 752,708 | 3,446 | 0.915 | 9,500 |
| Sulawesi Utara | Bolaang Mongondow | 260,639 | 829,561 | 546,019 | 33,718 | 3,493 | 96,939 | 680,169 | 2,609 | 2,609 | 96,900 |
| | Gorontalo | 697,075 | 2,694,985 | 1,647,291 | 106,532 | 9,340 | 143,598 | 1,906,761 | 2,735 | 0.707 | 74,400 |
| Sulawesi Selatan | Takalar | 68,985 | 265,137 | 155,508 | 10,853 | 924 | 1,933 | 169,218 | 2,452 | 0.638 | 32,100 |
| | Bone | 163,240 | 690,799 | 387,556 | 43,633 | 2,188 | 11,916 | 445,293 | 2,727 | 0.644 | 25,800 |
| | Sidrap | 138,780 | 505,978 | 270,180 | 15,926 | 1,860 | 10,409 | 298,375 | 2,149 | 0.589 | 15,300 |
| | Pinrang | 76,029 | 347,550 | 201,282 | 13,390 | 1,019 | 7,223 | 222,914 | 2,931 | 0.641 | 10,200 |
| | Polmas | 81,040 | 352,061 | 197,223 | 10,621 | 1,085 | 12,887 | 221,816 | 2,737 | 0.630 | - |
| | Enrekang | 79,031 | 280,840 | 183,476 | 8,132 | 1,060 | 56,191 | 248,859 | 3,148 | 0.886 | 6,600 |
| | Jeneponto | 173,238 | 829,096 | 584,676 | 32,271 | 2,321 | 35,341 | 654,609 | 3,778 | 0.789 | 68,100 |
| Sulawesi Tenggara | Kendari | 360,613 | 1,551,387 | 1,332,020 | 55,137 | 4,832 | 22,358 | 1,414,347 | 3,922 | 0.911 | 383,750 |
| | Buton | 312,443 | 1,093,415 | 934,026 | 16,505 | 4,187 | 54,052 | 1,008,770 | 3,228 | 0.922 | 89,250 |
| T o t a l | | 4,093,233 | 15,719,854 | 11,150,402 | 616,584 | 54,847 | 727,887 | 12,549,720 | 3,065 | 0.798 | 1,903,350 |
| Design Category | ( 3 ) | 38,975 | 156,756 | | | | | | | | |
| | ( 4 ) | 39,445 | 151,643 | | | | | | | | |
| | ( 5 ) | 237,936 | 943,877 | | | | | | | | |
| | ( 6 ) | 466,687 | 1,568,938 | | | | | | | | |
| | ( 7 ) | 1,046,762 | 4,139,399 | | | | | | | | |
| | ( 8 ) | 1,471,659 | 5,826,776 | | | | | | | | |
| | ( 9 ) | 202,383 | 758,095 | | | | | | | | |
| | (10 ) | 113,586 | 406,434 | | | | | | | | |
| | (11 ) | 475,800 | 1,767,936 | | | | | | | | |

Table 6.2.8. Adjusted Initial Cost of Local Currency of Main Support Work (Excluding Maintenance and Administration Cost) in 1980 (Thousand Rupiah)

| Province | Kabupaten | (1) Local Currency based on medium district | (2) = (1) X $\alpha$ Adjusted * Local Currency | (3) Bridge Support Work | (4) = (2)+(3) Total Local Currency | (5) Foreign Component | (6) = (4)+(5) Total |
|---|---|---|---|---|---|---|---|
| Riau | Kampar | 385,462 | 424,008 | 377,300 | 801,308 | 365,866 | 1,167,174 |
| | Kepulauan Riau | 605,018 | 665,520 | 197,750 | 863,270 | 552,785 | 1,416,055 |
| Sumatra Selatan | Lahat | 385,741 | 424,315 | 2,800 | 427,115 | 339,877 | 766,992 |
| | O.K.I | 1,122,417 | 1,234,659 | 211,750 | 1,446,409 | 956,477 | 2,402,886 |
| | O.K.U | 417,143 | 458,857 | 42,350 | 501,207 | 365,454 | 866,661 |
| | L.I.O.T | 311,667 | 342,834 | 176,750 | 519,584 | 272,180 | 791,764 |
| Lampung | Lampung Utara | 663,883 | 597,495 | 30,250 | 627,745 | 554,758 | 1,182,503 |
| | Lampung Selatan | 152,315 | 137,084 | 33,500 | 170,584 | 130,923 | 301,507 |
| Nusa Tenggara Timur | Manggarai | 482,235 | 434,012 | 19,000 | 453,012 | 323,801 | 776,813 |
| | Belu | 752,708 | 677,437 | 9,500 | 686,937 | 617,608 | 1,304,545 |
| Sulawesi Utara | Bolaang Mongondow | 680,169 | 680,169 | 96,900 | 777,069 | 547,752 | 1,324,821 |
| | Gorontalo | 1,906,761 | 1,906,761 | 74,400 | 1,981,161 | 1,683,802 | 3,664,963 |
| Sulawesi Selatan | Takalar | 169,218 | 169,218 | 32,100 | 201,318 | 153,693 | 355,011 |
| | Bone | 445,293 | 445,293 | 25,800 | 471,093 | 409,315 | 880,408 |
| | Sidrap | 298,375 | 298,375 | 15,300 | 313,675 | 259,336 | 573,011 |
| | Pinrang | 222,914 | 222,914 | 10,200 | 233,114 | 198,542 | 431,656 |
| | Polmas | 221,816 | 221,816 | - | 221,816 | 188,430 | 410,246 |
| | Enrekang | 248,859 | 248,859 | 6,600 | 255,459 | 173,771 | 429,230 |
| | Jeneponto | 654,609 | 654,609 | 68,100 | 722,709 | 572,363 | 1,295,072 |
| Sulawesi Tenggara | Kendari | 1,414,347 | 1,272,912 | 383,750 | 1,656,662 | 1,247,391 | 7,904,053 |
| | Buton | 1,008,770 | 907,893 | 89,250 | 997,143 | 909,350 | 1,906,493 |
| T o t a l | | 12,549,720 | 12,425,040 | 1,903,350 | 14,328,390 | 10,823,475 | 25,151,865 |
| | | | | | 57.0 % | 43.0 % | 100.0 % |

* Adjusting factor local currency : $\alpha$

Expensive district ( Riau, Sumatra Selatan ) = 1.1

Medium district ( Sulawesi Utara, Sulawesi Selatan ) = 1.0

Cheap district ( Lampung, N.T.T , Sulawesi Tenggara ) = 0.9

Table 6.2.9. Yearly Maintenance Cost

(Excluding Administrative cost)

in 1980

| Province | Kabupaten | Yearly length of maintenance (km) | Local Currency ($10^3$Rp.) | Foreign Currency Component ($10^3$ Rp.) | Total ($10^3$Rp.) |
|---|---|---|---|---|---|
| Riau | Kampar | 431 | 103,978 | 27,105 | 131,083 |
| | Kepulauan Riau | 331 | 79,853 | 20,816 | 100,669 |
| Sumatra Selatan | Lahat | 20' | 50,420 | 13,144 | 63,564 |
| | O.K.I | 286 | 68,997 | 17,986 | 86,983 |
| | O.K.U | 212 | 51,145 | 13,332 | 64,477 |
| | LIOT | 236 | 56,935 | 14,842 | 71,777 |
| Lampung | Lampung Utara | 187 | 45,113 | 11,760 | 56,873 |
| | Lampung Selatan | 203 | 48,973 | 12,766 | 61,739 |
| Nusa Tenggara Timur | Manggarai | 310 | 74,787 | 19,495 | 94,282 |
| | Belu | 246 | 59,347 | 15,470 | 74,817 |
| Sulawesi Utara | Bolaang Mongondow | 429 | 103,495 | 26,979 | 130,474 |
| | Gorontalo | 831 | 200,477 | 52,260 | 252,737 |
| Sulawesi Selatan | Takalar | 169 | 40,771 | 10,628 | 51,399 |
| | Bone | 241 | 58,141 | 15,156 | 73,297 |
| | Sidrap | 192 | 46,320 | 12,074 | 58,394 |
| | Pinrang | 243 | 58,623 | 15,282 | 73,905 |
| | Polmas | 125 | 30,156 | 7,861 | 38,017 |
| | Enrekang | 114 | 27,502 | 7,169 | 34,671 |
| | Jeneponto | 219 | 52,833 | 13,772 | 66,605 |
| Sulawesi Tenggara | Kendari | 490 | 118,212 | 30,815 | 149,027 |
| | Buton | 353 | 85,161 | 22,199 | 107,360 |
| Total | | 6,057 | 1,461,239 | 380,911 | 1,842,150 |

