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MECHANISMS FOR COST RECOVERY OF MUNICIPAL INVESTMENT IN TRUNK INFRASTRUCTURE

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Prepared by
PADCO
PLANNING AND DEVELOPMENT
COLLABORATIVE INTERNATIONAL

MECHANISMS FOR COST RECOVERY OF MUNICIPAL INVESTMENT IN TRUNK INFRASTRUCTURE

PREPARED FOR:
REGIONAL HOUSING AND URBAN DEVELOPMENT OFFICE
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TUNIS, TUNISIA

prepared by:
PADCO, Inc.
1834 Jefferson Place, N.W.
Washington, DC 20036

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PREFACE

The following report has been prepared by Planning and Development Collaborative International (PADCO). Team members in charge of the study were Mr. Duane Kissick, Mr. Ernest Slingsby, Ms. Assia Kheilaf, Mr. Fathi Kraiem and Mr. Charles Pill. The authors would like to thank the many Government and Public Agency employees involved for the enthusiasm they displayed, as well as for the time they gave and the information they contributed.

ACRONYMS

AFH	Agence Foncière d'Habitation (Public Land Development Agency)
ARRU	Agence pour la Réhabilitation et la Rénovation Urbaine (Urban Upgrading and Rehabilitation Agency)
ASP	Association Syndicale de Propriétaires (Landowners' Association)
BDH	Banque de Développement d'Habitat (Housing Bank)
BIRD	Banque International pour la Reconstruction et le Développement (World Bank)
COGEDRAT	Commissariat Général au Développement Régional et à l'Aménagement du Territoire (Urban and Regional Planning Function of Ministry of Planning and Finance)
CPSCL	Caisse de Prêt et de Soutien des Collectivités Locales (Local Government Support Fund)
CUF	Coefficient d'Utilisation Foncier (Land Use Coefficient)
DPC	Direction des Ponts et Chaussées (Department of Roads, Ministry of Housing and Public Works)
DRE	Direction Régionale de l'Equipement (Regional Offices of the Ministry of Housing and Public Works)
FCCL	Fonds Commun des Collectivités Locales (Common Fund for Local Governments)
FIAT	Fonds d'Intervention pour l'Aménagement du Territoire (Special Fund for Urban Development)
ONAS	Office National d'Assainissement (National Sewerage Agency)
PAD	Plan d'Aménagement de Détail (Detailed Urban Land Use Plan)
PAU	Plan d'Aménagement Urbain (Urban Land Use Plan)
PDM	Plan de Développement Municipal (Municpal Development Plan)
PDR	Programme de Développement Rural (Rural Development Plan)

PDRI	Plan de Développement Régional Intégré (Integrated Rural Development Plan)
PDU	Plan Directeur d'Urbanisme (Urban Master Plan)
PF	Planning Familiale (Family Planning)
PIF	Périmètre d'Intervention Foncier (Delineated intervention area)
PMI	Projets Maternels et Infantiles (Maternal and Child Health Projects)
PTT	Poste, Télégraphes et Télécommunications (Post and Communications)
SNIT	Société Nationale Immobiliere de Tunisie (National Housing Agency)
SONEDE	Société Nationale d'Exploitation et de Distribution des Eaux (National Water Company)
STEG	Société Tunisienne d'Electricité et de Gaz (National Electric and Gas Company)
USAID	United States Agency for International Development
VRD	Voirie et Réseaux Divers (Road and other networks)

INTRODUCTION

A key concern of the Regional Housing and Urban Development Office and the Government of Tunisia is the exploration of innovative techniques and public/private partnerships for promoting the development of serviced residential land for low and other income groups. Fundamentally, municipal and central governments can guide urban development and promote the participation of private entrepreneurs by, among other things, planning urban development and providing trunk infrastructure and utility networks for urban expansion. Pilot projects are under consideration by the Government of Tunisia and the Regional Housing and Urban Development Office to support the objectives of this program.

In this regard, two preliminary studies were recently undertaken. The aim of the first study (task 1) was to identify the legal impediments to land assembly and development by private developers and to recommend legislative changes to simplify and clarify the procedures that govern land acquisition, registration, and development for this group. Two separate reports on this subject have been prepared and may be acquired from the Regional Housing and Urban Development Office, Tunis, Tunisia.

The second study (task 2) which is the subject of this report was designed to develop cost recovery schedules, mechanisms and procedures to facilitate the provision of infrastructure and serviced land for low cost housing.

The Tunisian Government intends to encourage municipalities to help increase the supply of serviceable land by supplementing the activities of other public service agencies in the provision of trunk infrastructure, electricity, water, sewerage, storm water drainage and access roads. For this activity to be replicable, however, mechanisms must be established to implement and recover the cost of this infrastructure from the end users and/or future developers. Proposal options for this purpose are suggested in this report. We believe that this material will be of main interest to Tunisian authorities and the Regional Housing and Urban Development Office.

Because responsibilities for the various infrastructure elements rest with public utility agencies and different levels of government, current legislative procedures and schedules for recovering each type of infrastructure were examined. Service charges by the different public utility companies were studied in order to determine to what extent "double charges" to beneficiaries might occur and to what extent existing cost recovery mechanisms might be utilized for municipal investment programs. Analysis in this regard is presented in the French version of this report.

Annex 1 provides a table presenting the institutional and legal framework for the different institutions involved in urban development.

Annex 2 presents a hypothetical example as to how costs may be allocated and recovered in a joint public/private development area.

FUNCTIONAL FRAMEWORK AND PROPOSED MECHANISMS FOR MUNICIPAL INVESTMENT RECOVERY IN TRUNK INFRASTRUCTURE

A. FUNCTIONAL FRAMEWORK AND COST RECOVERY METHOD

1. Possible Functional Frameworks

According to the premises of this study, municipalities will be playing a major role in land development operations. They will undertake such work in areas earmarked for urban expansion according to their master plan for urban development (Plan d'aménagement urbain, or PAU).

If a concerted development effort is to be effective:

- the partners concerned in the area's development must be clearly identified.
- the functional relationship among the different partners at successive stages of the development process must be understood.

Knowledge of land ownership status within the zone is also essential to project organization. The land may be publicly or privately owned, or, more frequently, divided between the two types of ownership.

The latter case will be considered, as it allows for the full range of likely participants:

- Municipalities,
- Public developers,
- Private developers, whether or not they are landowners, and
- Landowners adjacent to the improvements.

Because of the characteristics of land ownership in each project, a functional arrangement based on the three following options will be proposed:

- The municipality undertakes the project on municipal land.
- The municipality undertakes the project on privately-owned property through the creation of landowners' associations.
- The municipality undertakes the project on privately-owned land by defining a zone of intervention and issues a decree indicating that the works to be completed within it are in the public interest.

a. The Municipal Subdivision Project

When the municipality owns the land, it will act like any other developer. Within the approved PAU framework, the municipality defines the priority intervention zone, completes the surveys needed for subdivision, and submits the project to the Municipal Council before presenting it to the Regional Commission for Subdivisions (Commission régionale des lotissements).

Finally, before entrusting work to the contractors, the municipality establishes agreements with the public utilities (ONAS, SONEDE and STEG)

for engineering specifications concerning technical studies, supervision, and conditions for "reception" of these improvements by the municipalities.

b. **The Landowners' Association (Association syndicale de propriétaires--ASP)** Article 48 of the Code de l'urbanisme (Urban Development Code) stipulates that ASPs may be constituted either at the municipality's initiative or by the landowners themselves in order to undertake site development projects in a given area. The procedure is roughly as follows:

- When the priority development zone has been designated within the approved PAU, the municipality establishes a perimeter defining it and a proposal for the creation of an ASP, which is made public. The landowners in the areas enclosed by the perimeter are called to a general constitutive assembly, which designates an association committee comprised of 4 to 8 members, whose responsibility is to represent the association. The compliance of a majority of landowners, representing at least half the land area, is needed.

Under the municipality's control, the association committee has the city's engineering department prepare the plans for development, discusses them and determines implementation.

In the case of land consolidation, the program is confirmed by a decree from the Ministry in charge of urban development. Reimbursement is made through the exchange of lots of equivalent value. The exchange is registered with the land conservation authority.

- When land consolidation is needed in order to proceed with the development project, and it is impossible to constitute an ASP, the municipality may impose consolidation through land exchange on the basis of professional advice.

This course of action thus allows the municipality to substitute itself for the landowners in order to implement the most appropriate form of land development.

The ASP formula has rarely been used since the body of law regulating urban development was adopted in 1979, and it does not seem to be entirely appropriate to the Tunisian context. It could, however, be used if deemed appropriate.

c. **The "Land Intervention Zone" (Périmètre d'intervention foncière--PIF)** Article 32 of the Urban Development Code allows municipalities to define "zones of land intervention." Within these zones, the municipalities may implement site development programs according to the PAU or master plan.