Table 6.2.10 Transportation Chart for Equipment

| Port | Method of Transportation & Relay point & Distance | Kabupaten ( Capital ) | Province |
|---|---|---|---|
| Pakan Baru or Tanjung Pinang (from Singapore) | Land 65 Km | Kampar ( Bangkinang ) | Riau |
| | Sea 0 | Kepulauan Riau ( Tanjung Pinang ) | |
| Palembang | Land 219 | Lahat ( Lahat ) | Sumatra Selatan |
| | Land 62 | O.K.I ( Koyuagung ) | |
| | Land 298 | O.K.U ( Baturaja ) | |
| | Land 176 | L.I.O.T. (Muara Enim) | |
| | Land 353 | Lampung Utara ( Kota Bumi ) | Lampung |
| | Land 465 | Lampung Selatan ( Telukbetung ) | |
| Surabaya | (Sea) 980 → Reo (Land) 64 | Manggarai ( Ruteng ) | Nusa Tenggara Timur |
| | (Sea) 1260 → Kupang (Land) (287) | Belu ( Atambua ) | |
| Bitung | Land 228 | Bolang Mongondow ( Kotamubagu ) | Sulawesi Utara |
| | Sea 300 | Gorontalo ( Gorontalo ) | |
| Ujung Pandang | Land 35 | Takalar ( Takalar ) | Sulawesi Selatan |
| | Land 171 | Bone ( Watangone ) | |
| | Land 185 | Sidrap ( Rappang ) | |
| | Land 207 | Pinrang ( Pinrang ) | |
| | Land 272 | Polmas ( Polewali ) | |
| | Land 232 | Enrekang ( Enrekang ) | |
| | Land 87 | Jeneponto ( Bontosunggu ) | |
| | Sea 410 → Kolaka (Land) 173 | Kendari ( Kendari ) | Sulawesi Tenggara |
| | Sea 410 | Buton ( Baubau ) | |

Table 6.2.11. Unit Cost for Unloading and Local Transportation

in 1980

| | Dead Weight permit (t) | Size L x W x H (m) | Port charge per unit (Rp.) | Document per unit (Rp.) | Storage charge per unit (Rp.) | Inland Transportation (Rp.) | Sea Transportation (Rp.) |
|---|---|---|---|---|---|---|---|
| Bulldozer | 11.7 | 4.6 x 3.7 x 2.9 | 100,000 | 50,000 | 50,000 | 200,000 per day per 120 km (by Trailler) | They will be transported by (the) Barge (750 HP and size of 15m x 45m) Cost will be Rp.620,000 per day per 200 km |
| Tire Roller | 8.5 | 5.2 x 2.1 x 2.6 | | | | | |
| Wheel Loader | 10.2 | 6.2 x 2.4 x 3.3 | | | | | |
| Hydraulic Excavator | 11.0 | 5.7 x 2.5 x 2.6 | | | | | |
| Motor Grader | 9.5 | 6.8 x 2.2 x 3.4 | 100,000 | 50,000 | 50,000 | 20,000 per day per 150 km (Drive itself) | |
| Dump Truck | 3.7 | 5.8 x 2.2 x 2.5 | 50,000 | 50,000 | 40,000 | 20,000 per day per 150 km (Drive itself) | |
| Water Tank Truck | 3.7 | 5.8 x 2.2 x 2.5 | | | | | |
| Portable Cone Mixer | 2.0 | 2.2 x 1.6 x 1.0 | | | | | |
| Mobile Workshop | 9.0 | 5.8 x 2.2 x 3.0 | | | | | |
| Fuel Tank Truck | 3.7 | 5.8 x 2.2 x 2.5 | | | | | |
| Service Car | 2.3 | 4.0 x 1.7 x 2.0 | | | | | |
| Portable Crushing Plant | 10.0<br>13.0 | 7.2 x 2.4 x 3.0<br>7.2 x 2.4 x 3.1 | 100,000 | 50,000 | 50,000 | 30,000 per day per 100 km (Pulling by Truck) | |
| Portable Compressor | 1.9 | 2.2 x 1.6 x 1.0 | 3,000/$m^3$ | 50,000 | | - (by Dump Truck) | |
| Leg Drill | 0.04 | 1.5 x 1.0 x 1.0 | | | | | |
| Hand Hammer | 0.03 | 0.5 x 0.3 x 0.3 | | | | | |
| Spare parts | | | 10% | 10% | | - (by Dump Truck) | |

Table 6.2.12. Unloading and Transportation Cost of Equipment (from Port to Kabupaten)

in 1980 X $10^3$ Rp

| Province | Kabupaten | Port Charge | Document | Storage Charge | Inland Transporta - tion Cost | Sea Transporta- tion Cost | Total |
|---|---|---|---|---|---|---|---|
| Riau | Kampar | 2,351 | 1,980 | 1,650 | 1,735 | - | 7,716 |
| | Kep. Riau | 2,521 | 2,145 | 1,800 | 1,555 | - | 8,021 |
| Sumatra Selatan | Lahat | 2,406 | 2,090 | 1,750 | 3,050 | - | 9,296 |
| | O.K.I | 3,791 | 3,135 | 2,700 | 2,875 | - | 12,501 |
| | O.K.U | 2,736 | 2,365 | 2,000 | 3,785 | - | 10,886 |
| | L.I.O.T | 2,516 | 2,145 | 1,800 | 3,090 | - | 9,551 |
| Lampung | Lampung Utara | 2,636 | 2,255 | 1,900 | 5,540 | - | 12,331 |
| | Lampung Selatan | 1,801 | 1,485 | 1,200 | 5,935 | - | 10,421 |
| Nusa Tenggara Timur | Manggarai | 4,782 | 1,980 | 3,300 | 2,090 | 6,200 | 18,352 |
| | Belu | 4,923 | 2,145 | 3,600 | 4,825 | 7,440 . | 22,933 |
| Sulawesi Utara | Bolaang Mongondow | 2,521 | 2,035 | 1,700 | 4,130 | - | 10,386 |
| | Gorontalo | 8,123 | 3,300 | 5,700 | 2,730 | 2,480 | 22,333 |
| Sulawesi Selatan | Takalar | 1,746 | 1,485 | 1,200 | 1,375 | - | 5,806 |
| | Bone | 2,241 | 1,925 | 1,600 | 2,630 | - | 8,396 |
| | Sidrap | 2,021 | 1,760 | 1,450 | 2,550 | - | 7,781 |
| | Pinrang | 1,856 | 1,595 | 1,300 | 2,490 | - | 7,241 |
| | Polmas | 1,856 | 1,540 | 1,300 | 3,355 | - | 8,051 |
| | Enrekang | 1,866 | 1,540 | 1,250 | 3,345 | - | 8,001 |
| | Jeneponto | 2,626 | 2,310 | 1,950 | 1,655 | - | 8,541 |
| Sulawesi Tenggara | Kendari | 6,152 | 2,640 | 4,500 | 3,650 | 2,480 | 19,422 |
| | Bucon | 5,143 | 2,200 | 3,700 | 1,555 | 2,480 | 15,078 |
| T o t a l | | 66,614 | 44,055 | 47,330 | 63,945 | 21,080 | 243,044 |
| | | | | | | Unexpected expenses (50 %) | 121,502 |
| | | | | | | | 364,566 |

## 6.3 Estimates of Local and Foreign Funds for the Project.

The total cost of the Project, including contingency allowances and administrative costs, are estimated at about Rp 38,250 million, with a foreign exchange component of Rp 12,250 million ( Yen 4,900 million ), or 32% as summarized in table 6.3.1.

In the cost estimates, a 10% physical contingency for support work has been included.
In addition,a 10% of price escalation contingency has also been provided for support work. An adequate contingency has been included in the procurement of equipment in local and foreign currency,unloading and transportation costs and the consulting services .

It should be noted that the estimate is based on the assumption,that the whole of the support works will be executed by the force account works operations.

Cost estimates, for the main support work, of about 4,100 Km of roads and the maintenance of about 6,000 Km (in the first year 1981/82 only), have been estimated as Rp 15,761 million and Rp 1,607 million respectively on the prices in 1980. The cost of the main support work, including price escalation, is estimated as Rp 21,065 million.

The cost estimate of the equipment to be procured, by an international bidding, is shown in Appendix F.3 .

Cost estimates for the consulting services are based on the estimates of the number of man-months required for each task, taking into account the anticipated mix of foreign and local staff (refer to Appendix G.4 ).

Table 6.3.1 COST ESTIMATES

Rp thousand
(Yen thousand)

| Project Element | Local Cuurency | Foreign Exchange | Total | Foreign Exchange Component (%) |
|---|---|---|---|---|
| A. Support Works | | | | |
| 1. Main Support Work a/ | 15,761,229 | - | 15,761,229 | - |
| 2. Maintenance (in the first year 81/82) b/ | 1,607,363 | - | 1,607,363 | - |
| 3. Contingencies | | | | |
| (a) Physical c/ | 1,736,859 | - | 1,736,859 | - |
| (b) Price Escalation d/ | 5,464,533 | - | 5,464,533 | - |
| Sub Total (A) | 24,569,984 | - | 24,569,984 | - |
| B. Equipment for twenty-one Kabupatens | | | | |
| 1. Equipment & Workshops e/ | 1,083,044 | (Yen 4,380,000) 10,950,000 | 12,033,044 | 91.0 |
| 2. Contingencies | | | | |
| (a) Physical f/ | 121,502 | (Yen 300,000) 750,000 | 871,502 | 86.1 |
| (b) Price Escalation g/ | 84,000 | - | 84,000 | - |
| Sub Total (B) | 1,288,546 | (Yen 4,680,000) 11,700,000 | 12,988,546 | 90.1 |
| C. Consulting Services | | | | |
| 1. Consulting Services | 974,081 | (Yen 188,764) 471,910 | 1,445,991 | 32.6 |
| 2. Contingency | 89,688 | (Yen 31,236) 78,090 | 167,778 | 46.5 |
| Sub Total (C) | 1,063,769 | (Yen 220,000) 550,000 | 1,613,769 | 34.1 |
| Total Cost (A+B+C) | 26,922,299 | (Yen 4,000,000) 12,250,000 | 39,172,299 | 31.3 |

a/ 10% administrative cost is included.

b/ 10% administrative cost is uncluded.

c/ 10% of A.1 and A.2

d/ an annual rate of 10% for A.1 and A.2

e/ Unloading and transportation costs for eqipment and workshop cost (local currency).

f/ 50% of unloading and transportation cost (local currency).

g/ 10% of workshop cost (local currency).

## 6.4 Estimates of Annual Fund Requirement

Table 6.4.1 shows local currency required for 21 selected Kabupatens in the first 6 years of the Project.

Table 6.4.2. and 6.4.3 show the breakdown of total local currency shown in Table 6.4.1. into main support work and maintenance respectively.

These local currency requirement are calculated using the same assumptions of yearly accomplishment described in chapter 5, section 8, Table 5.8.1 and of inflation rate described in section 2 of this chapter , namely annual rate of cost increase is assumed to be 10 %.

Annual fund requirement reaches 7 billion Rupiahs in the first year of the Project, that is the 1981/82 fiscal year. This is considered to be tolerable, as the growth rate of the budget of Kabupaten Roads Support Works is significantly high ( Rp. 13,000,000,000 in 1979/80 and Rp. 40,000,000,000 in 1980/81 ).

Similarly, annual disbursement plan of foreign currency is shown in Table 6.4.2.

Table 6.4.1. Budgetary Schedule of Local Portion of the Project

( Main Support Work and Maintenance )

Local currency in 1,000 Rp.

| PROVINCE | KABUPATEN | MAIN SUPPORT* WORK $10^3$Rp. | YEARLY MAINTE-* NANCE COST $10^3$Rp. | (1) FIRST YEAR 1981/82 | (2) SECOND YEAR 1982/83 | (3) THIRD YEAR 1983/84 | (4) FOURTH YEAR 1984/85 | (5) FIFTH YEAR 1985/86 | (6) SIXTH YEAR 1986/87 | TOTAL (1) - (6) |
|---|---|---|---|---|---|---|---|---|---|---|
| RIAU | Kampar | 801,308 | 114,376 | 378,807 | 465,167 | 511,684 | 177,300 | 195,042 | 214,552 | 1,942,552 |
| | Kepulauan - Riau | 863,270 | 87,838 | 372,717 | 462,217 | 508,438 | 145,160 | 159,686 | 175,659 | 1,823,877 |
| SUMATRA SELATAN | Lahat | 427,115 | 55,462 | 196,410 | 241,891 | 266,081 | 90,063 | 99,075 | 108,986 | 1,002,506 |
| | O.K.I. | 1,446,409 | 75,897 | 314,554 | 363,511 | 399,862 | 461,019 | 530,422 | 583,467 | 2,652,835 |
| | O.K.U. | 501,207 | 56,259 | 221,657 | 274,146 | 301,561 | 90,769 | 99,852 | 109,841 | 1,097,826 |
| | LIOT | 519,584 | 62,628 | 234,091 | 288,885 | 317,828 | 98,892 | 108,788 | 119,671 | 1,168,205 |
| LAMPUNG | Lampung Utara | 627,745 | 49,624 | 256,780 | 320,437 | 352,480 | 92,182 | 101,406 | 111,550 | 1,234,835 |
| | Lampung Selatan | 170,584 | 53,870 | 110,163 | 131,499 | 144,650 | 79,467 | 87,419 | 96,164 | 649,362 |
| NUSA TENGGARA TIMUR | Manggarai | 453,012 | 82,266 | 157,013 | 178,195 | 196,014 | 222,241 | 251,768 | 276,950 | 1,282,181 |
| | Belu | 686,937 | 65,282 | 178,627 | 204,801 | 225,281 | 257,861 | 294,715 | 324,190 | 1,485,475 |
| SULAWESI UTARA | Boleang Mongondow. | 777,069 | 113,844 | 242,060 | 275,670 | 303,237 | 344,927 | 391,945 | 431,145 | 1,988,984 |
| | Gorontalo | 1,981,161 | 220,525 | 547,417 | 626,130 | 688,743 | 786,603 | 897,190 | 986,920 | 4,533,003 |
| SULAWESI SELATAN | Takalar | 201,318 | 44,848 | 111,283 | 134,591 | 148,050 | 67,812 | 74,598 | 82,060 | 618,394 |
| | Bone | 471,093 | 63,955 | 219,416 | 269,859 | 296,845 | 104,190 | 114,616 | 126,082 | 1,131,008 |
| | Sidrap | 313,675 | 50,952 | 154,465 | 188,888 | 207,777 | 84,059 | 92,470 | 101,720 | 829,379 |
| | Pinrang | 233,114 | 64,485 | 141,413 | 169,658 | 186,623 | 94,654 | 104,126 | 114,542 | 811,016 |
| | Polmas | 221,816 | 33,172 | 106,371 | 130,428 | 143,471 | 53,684 | 59,057 | 64,964 | 557,975 |
| | Enrekang | 255,459 | 30,252 | 114,553 | 141,464 | 155,611 | 49,446 | 54,394 | 59,835 | 575,303 |
| | Jeneponto | 722,709 | 58,116 | 296,610 | 369,995 | 406,995 | 97,833 | 107,623 | 118,388 | 1,397,444 |
| SULAWESI TENGGARA | Kendari | 1,656,662 | 130,033 | 403,382 | 463,767 | 510,143 | 585,400 | 670,633 | 737,702 | 3,371,027 |
| | Buton | 997,143 | 93,677 | 258,206 | 296,092 | 325,701 | 372,862 | 426,216 | 468,841 | 2,147,918 |
| SUBTOTAL | | 14,328,390 | 1,607,361 | 5,015,995 | 5,997,341 | 6,597,075 | 4,356,424 | 4,921,041 | 5,413,229 | 32,301,105 |
| ADMINISTRATION FEE | | | | 501,600 | 599,734 | 659,708 | 435,642 | 492,104 | 541,323 | 3,230,111 |
| TRANSPORTATION COST IN INDONESIA | | | | 182,283 | 182,283 | - | - | - | - | 364,566 |
| CONSULTING SERVICES | | | | 500,000 | 313,769 | 250,000 | - | - | - | 1,063,769 |
| WORKSHOP | | | | 924,000 | | | | | | 924,000 |
| GRAND TOTAL | | | | 7,123,878 | 7,093,123 | 7,506,783 | 4,792,066 | 5,413,145 | 5,954,552 | 37,883,551 |

* both costs are those in 1980.

Table 6.4.2. Budgetary Schedule of Local Portion of the Main Support Work

Unit $10^3$ Rp

Administration Fee is excluded

| Province | Kabupaten | (1) Total Local Currency | (2) First Year 1981/82 | (3) Second Year 1982/83 | (4) Third Year 1983/84 | (5) Fourth Year 1984/85 | (6) Fifth Year 1985/86 | (7) Sixth Year 1986/87 | Total (2) - (7) |
|---|---|---|---|---|---|---|---|---|---|
| Riau | Kampar | 801,308 | 264,431 | 339,354 | 373,289 | - | - | - | 977,074 |
| | Kepulauan Riau | 863,270 | 284,879 | 365,595 | 402,154 | - | - | - | 1,052,628 |
| Sumatera Selatan | Lahat | 427,115 | 140,948 | 180,883 | 198,972 | - | - | - | 520,803 |
| | O.K.I | 1,446,409 | 238,657 | 280,025 | 308,027 | 360,007 | 419,302 | 461,232 | 2,067,250 |
| | O.K.U | 501,207 | 165,398 | 212,261 | 233,487 | - | - | - | 611,146 |
| | LIOT | 519,584 | 171,463 | 220,044 | 242,048 | - | - | - | 633,555 |
| Lampung | Lampung Utara | 627,745 | 207,156 | 265,850 | 292,435 | - | - | - | 765,441 |
| | Lampung Selatan | 170,584 | 56,293 | 72,242 | 79,467 | - | - | - | 208,002 |
| Nusa Tenggara Timur | Manggarai | 453,012 | 74,747 | 87,703 | 96,473 | 112,753 | 131,324 | 144,457 | 647,457 |
| | Belu | 686,937 | 113,345 | 132,991 | 146,290 | 170,977 | 199,137 | 219,051 | 981,791 |
| Sulawesi Utara | Bolaang Mongondow | 777,069 | 128,216 | 150,441 | 165,485 | 193,410 | 225,266 | 247,793 | 1,110,611 |
| | Gorontalo | 1,981,161 | 326,892 | 383,553 | 421,908 | 493,105 | 574,322 | 631,755 | 2,831,535 |
| Sulawesi Selatan | Takalar | 201,318 | 66,435 | 85,258 | 93,784 | - | - | - | 245,477 |
| | Bone | 471,093 | 155,461 | 199,508 | 219,459 | - | - | - | 574,428 |
| | Sidrap | 313,675 | 103,513 | 132,841 | 146,125 | - | - | - | 382,479 |
| | Pinrang | 233,114 | 76,928 | 98,724 | 108,596 | - | - | - | 284,248 |
| | Polmas | 221,816 | 73,199 | 93,939 | 103,333 | - | - | - | 270,471 |
| | Enrekang | 255,459 | 84,301 | 108,187 | 119,006 | - | - | - | 311,494 |
| | Jeneponto | 722,709 | 238,494 | 306,067 | 336,674 | - | - | - | 881,235 |
| Sulawesi Tenggara | Kendari | 1,656,662 | 273,349 | 320,730 | 352,803 | 412,338 | 480,253 | 528,278 | 2,367,751 |
| | Buton | 997,143 | 164,529 | 193,047 | 212,352 | 248,186 | 289,064 | 317,970 | 1,425,148 |
| T o t a l | | 14,328,390 | 3,408,634 | 4,229,243 | 4,652,167 | 1,990,776 | 2,318,668 | 2,550,536 | 19,150,024 |