In this case, the municipality establishes a detailed development plan (Plan d'aménagement de détail, PAD), which is approved by the Municipal Council before being submitted for joint approval by the Ministry of the Interior and the Ministry in charge of urban development.

The decree establishing their approval includes the declaration that the work is in the public interest (d'utilité publique).

From then on, the municipality can declare the site development works to be in the public interest. It can then determine the rates and the manner in which the landowner beneficiaries will contribute to the costs of the project.

The Zone of Intervention approach, because of the flexibility it allows municipalities, from control of land ownership to recovery of project costs, seems to be the most appropriate for the types of pilot projects desired.

One should note that municipal involvement in land development does not eliminate the participation of private or public developers in these programs. In fact, it appears that their involvement will be necessary if the programs are to be financially feasible.

2. **Level of Municipal Intervention**

It is anticipated that municipalities will be responsible for "trunk infrastructure" in the zones to be developed. Fundamentally, the towns will bring infrastructure to project sites in order to allow subdivisions to develop. It is assumed that city-wide primary infrastructure such as a new water treatment plant will not be needed to make the project feasible. Rather, primary or secondary distribution networks or roads would be constructed to connect the project with existing city-wide trunk services.

Municipal intervention must therefore include:

a. For electricity, medium voltage power distribution networks, transformers from medium to low voltage power, and low voltage power distribution networks. (Part of the low voltage power distribution networks, and branch circuits, will be installed when subdivision takes place).

b. For water, according to the circumstances, a reservoir and main distribution networks (diameter 150-1000 mm), an urban grid (diameter 150 mm), as well as part of a secondary distribution network within an urban grid.

c. For sewage, collection and distribution networks: main collectors (diameter 300-400 mm) and networks on a neighborhood scale (diameter 200-300 mm).

d. For roads, municipal neighborhood or urban roads.

In general, infrastructure works are carried out by public service agencies: (ONAS for sewage, STEG for electrical power, SONEDE for water, Department of Roads or the municipality itself). Their financing derives almost exclusively from these agencies. Generally, only tertiary networks and branch connections are directly recovered from beneficiaries.

Usually, part of public service agency investment is financed through government subsidies (or national taxes). The rest of the financing comes from the agency's own funds, including beneficiary participation through some sort of tariff (consumption) charges. The study's analysis has shown, however, that cost recovery through beneficiaries is negligible; the rates generally only cover operating costs--and they do not generate any surplus.

Thus, two categories of costs to be recovered may be considered: those which are recovered directly from beneficiaries; and those financed by the State or by the agency's own funds.

In order to be equitable, proposals for municipal cost recovery should be as close as possible to the existing cost recovery arrangements. For example, municipalities will rarely intervene in tertiary networks. The costs of these networks should be financed and recovered as they normally are by the public utilities (e.g., water, electricity).

B. FINANCING ALTERNATIVES AND INSTRUMENTS FOR COST RECOVERY

1. Fixing Cost Recovery Rates

Local authorities can use different instruments for cost recovery: (i) indirect payments, raised by local revenues: a tax may be raised in exchange for provision of a service; or (ii) direct payments, in the form of rates or fees, collected directly from the beneficiary for the service provided.

The appropriate cost recovery method will depend on two factors: (i) the possibility of identifying direct beneficiaries, and (ii) the possibility of individualizing expenditure as well as receipts.

a. When beneficiaries of the service can be identified, individual improvement costs may be attributed to them. Direct recovery is achieved when lots are sold in subdivisions, or upon sale of infrastructure "access rights" to subdividers.

   When beneficiaries cannot be individually identified, that is, when the service provided benefits a much larger group, the cost of the operation could be imputed to the local authority as a whole. Indirect cost recovery can be achieved at the municipal level, by local taxation, or at the national level, by national taxation. Redistribution of these funds and cost recovery are achieved by the State or the municipality for the benefit of the agencies responsible for implementing the various types of infrastructure.