Table 6.4.3. Budgetary Schedule of Maintenance of Cost in the First Stage

Administration Fee is excluded.

Local Currency in 1,000 Rp.

| PROVINCE | KABUPATEN | COST ESTIMATED IN 1980 | 1981/82 | 1982/83 | 1983/84 | 1984/85 | 1985/86 | 1986/87 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| RIAU | Kampar | 103,978 | 114,376 | 125,013 | 138,395 | 177,300 | 195,042 | 214,552 | 965,478 |
| | Kepulauan-Riau | 79,853 | 87,838 | 96,622 | 106,284 | 145,160 | 159,686 | 175,659 | 771,249 |
| SUMATRA SELATAN | Lahat | 50,420 | 55,462 | 61,008 | 67,109 | 90,063 | 99,075 | 108,986 | 481,703 |
| | O.K.I. | 68,997 | 75,897 | 83,486 | 91,835 | 101,012 | 111,120 | 122,235 | 585,585 |
| | O.K.U. | 51,145 | 56,259 | 61,885 | 68,074 | 90,769 | 99,852 | 109,841 | 486,680 |
| | LIOT | 56,935 | 62,628 | 68,891 | 75,780 | 98,892 | 108,788 | 119,671 | 534,650 |
| LAMPUNG | Lampung Utara | 45,113 | 49,624 | 54,587 | 60,045 | 92,182 | 101,406 | 111,550 | 469,394 |
| | Lampung Selatan | 48,973 | 53,870 | 59,257 | 65,183 | 79,467 | 87,419 | 96,164 | 441,360 |
| NUSA TENGGARA TIMUR | Manggarai | 74,787 | 82,266 | 90,492 | 99,541 | 109,488 | 120,444 | 132,493 | 634,724 |
| | Belu | 59,347 | 65,282 | 71,810 | 78,991 | 86,884 | 95,578 | 105,139 | 503,684 |
| SULAWESI UTARA | Bolaang Mongondow | 103,495 | 113,844 | 125,229 | 137,752 | 151,517 | 166,679 | 183,352 | 878,373 |
| | Gorontalo | 200,477 | 220,525 | 242,577 | 266,835 | 293,498 | 322,868 | 355,165 | 1,701,468 |
| SULAWESI SELATAN | Takalar | 40,771 | 44,848 | 49,333 | 54,266 | 67,812 | 74,598 | 82,060 | 372,917 |
| | Bone | 58,141 | 63,955 | 70,351 | 77,386 | 104,190 | 114,616 | 126,082 | 556,580 |
| | Sidrap | 46,320 | 50,952 | 56,047 | 61,652 | 84,059 | 92,470 | 101,720 | 446,900 |
| | Pinrang | 58,623 | 64,485 | 70,934 | 78,027 | 94,654 | 104,126 | 114,542 | 526,768 |
| | Polmas | 30,156 | 33,172 | 36,489 | 40,138 | 53,684 | 59,057 | 64,964 | 287,504 |
| | Enrekang | 27,502 | 30,252 | 33,277 | 36,605 | 49,446 | 54,394 | 59,835 | 263,809 |
| | Jeneponto | 52,833 | 58,116 | 63,928 | 70,321 | 97,833 | 107,623 | 118,388 | 516,209 |
| SULAWESI TENGGARA | Kendari | 118,212 | 130,033 | 143,037 | 157,340 | 173,062 | 190,380 | 209,424 | 1,003,276 |
| | Buton | 85,161 | 93,677 | 103,045 | 113,349 | 124,676 | 137,152 | 150,071 | 722,770 |
| TOTAL | | 1,461,239 | 1,607,361 | 1,768,098 | 1,944,908 | 2,365,648 | 2,602,373 | 2,862,693 | 13,151,081 |

Table 6.4.2. Annual Disbursement Plan of Foreign Currency

Unit : Yen

| | 1981/82 | 1982/83 | 1983/84 | Total |
|---|---|---|---|---|
| Equipment | 3,711,800,000 | - | - | 3,711,800,000 |
| Spare-Parts | 334,100,000 | - | 334,100,000 | 668,200,000 |
| Consulting Services | 124,146,000 | 46,548,000 | 49,306,000 | 220,000,000 |
| Others | 277,000,000 | | 23,000,000 | 300,000,000 |
| T o t a l | 4,447,046,000 | 46,548,000 | 406,406,000 | 4,900,000,000 |

## 6.5 Financing Program of the Project

Financing program of local currency required for the Project is stated in the foregoing section.

Financing program of foreign currency required for the Project is as follows.

(1) Budget and its Breakdown of Foreign Currency.

| | |
|---|---|
| Equipment | ¥ 3,711,800,000.- |
| Spare Parts | ¥ 668,200,000.- |
| Consulting Service | ¥ 220,000,000.- |
| Contingency | ¥ 300,000,000.- |
| T o t a l | ¥ 4,900,000,000.- |

(2) Assumed Conditions of the Loan for Foreign Currency Disbursement for the Procurement of Equipment are taken as at January 1981 which is the earliest possible date.

Amortization term and grace period are assumed as 20 years and 10 years respectively.

The yearly rate of interest is assumed to be 2.5 %.

(3) Repayment plan

Repayment is scheduled to be constant for the amortization term of 20 years.

First year of Repayment ; 1992

Constant Amount of Yearly Repayment ; ¥ 402,355,000.-

Last Year of Repayment ; 2011

# 7. EXECUTION ORGANIZATION OF THE PROJECT

## 7.1 Responsible Agency of the Project

### (1) General

As is apparent, many Ministries and local Governments are involved in the Project. Each Organization involved in the Project must fulfill their duties, and for the successfull execution of the Project it will be necessary for good coordination and cooperation to be achieved.

In this chapter the responsible agency has been studied from the view-points of road classification and existing responsible agency, equipment possessionand the execution system of Inpres for support aid to Kabupaten Road.

### (2) Road Classification and Existing Responsible Agency

In Indonesia the roads can be classified into national road, provincial road, Kabupaten road and Desa road. It is generally conceived that the national roads connect the capitals of provinces, the provincial roads, the capitals of Kabupatens and the Kabupaten roads, the capitals of Kecamatans.

There are certain procedures to decide which the roads are national and which provincial, but also it is found that in special conditions, road links which terminate at a Kabupaten can sometimes be classified as provincial roads. However the Kabupaten roads studied for the Project seem sometimes not to follow the principles noted above, namely to connect the capitals of Kecamatans.

It is supposed that this is caused by the lack of criteria for Kabupaten road throughout the country. It is found that in some Kabupatens the minor roads have been included in the Inventory survey, while in other Kabupatens even the major roads to connect Kecamatans have been omitted from the Inventory survey.

Concerning to the responsible executing agency for the improvement and maintenance of the classified roads, the general conception is shown in the table 7.1.1.

Table 7.1.1 General Conception of the Responsible Agency for Road Improvement and Maintenance Execution

| | Responsible Agency | |
|---|---|---|
| | Improvement | Maintenance |
| National Road | R.B.O.<br>D.P.U.P. | D.P.U.P. |
| Provincial Road | D.P.U.P. | D.P.U.P. |
| Kabupaten Road | D.P.U.K. | D.P.U.K. |

Note 1. Some Kabupaten Roads are being handled by the branch of DPUP at present.

It some cases, Kabupaten Roads are improved and maintained by the DPUP branch.
But it may be said that, if sufficient funds were available, DPUK would handle all the work of Kabupaten roads. In 1979 the Inpres of Support Aid for the Kabupaten Road system has been agreed within the Four Ministries concerned and the Kabupaten organization has been identified as an executing agency. It therefore seems suitable and appropriate that the DPUK is considered a responsible agency for the actual execution of the Project, on condition that the technical capability is sufficiently strengthened to ensure the successfull execution of the work.

(3) Administration and Maintenance of Equipment

The equipment to be procured for the Project under the loan of foreign assistance, will be owned by the Central Government. (Ministry of Public Works-Directorate General of Highways)

However, it is proposed to transfer the responsibility for administration and maintenance of equipment to DPUK (Public Works Kabupaten) during the execution of support works.

Some agreement would be necessary between Directorate General of Highways and DPUK to ensure that equipment is adequately maintained and returned to the owner at the end of the Project.

The number of items of heavy equipment distributed to each Kabupaten ranges from ten (10) to twenty (20), and the number of vehicles from sixteen (16) to thirty-seven (37).

However, at present the DPUK possesses from one (1) to ine (9) items of equipment at present.
It is considered that the possesssion and maintenance of equipment will be a heavy duty for the Kabupaten concerned. However the possession and maintenance of equipment should be handled by the same organization who is responsible for the actual execution .

Equipment possession and maintenance by another organization from the actual executing agency often leads to irresponsible handling of the equipment.

It is recommended that taking the above mentioned matters into consideration, the DPUK is the appropriate agency to possess and maintain the equipment. This recommendation is subject to the condition that the repair and maintenance capability of the DPUK must be sufficiently strengthened to ensure the successfull execution of the Project.

(4) Summary of the study concerning the Responsible Agency for the Project.

From the results of studies noted above and the current practice of Inpres projects stated in chapter 2, section 5, it is recommended that DPUK should be the responsible agency for the operation and maintenance of the equipment.

The Ministries and Provincial Governments are also responsible for the Project to some extent. To avoid confusion caused by the remodelling of administrative systems, it seems desirable to follow the present governmental system of Inpres of Support aid for Kabupaten roads.

Basically this is subject to the DPUK being sufficiently strengthened to enable them to execute the Project successfully.

It is important that each authority is aware of its area of responsibility for the Project. To clarify this matter, Table 7.1.2 has been prepared and it should also be noted that it is proposed that the Project Manager will work exclusively for the Road. Support Work program.

Table 7.1.2. Responsible Agencies of the Project

| Responsible Agency | | Areas of Responsibility |
|---|---|---|
| 1. CENTRAL GOVERNMENT LEVEL | | |
| Min. of Home Affairs | : | Responsible for managing the execution of support work aid for Kabupaten Roads. |
| Min. of Finance | : | Responsible for applying for aid. |
| Min. of Public Works | : | Responsible for planning and technical management of support work aid for Kabupaten Roads. |
| BAPPENAS | : | Responsible for general managing the plan of support work aid for Kabupaten Roads under scheme of National Development. |
| all Four Minitries noted above | : | to decide amount of provincial and Kabupaten aid by joint agreement. |
| 2. PROVINCIAL GOVERNMENT LEVEL | | |
| Province/Local Government Level I | : | As the head of local government level I, responsible for planning, managing, implementing, supervising, reporting and administrative discipline of support work aid for Kabupaten Roads. |
| BAPPEDA | : | to assist the Governor, Head of Province/Local Government level I. |
| D.P.U.P. | : | to assist the Governor, Head of Province/Local Government level I. |
| 3. KABUPATEN GOVERNMENT LEVEL | | |
| Kabupaten/Local Government Level II | : | As the head of local government level II, responsible for planning, managing, implementing, supervising, reporting and administrative discipline of support work aid for Kabupaten Roads. |
| Section of D.P.U.P. | : | to assist the Bupati, Head of Kabupaten/Local Government level II. |
| 4. EXECUTING LEVEL | | |
| D.P.U.K., Project Manager * | : | Responsible for planning and execution of the project, and pocessing and maintenance of equipment |

* It is proposed that the Project Manager should exclusively work for the support works (the Project). Detailed proposal will be stated in the following section 4 of this chapter.

## 7.2. Procurement Program of Equipment

The equipment proposed in Chapter 5, Section 5 , will be procured through an international bidding, utilizing the loan from the Overseas Economic Cooperation Fund of Japan.

Since there are no conditions to the said loan, the conditions and provisions of the bid should meet the requirements specified in the procurement under the OECF loan.

In order to minimize the equipment delivery period, it is proposed to specify the ports of entry ( unloading ) in Indonesia as follows:

| | |
|---|---|
| (1) Port, Pakan Baru: | Equipment for Kampar |
| (2) Port, Tanjung Pinang: | Equipment for Kepulauan Riau |
| (3) Port, Palembang: | Equipment for 4 Kabupatens in Sumatra Selatan and for 2 Kabupatens in Lampung |
| (4) Port, Surabaya: | Equipment for 2 Kabupatens in Nusa Tenggara Timur |
| (5) Port, Bitung: | Equipment for 2 Kabupatens in Sulawesi Utara |
| (6) Port, Ujung Pandang: | Equipment for 7 Kabupatens in Sulawesi Selatan and 2 Kabupatens in Sulawesi Tenggara. |

It is strongly recommended that the international bidding starts immediately after the signing of the loan agreement. It is estimated that this will take place at the end of May 1980 or at the beginning of June, in order to start the support works of the Project in April 1981.

The following schedule is tentatively proposed :

| | |
|---|---|
| Annoucement of bid | July 1980 |
| Excecution of bid | September 1980 |
| Award of contracts (bid) | October 1980 |
| Arrival of equipment in Indonesia | January - April 1981 |
| Arrival of equipment in each Kabupaten | March - August 1981 |

It is also proposed to retain a part of the foreign currency from the loan, corresponding to about half of the estimated spare parts required and to use it for the procurement of additional spare parts based on the actual performance of equipment in the first ( few ) years of the Project.

Table 7.2.1. List of Equipment in Each Port of Entry

| Equipment \ Port | Capacity | Pakan Baru | Tanjung Pinang | Palembang | Surabaya | Bitung | Ujung Pandang | Number of Equipment |
|---|---|---|---|---|---|---|---|---|
| Bulldozer | 11t | 2 | 2 | 13 | 5 | 8 | 12 | 42 |
| Motor Grader | 3.1 m | 3 | 3 | 16 | 3 | 7 | 22 | 54 |
| Tire Roller | 8.5 - 15t | 2 | 2 | 13 | 4 | 4 | 18 | 43 |
| Wheel Loader | 1 $m^3$ | 2 | 2 | 13 | 4 | 4 | 18 | 43 |
| Dump Truck | 3.5t | 15 | 19 | 120 | 34 | 43 | 139 | 370 |
| Water Tank Truck | 3,500 l | 1 | 1 | 6 | 2 | 2 | 9 | 21 |
| Portable Concrete Mixer | 0.3 $m^3$ | 1 | 1 | 6 | 2 | 2 | 9 | 21 |
| Portable Crushing Plant | 10 - 20t/h | - | 1 | - | 3 | 2 | 1 | 7 |
| Portable Crushing Plant | 20 - 30t/h | 1 | - | 6 | - | 2 | 8 | 17 |
| Portable Compressor | 7.0$m^3$/min | 1 | 1 | 6 | 3 | 4 | 9 | 24 |
| Leg Drill | 38 $\phi$ Bit | - | 1 | 4 | - | 8 | 4 | 17 |
| Hand Hammer | 30 $\phi$ Bit | 3 | 2 | 14 | 9 | 4 | 23 | 55 |
| Hydraulic Excavator | 0.4 $m^3$ w/Braker | - | - | 2 | 1 | 2 | 1 | 6 |
| Mobile Workshop | 4t | 1 | 1 | 6 | 2 | 2 | 9 | 21 |
| Fuel Tank Truck | 3,500 l | 2 | 1 | 7 | 2 | 3 | 10 | 25 |
| Service Car | | 2 | 2 | 13 | 4 | 6 | 18 | 45 |

## 7.3 Execution Procedure of the Project

### (1) Support Works by Force Account

The Support Wokrs of the Project is planned to be executed fundamentaly, by force account (administration), although the conventional support works of local roads have been, and will be, executed mostly by contractors (refer to Chapter 2 Section 5).

The Directorate General of Highways, has a basic policy on the use of force account for routine roadwork activities and rural road support works, and on the use of contractors for rehabilitation, betterment and construction of new roads. Generally speaking, how much of the works it is desirable to do in-house, by force account, rather than by contractors is affected by the nature and size of the Government organizational structure that will be required.

According to the observations of the study team, during the field trip, there are different sizes of DPUK organizational structures among the Kabupatens.

If any Kabupatens cannot carry out road support work by force account, because of weak organizational structure, it is recommended that a part of works should be carried out by the local contractors by lending them some equipment on a rental basis.

### (2) Necessity and Manner of Detailed Design

Since the estimate of construction quantity and cost used in this study report is understood to be a preliminary design, detailed designs are necessary before the execution of the support works for each Kabupaten Road.

The word "Detailed Design" of support works,for individual Kabupaten Roads is much different from the one being used for conventional civil works, such as betterment of roads.