   This explains why in the case of ONAS, a distinction is made between the "main" networks and the "collection and distribution" networks. The first are public networks, financed by national taxes; the networks, or private networks, benefitting smaller groups are theoretically financed by beneficiaries. Our analysis suggests, however, that in practice, particularly for ONAS, important subsidies may still be granted at this level.

b. Problems relating to the possibility of identifying correct expenditure and receipts stem from the accounting system used by the agency responsible for the service provided. When local authorities are involved, their accounting systems are based on principles of public accounting and budgetary unity; as a result, a given receipt cannot be attributed to a given expenditure. Receipts sink into the mass of non-attributed resources which constitute the general account. Also, within this type of accounting system, it is difficult to precisely identify the costs of each operation implemented by the local authority. Such a system is justified by the primary role that municipalities are intended to fulfill, which is the production of "public services." When private services are involved, and costs should be identified and recovered from specific beneficiaries, services and accounting should be managed in a more or less autonomous manner.

In fact, different types of service management can be chosen by local authorities (direct or indirect autonomous agencies, concessions, etc.). Autonomous municipal agencies which are public bodies, emanating from the local authority, are granted: (i) status as independent entities, (ii) autonomous administration and management, and (iii) a separate budget with the possibility of developing an analytical accounting system.

This provides a frame of reference for the choice of cost recovery type that municipalities could adopt. It should be further noted that the aim is to stay as close as possible to national objectives as far as fairness and social justice are concerned. The methods proposed will avoid solutions that present difficulties in recovery (and high recovery costs), while taking into account the affordability of these services.

2. Financing Alternatives

In the development of secondary or trunk infrastructure, direct cost recovery can be considered by identifying the beneficiaries as a group, rather than allocating the costs on a consumption basis.

However, having beneficiaries pay the total costs involved may cause equity problems. According to our analysis, the greater part of most infrastructure investments are financed by the central budget, in the form of subsidies.

Existing cost recovery models by national infrastructure agencies suggest four possible financing modes:

a. Endowment by the State, in the form of allocated credits (specifically linked to site development expenditure), through either the Ministry concerned or the infrastructure agencies. In this case, recovery of investments from beneficiaries will only concern secondary and tertiary investment, for example.

b. Compensation through a transfer of funds, from infrastructure agencies to municipalities for the investments undertaken in their sector. This solution seems somewhat unlikely as the agencies cannot divert part of their investment resources for non-programmed operations. As their financial capacity for investment is limited, they keep to their investment plans. Only STEG would have the capacity to intervene and finance an extension of networks on requests that were not previously programmed (insofar as it judges the project to be economically expedient).

c. Financing from the municipality's own funds. The municipality can in fact finance part of the infrastructure investments with its own funds, as in certain cases of upgrading projects completed with ARRU participation. This would require the municipality to have sufficient fiscal resources, and to achieve this, a good level of revenue from its rental value tax. The fairness of this solution is questionable, because it will involve financing services for which beneficiaries can be identified, and whose costs will be paid for by the entire community. Furthermore, these services are financed in part by State subsidies, and thus by national taxes. Financing from municipal funds would impose a double payment on the local population, first on the national, then on the municipal level. Despite the equity issue, this solution is certainly interesting, because it may make urban services affordable to people of moderate income.

d. Recovery of total cost from beneficiaries. This solution is probably the most feasible, despite the disadvantage of being inequitable. It may also raise the problem of affordability to the population targeted by this type of project, specifically low-income groups.

Although our cost recovery framework, up till now, has been based on models for national agencies, other examples of infrastructure cost recovery for projects undertaken by ARRU, AFH, SNIT, or private developers also exist. In most cases, the networks, including off-site infrastructure, are chargeable to beneficiaries in their entirety. Only in certain cases of social housing undertaken by ARRU have the municipality and national infrastructure agencies assumed part of the financing. In those cases, negotiations took place among the partners for infrastructure development (the infrastructure agency, the beneficiary and the municipality) in order to determine each partner's financial participation.

It should finally be noted that financing for infrastructure could come from a special municipal fund for financing trunk infrastructure. Its main aim would be to provide bridging finance for municipalities.

The fund, for example, might be established through a HG loan from USAID and would assess a financially viable recovery rate on investments to be recovered from the pilot projects.

The resources needed to maintain the fund would come from a flat fee on a per plot basis in the zone of intervention, which could be paid when cost recovery occurs.

The bridging finance would be used to finance the cost of infrastructure outside the subdivision. The developer would be responsible for recovering his portion of the costs from plots within his project.