For example, the templating of cross sections at 20 m (or 50 m) interval is not always necessary.

The most essential part of the detailed design, should be the establishment of a standard cross section, determination of the length of each standard cross section applied and the comparative study of the source of aggregate.

The following is a tentative procedure for the detailed design of each Kabupaten Road Link, excluding typical work such as leveling of existing paving, side ditching etc.

(a) Determination of the width of graveling, considering the technical standard and existing width.

(b) Determination of the necessity and thickness of earth work.

(c) Determination of the partial improvement of existing paving.

(d) Determination of the thickness of aggregate.

(e) Determination of the necessity for and thickness of shouldering.

(f) The establishment of a standard cross section, based on the result from (a) to (e), and their applicable sections.

(g) Determination of the construction volume by multiplying the area of cross section with the length of road section.

(h) Conduct a comparative study of the source of aggregate in order to minimize the cost and period of support works.

As the cost of the aggregate and transportation often reaches a half and a quarter of the total cost respectively, it is advisable to conduct a comparative study of the source of aggregate.

In the case of Manggarai, for example, at least two quarries of diluvial deposite exist, quantity and quality of which are sufficient and acceptable. A lot of quarries of boulders, both in the rivers and the mountains, also exist. Whilst the former only requires a loading cost, the latter requires an expensive cost for crushing and loading, which is often, more than Rp8,000.- per cubic meter.

On the other hand, the hauling cost of the aggregate increase almost proportionaly with the hauling distance. The average hauling cost of aggregate with 3 - 4$^{t}$ (smaller) dump trucks is about Rp 350.- per cubic meter - kilometer. Only a comparative study of the different sources of the aggregate can determine the most appropriate use.

It is also desirable to get advice and assistance, from the consultants hired for the Project, to carry out such studies and design.

(3) Bottleneck of the Main Support Work

Since the supplying capacity of the aggregate will most probably govern the speed of the main support work, it is recommended that maximum use is made of the appropriate size of river sand and gravel, diluvial deposit, bauxite, and lateritic soil of good quality.

It is recommended that the crushing plants are operated for a longer period each day.
It is more strongly recommended to increase the supplying capacity of raw material for the plants ahead of crushing process, because no portable crusher can crush cobbles bigger than 30 cm.

(4) The selective use of box and pipe culvert

In the calculation of the work volume and cost estimate in this study report, it is assumed that the pipe culverts are of an 80 cm diameter, as their prefabricated structure lessens the disturbance of traffic during construction.

However, it is also adyisable to compare a pipe culvert with box culvert under local conditions, especialy when considering the discharge capacity.

## 7.4. Administrative Organization of the Project including Training Program

### 7.4.1. General

It is recommended in Chapter 7.1. that DPUK (Public Works Kabupaten) should be the responsible agency for the job-site operation and maintenance of equipment, subject to the condition that DPUK is sufficiently strengthened to provide the required capability to execute the Project.

With the procured equipment the Local Road Support Works Project will be carried out by Force Account method in order to develop DPUK's engineering and executing abilities.

However, it also requires various improvements in organization, since the present organization and manpower is well below the standard required to meet the requirements of the Project. This deficiency would easily be seen because of the size of the project, the use of mechanized work procedures and the adoption of the force account method.
As noted in Chapter 7.1, 10-20 units of equipment and 16-37 units of vehicles are expected to be distributed to each of the 21 Kabupaten.

The impact of this number of equipment and vehicles will be extremely large, because the present DPUK's organization is as studied in Chapter 4.4., provided with an average number of total staff of 50 and the existing road section of it around 10 staff.

In this section, DPUK's administrative organization is studied on the view-points of:

- establishment of (new) road development section and Project Manager.

- its suborganizations
- number of employee
- supporting system from DPUP
- workshops, and
- training

### 7.4.2. Establishment of Road Development Section and Project Manager

First, it is recommended to establish a road development section to execute the support works.

The new section should be organized in the office of DPUK as shown in Figure 7.4.1.

The head of the road development section should be nominated as the Project Manager for the Project.

Since the Head of DPUK is involved in various works such as irrigation, existing road maintenance, house and building, planning, etc., it is recommended that the head of the section should be the Project Manager who is able to be engaged in the Project exclusive of these items.

In the nomination of a Project Manager by Bupati, it is proposed that there should be some recommendations from DPUP (Public Works Province) on behalf of the Governor of the Province concerned.

The Project Manager is required to be a very talented and reliable person if successfull execution is to be achieved.

He should be looked for at the provincial level and the head of DPUP is a most suitable person to recommend the Project Manager. This will also help to ensure DPUP's willing cooperation with the Project in the fields of technique and personnel.

Figure 7.4.1 Diagram of Administration and Budget Flow

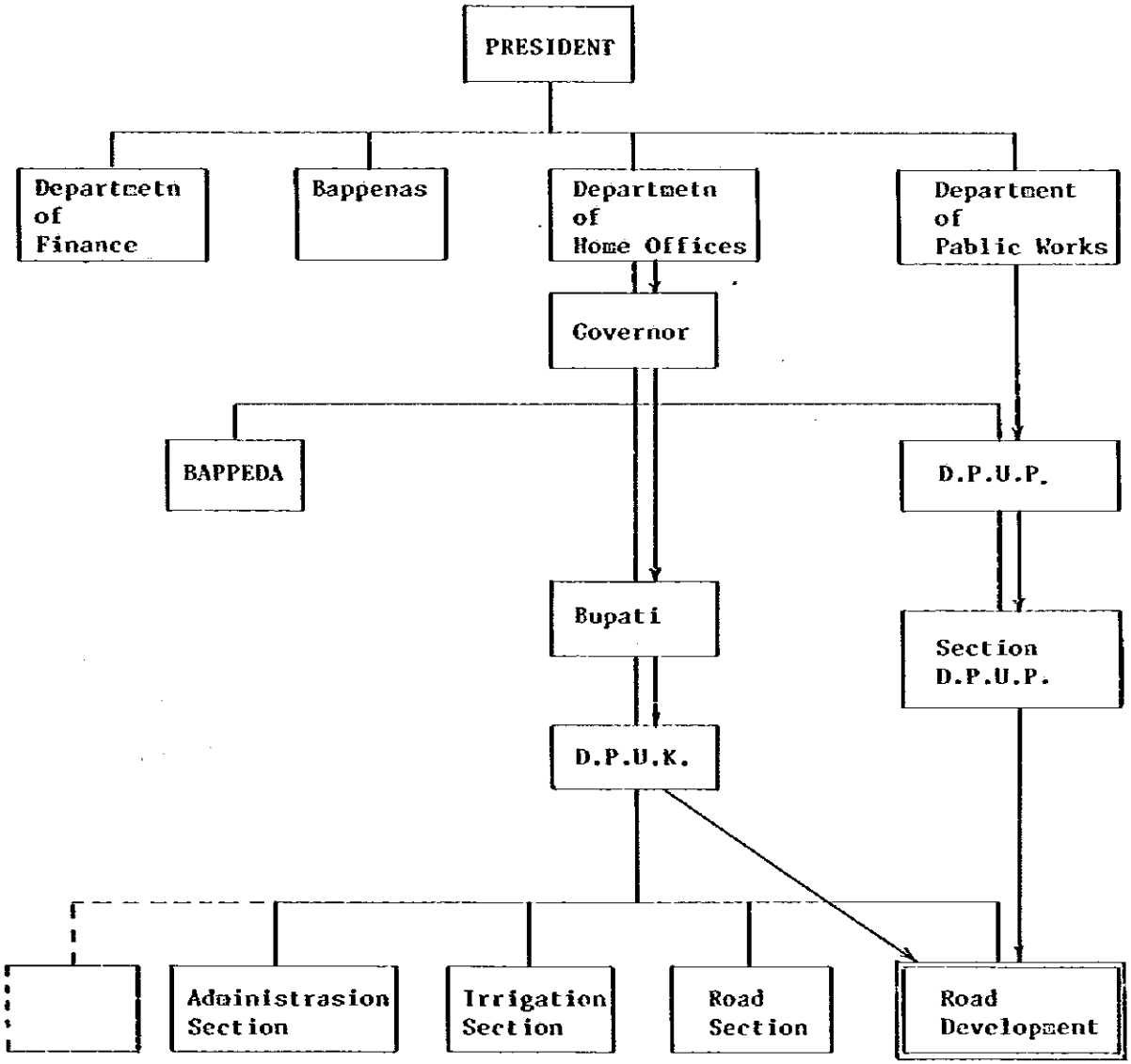


Fig. 7.4.2. Diagram of Recommend Procedure for Appointment of a Project Manager

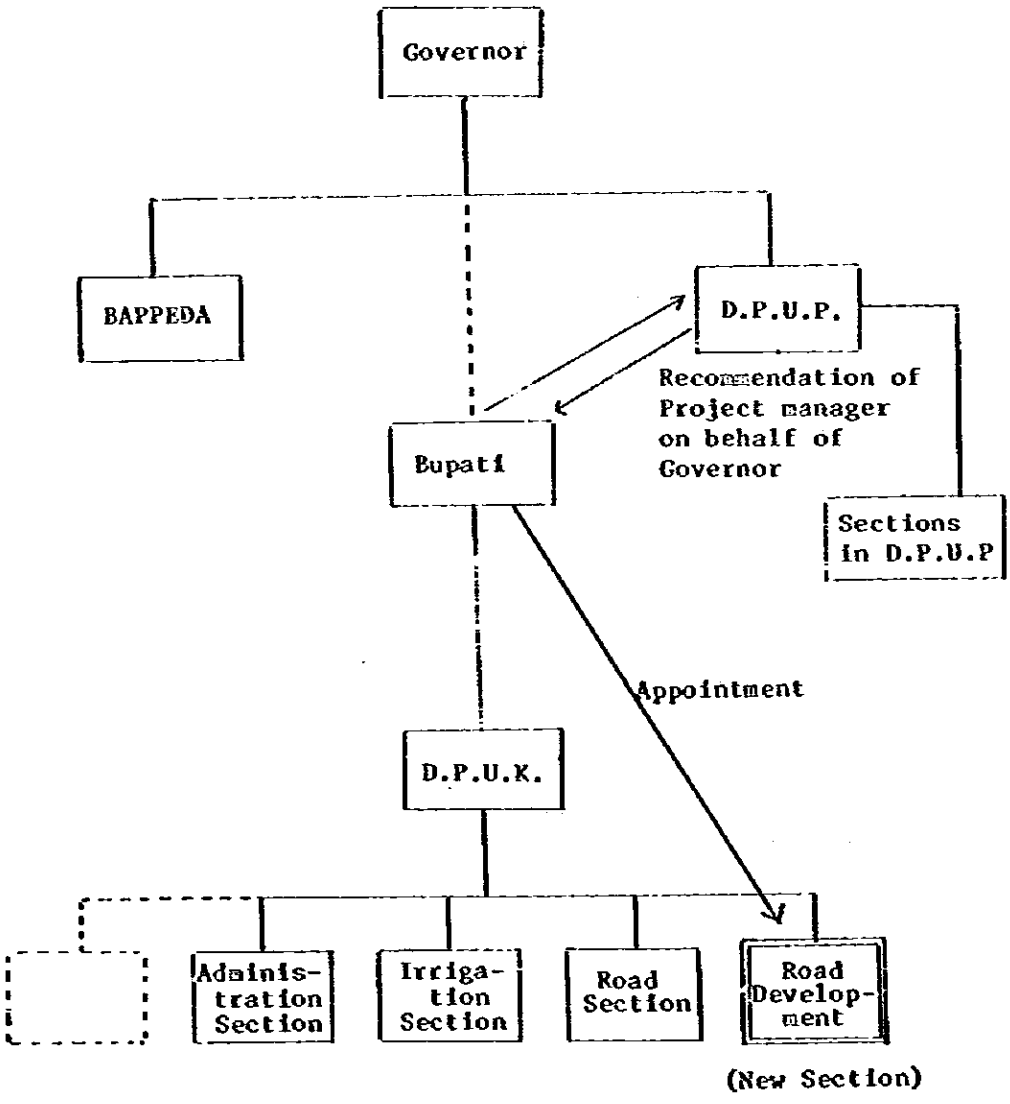


Figure 7.4.2. shows a recommended nomination procedure for the appointment of a Project Manager recommended.

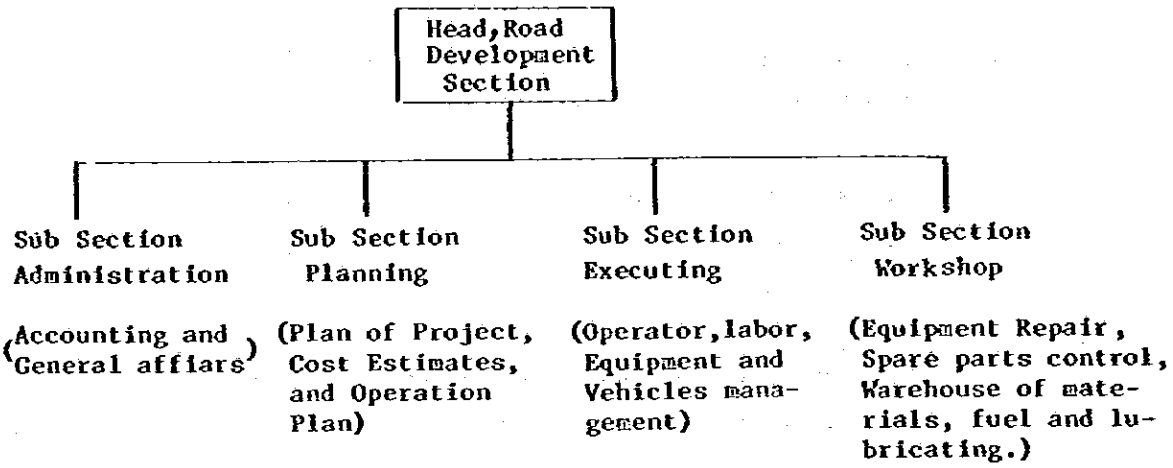
### 7.4.3. Organization and Number of Employees proposed for the New Road Development Section

It is proposed to establish one workshop, together with 3 other subsections manely, Administration, Planning and Executing.

The number of permanent and temporary employees of the new organization is proposed to be 35 - 56 and 38 - 49 respectively, as shown in Table 7.4.1.

The number of employees will therefore be between 73 and 105, including temporary ones.
In Table 7.4.1., half of the drivers are counted as permanent employees and the rest as temporary workers. All unskilled labour were counted as temporary employees.

Table 7.4.1. Organization Structure and Required Number of Employees of Proposed Road Development Section




| | Administration | Planning | Executing | Workshop | Total |
|---|---|---|---|---|---|
| Office Head | 1 | 1 | 1 | 1 | |
| Staff | 1 | 1 | 1 | 2(Storage Control)<br>2(Mechanical Repair)<br>2(Materials, Fuels, Lubrications)<br>1(Assistant Labor) | |
| Total | 2 | 2 | 2 | 8 | 15(with Head of Section) |
| Job - Site (Permanent Employee) | - | - | 2-3(Foreman)<br>10-20(Operator)<br>8-18(Driver ½) | - | - |
| Total | - | - | 20 - 41 | - | 20 - 41 |
| (Temporary Employee) | - | - | 8-19(Driver ½)<br>30 (Labor) | | |
| Total | | | 38 - 49 | | 38 - 49 |
| | | | | Grand Total | 73 - 105 |

Although, such a large number of employe is indeed necessary, but it may be more practical to start with the least number of permanent employees and increase the number in accordance with the progress of the support works. However, it is not recommended to reduce the number of operators even in the early period, as this will result in idle equipment.

A Project Manager in DPUK, will submit and receive official letters through the Head of DPUK (for example submission of Plan of Project will be conducted through the head DPUK Refer to Figure 7.4.3.)

### 7.4.4. Supporting System from DPUP

In establishing the administrative organization and in strengthening it, cooperation from DPUP is indispensable in technique and personnel. To achieve this objective instruction from DPU is desirable to motivate DPUP to cooperate to the full extent with D.P.U.K. for the execution of the Project. (Refer to Figure 7.4.3.)

### 7.4.5. Workshop

#### (1) Introduction

It is considered that mechanized operation with procured equipment will affect the basic performance of the Project. Needless to say, the adequate operation and maintenance of equipment is one of key factors to achieve the goal of the Project.

It is concluded that DPUK, should be the responsible agency for administration and maintenance of equipment together with the civil work execution of the Project.

To keep the equipment in good condition to ensure efficient operation, it is proposed that a suitable and