Similarly, the municipality would recover its share of the costs from other beneficiaries in the adjacent development or impact zone. Presumably, the municipality would recover costs at the time that building permits or subdivision permits are granted. It is anticipated that these charges include debt servicing costs and should be indexed to cover inflation.[1]

Since the purpose of the proposed fund is to finance infrastructure which, in turn, will encourage (housing) development, the loans would be treated as bridging finance rather than long or medium term loans. On the basis of preliminary analysis, if the municipal investment project is to be feasible, development in the zone of intervention should occur within a five year period. If this is unlikely, the project should probably be postponed since scarce infrastructure development funds should be used in locations where the benefits will be realized with the least amount of delay.

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[1]This form of financing was developed in Corpus Christi, Texas, to finance water and sewer lines when voters refused to approve new tax measures. See League of Cities, Financing Infrastructure: What Works at the Local Level, December 1987.

In this particular case, the following is assumed:

a. Credits for financing would come from a fund for the financing of trunk infrastructure. This would involve bridging finance over a five-year term.

b. Financing by the infrastructure agency as well as by state subsidy should only occur in exceptional cases.

c. Municipalities should have the opportunity to finance the part of the operation they consider affordable.

d. Beneficiary payments will provide the greater part of cost recovery. The cost to be recovered will thus be the total cost of the project, with adjustments for possible state subsidies, transfers from the national agencies, and financing from the municipality.

3. Instruments for Cost Recovery

Three methods for cost recovery are proposed:

- direct recovery through the sale of developed lots,
- recovery through a betterment fee chargeable to landowners adjacent to the improvement,
- recovery through the application of a development ("aménagement") tax.

The first two methods can be applied immediately within the existing legal framework. The third proposal, which calls for the creation of a new tax, would require a change in legislation and could be operational only in the medium term.

a. Direct Recovery through the Sale of Lots
If it owns the land, the municipality can recover the expenditure (including off-site infrastructure) from purchasers when lots are sold. This is how other subdividers, including AFH or SNIT, proceed.

b. Recovery through a Betterment Fee
The first law calling for contributions by landowners adjacent to public improvements (premier établissement) dates from January 31, 1887. This law, which has been amended several times, is still in effect and in practice today.

Statutes are commonly created which use this law as a frame of reference to declare certain works "in the public interest." These generally fix conditions and methods of collection from landowners adjacent to the improvements.

The municipalities should make use of this flexible provision for cost recovery to correspond with specific project conditions (improvement type, target population, recovery rate, etc.).

On the basis of Article 132 of the Municipal Law (Loi organique des communes), it is possible to determine by decree the conditions and payment schedule to be met by adjacent landowners for each type of improvement.

Since each site development project could be the object of such a decree, the conditions of cost recovery will vary according to the specific costs incurred by the municipality for each operation.

In this way, the period allowed for reimbursement will not exceed the time of municipal debt amortization for the project under consideration, and the interest rate may be equal or superior to the rate of the loan.

The municipality could also adopt a procedure similar to STEG's and SONEDE's phasing payment over five years at the commercial interest rate.

A model decree for "improvement in the public interest" or betterment levy is presented in the French version of this report.

c. Creation of a Development Tax

This would involve the creation of a new tax, and would require some legislative changes. Authorities have been seriously considering such a tax and its establishment seems likely, but only in the medium term.

Based on information from the authorities concerned and on experience in other countries, it is possible to draw a general outline of its characteristics.

Conditions for Recovery

Recovery can take place in two ways:

- The tax is due from the developer on delivery of the subdividsion permit; the subdivider will later collect a corresponding amount from beneficiaries purchasing lots.
- The tax is collected directly from beneficiaries (in the zone of intervention) when building permits are delivered; those who have already paid the corresponding amount to the subdivider would of course be exempted.

Payment Schedule for the Tax

The tax may be collected in full (in a single payment), or else in several installments. Full payment from a single deposit is preferable for the municipality, because that would eliminate cash flow problems (a large revolving fund, wide fluctuations in cash positions, etc.)

However, adjacent beneficiaries and subdividers may not always be able to pay the tax in a lump sum, given there are no existing loan formulas for purchasing land. Municipalities may, therefore, have to institute installment payment schedules.

For example, depending on the amount involved, three installment payments of equal value could be made:

- 1st installment: due on delivery of the subdivision permit or the building permit, depending on the case;
- 2nd installment: due within two years dating from delivery of the subdivision permit or the building permit;

- 3rd installment: due within 3 years dating from delivery of the building permit.

C. COST RECOVERY MECHANISMS

1. Basic Prinicples

The basic principle for recovering the costs of the proposed trunk infrastructure is that those who benefit the most from the services should pay the most. Although it would be desirable to capture part of the added property value caused by the infrastructure investment, this may not be feasible given the present state of cadastral and property tax systems.

The cost recovery methods proposed later in this note are based on consumption related measures which take into account increased benefits but are tied to known engineering parameters which would be required to design the infrastructure projects.

Consumption or demand related cost recovery mechanisms are relatively equitable. Lower income groups tend to consume less services on a per capita or per household basis than middle and upper income groups. Thus, they should pay proportionately less for those services than upper income groups. This principle has long been recognized in the design of tariff policies for water supply and electricity.

2. Defining the Zone of Intervention

Construction of trunk infrastructure to a developer's project site will open up an area for development which is being referred to as the "zone of intervention" or impact zone. Frequently in the past, if the developer's site was not within the area of utilities' development plans, the developer was required to finance the entire costs of the off-site infrastructure. This resulted in a development pattern which was both inequitable and inefficient.

It was inequitable because the developer passed the entire costs of off-site infrastructure onto his project beneficiaries. In addition, plots which were developed along the off-site infrastructure received access to services without paying for it. It is also likely that the original infrastructure was not designed to accommodate the population in the impact zone.

Thus, when a developer proposes a project, a "zone of intervention" should be defined comprising the adjacent properties which can be expected to benefit from provision of the off-site infrastructure. Establishing this zone is permitted under Tunisian law (Article 32 of the Urban Code).

Several techniques exist for defining the zone. In Colombia, zones of influence are defined in a more or less rudimentary fashion by drawing a 500 meter circle around the project.[2] However, this may represent an overstatement of benefits, particularly for road infrastructure.

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[2]See Doeble, Grimes, and Linn, "Participation of Beneficiaries in Financing Urban Services: Valorization Charges in Bogota, Colombia," in Land Economics, vol. 55, #1, February 1979.

Evidence from other countries suggests that the benefits from off-site infrastructure may diminish much faster than is described in the Colombian experience. For example, in Bangkok, it has been found that property values drop 30 percent at distances of about 40 meters from major and secondary roads.[3] In the United States, several transit studies have shown that property values around major road or transport facilities soared in value if they were adjacent to the facility, but that values tended to drop significantly as the distance from the facility increased.

Although no fixed rules can be offered to define the zone of intervention in Tunisia, several rules of thumb might be used:

a. If no access to the service is being provided, it is unlikely that benefits will emerge. For example, if the pattern of development around a road is such that properties in back of the properties fronting on the road have no access to it, those properties will probably not receive much benefit from the road. Thus, the zone of intervention should be defined to cover only those properties fronting onto the road.

b. Engineering practice and the existence of excess capacity may define the extent to which services can be provided and thus the zone of intervention. If it is standard engineering practice to provide secondary networks off of trunk infrastructure at relatively fixed intervals because providing larger intervals would result in lines which are either technically infeasible or excessively costly, then these intervals define a zone of influence. For example, the zone of influence around a water line could well be defined by the length of tertiary lines (or number of households) which can connect efficiently to the line.

   If the combination of the project and the zone of intervention require a major expansion of trunk infrastructure such as a new water treatment plant or sewerage plant, then the scope of the works is greatly expanded beyond the nature of projects envisioned under this loan fund. In such a case, the project should be developed within the framework of the infrastructure agency's development plan.

c. If the project is defined solely on the basis of benefits, then the zone of intervention should be defined as those properties which have direct access to the off-site infrastructure. If a property requires additional investment to give it access (such as another primary road or secondary sewer line), then it should be excluded from the zone of intervention.

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[3]See PADCO, Bangkok Land Management Study for the National Housing Authority and the Asian Development Bank, 1987. It should be noted that properties surrounded by development, but with no access to roads, had property values which were a fraction of values encountered on roads.

3. Recovery Based on the Consumption of Services

a. Recovery of Water, Sewerage, Electricity, and Solid Waste

Essentially piped water supply, sanitary sewerage, electricity and solid waste removal provide tangible services or products upon which cost recovery can be based. The design of off-site infrastructure (and on-site infrastructure) for these services is based on estimates of the total consumption of these services. For example, sewerage mains are sized according to the number of users connected to the system and estimates of waste water flows. These estimates are absolutely essential to design and build the services.