Fig. 7.4.3 Diagram of Submission Procedure for the Project Plan

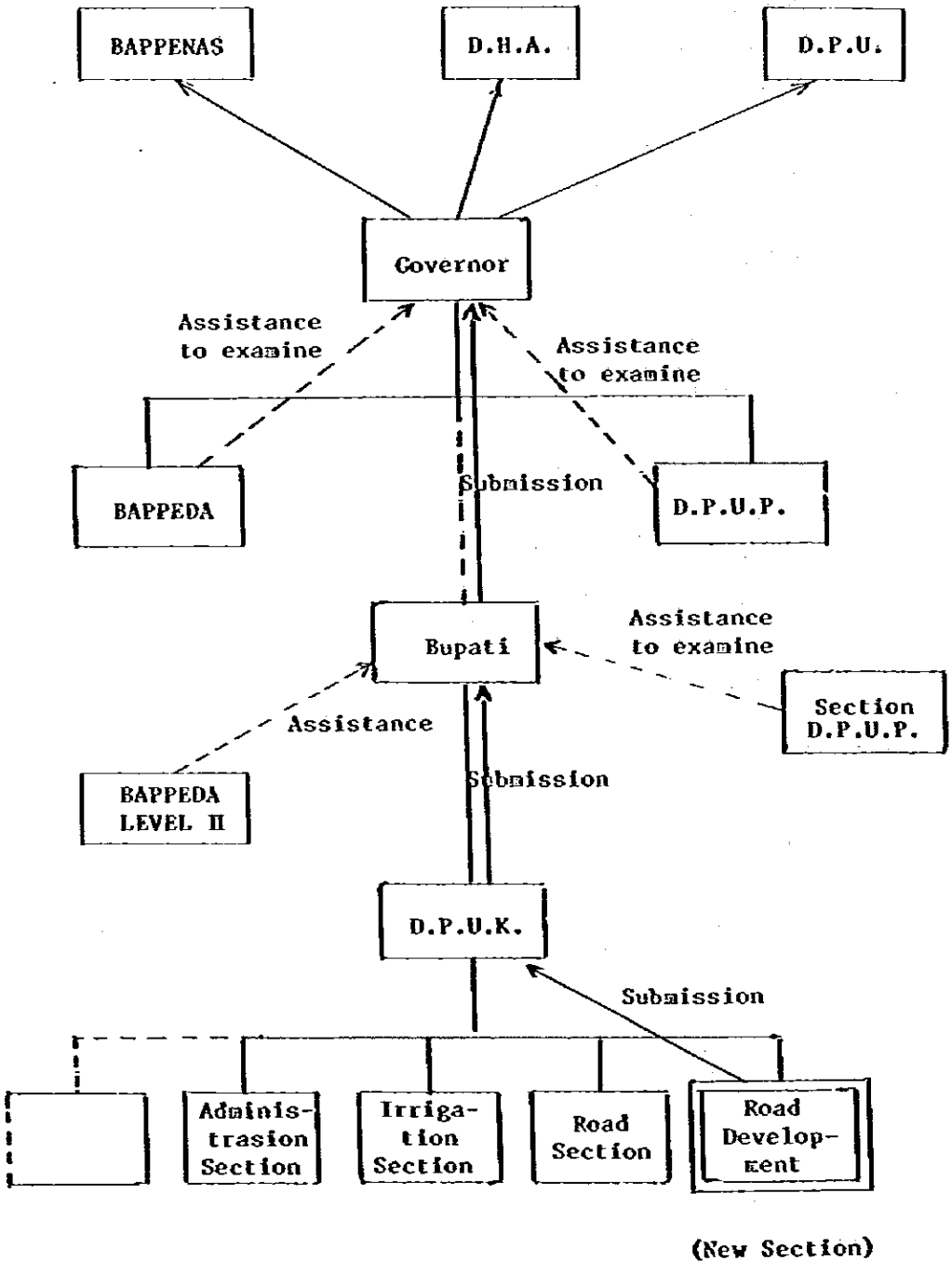
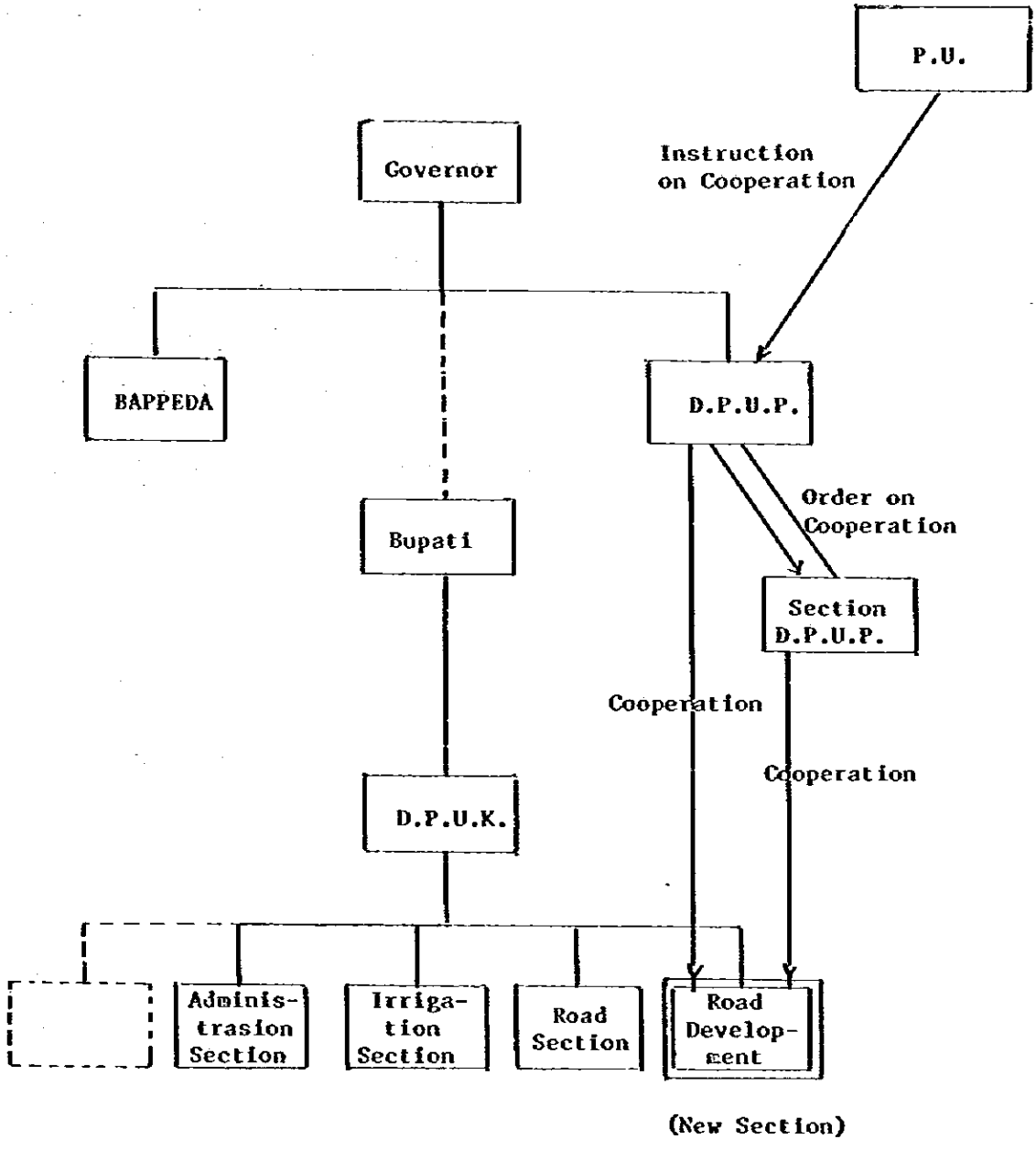


Figure 7.4.3. Diagram of Instruction on Cooperation in Technique and Personnel



duly responsible workshop will be necessary as one of subsections of the Road Development Section. It is recommended that the workshop should be supervised and controlled by the Project Manager though the organization structure as shown in Table 7.4.1.

(2) Tasks of the Workshop

At the responsible Agency for maintaining and repairing the equipment, the workshop has to meet the requirements of various types of Tasks such as lubrication, inspection, daily maintenance and minor repairs, in order to keep the equipment and vehicles in a good workable condition.

It is considered that the main tasks of the workshop are as follows.

Tasks of Workshop

1. Administration and storage of equipment

2. Maintenance and repairing of equipment

3. Purchase, management and supply of spare parts

4. Storage and service of materials, fuel, lubrication oil and so on.

(3) Planning of Workshop

a) Location

The area and building of the workshop is generally large. It will therefore require to be located outside of the quarters of the main office of DPUK.

However, it is preferable that the workshop is located at a place not far from the main office.

b) Number of Staff

According to the volume of work, the number of staff may be flexisible, but the general conception of number is as follows:

(Staff of Workshop)

| | |
|---|---|
| - Head of Workshop | 1 |
| - Spare Parts Control | 2 |
| - Mechanical Maintenance and Repairing | 2 |
| - Storage and Service of Materials, Fuel and Lubrication Oil | 2 |
| - Assistant Labor | 1 |
| Total: | 8 |

c) Area of Plot and Building

The necessary plot area of the workshop will differ according to the number of items of equipment. But from the general conception of the workshop it is proposed that the plot area is around one hectare preferably in the shape of square. It is also proposed that the building of the workshop is around 8 meters by 50 meters in size which is composed of storage section, repairing space and office.

It is necessitated that fuel storage tank and washing equipment for vehicles is facilitated inside the plot.

d) Facilities of Woskshop

To achieve a good and quick repairing service, a mobile workshop is allocated to each Kabupaten. With the mobile workshop, the necessary tools and equipment for most usual repairs is available. It is expected that the mobile workshop will be utilized both within in the static workshop and also in the field

(4) Cooperation with DPUP Workshop

The equipment maintenance and repairing capability of the DPUK at present is generally expremely poor. In this situation, the willing cooperation and support from the DPUP Workshop is required.

DPUP Workshop should cooperate in the fields not only of planning and technique, but also personnel arrangement.

DPUP Workshop's cooperation is especially needed in case DPUK is faced with:

(i) especially difficult repair work,

(ii) requirement for rarely available spare parts, and

(iii) Procurement of spare parts as a result of unexpected damage.

The DPUP Workshop should also cooperate in the training.