These same estimates of consumption (actually demand) can be used as a mechanism for determining cost recovery of capital investment as well. Plots which have large numbers of users, or are expected to consume greater quantities of services would pay a greater share of off-site infrastructure costs than smaller consumers of the services.

The procedure for determining cost recovery is to first group plots according to estimated consumption of services. For the zone of intervention this would be based on the planned nature of development. These data should be available from planning studies conducted during engineering design. For example, all plots containing households expected to consume less than 100 liters per capita per day could form the group with lowest consumption characteristics. The next group might consume between 101 and 200 liters per capita per day, etc.

Then the total estimated consumption for each group should be determined by multiplying the number of plots in each group times the group's consumption. Then these group totals should be summed to determine the total consumption for the entire zone. Finally a coefficient can be determined by comparing each plot group's expected consumption to the total. This factor would then be multiplied times the total costs of the services to find the amount of the costs which should be recovered from each group of consumers. Recovery from individual plots would then be determined by dividing the total amount to be recovered from each consumption group by the number of households (or plots) in the group.

Although water supply was used in the example just discussed, the procedure for sanitary sewerage and electricity is exactly the same. In fact in most cases, the same groups developed for recovery of water supply can be used for recovery of sanitary sewerage since the quantity of water flowing into sewerage systems is directly related to water consumption. The only adjustment which might be made is to exclude plots which are not (and will not be) connected to the sewerage system.

b. Recovery of Surface Drainage Costs

A somewhat different approach to recovering the costs of surface drainage is needed if plots are to be allocated costs on the basis of those benefitting most from the service provided. The quantity of water flowing into a surface water drainage system is the result of rainfall patterns (an exogenous factor and therefore not considered), plot size and plot development patterns.

The first factor, plot size, determines the total area to be covered by a drainage system: the greater the area, the longer a drainage network is needed. But size alone is not the only factor which affects the design of drainage systems, plot development or the percent of the plot which is paved or built-upon is equally important. A plot with large green areas will absorb a large share of the rainwater falling on it resulting in less water flowing into the drainage system. Conversely almost all rainwater falling on a plot which is entirely paved or built-upon will flow into drainage system resulting in a greater requirement for drainage. This well known engineering principle can serve as the basis of cost recovery for the drainage system.[4] The steps involved are:

- Divide plots into groups according to size categories. For example, all plots with areas less than 100 square meters might be classified as group A, plots with areas 101 to 200 group B, etc. Each group should be assigned an area size factor (ASF) which increases with plot size: i.e., Group A would be assigned 1.0, Group B 2.0, etc.

- Assign each plot a runoff coefficient factor (RCF) based on the type of development on the plot. These coefficients can be obtained from well known engineering practices. For example, park areas have a coefficient of 0.05, residential areas which green areas of covering half of the plot roughly 0.50 and plots which are entirely built-up have coefficients of 0.95.

Next determine each plot's share of cost recovery by multiplying the total costs of the drainage system times the runoff coefficient times the plot's group size factor. The equation for determining cost recovery would be:

$$C_i = (C / N) \times ASF_i \times RCF_i ,$$

where:

C_i = The cost recovery from plot i
C = Total costs of the drainage system
N = The number of plots in the zone of intervention
ASF_i = The Area Size Factor of plot i
RCF_i = The Runoff Coefficient Factor of plot i

Application of this procedure will result in larger plots being charged more for the drainage system. If the zone of influence includes high density low income households, the costs to these groups can be reduced by assigning a low ASF to the group thereby counter-balancing the effects of the likely higher RCF.

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[4]This procedure was first used in Cincinnati, Ohio, to renovate drainage systems.

c. Recovery of Off-site Road Networks

The benefits of primary and secondary road networks flow in two directions: first, the occupants of the area where the roads are being built receive access to other areas; and second, the roads provide access to these areas from the rest of the city. Unfortunately, determining the direction of these benefits is both complicated and controversial.

We recommend using a cost recovery procedure that is much simpler and easier to administer and is based on known studies of the impacts which road networks have on property values.

The procedure we recommend is first that all tertiary road networks be recovered on the basis of plot frontage on roads, since these roads are almost exclusively used to provide direct plot access.

The recovery of primary and secondary road costs, however, should be based on the principles of usage and expected benefits from the road. It is well known that property values fronting on major roads increase more rapidly than those more distant from the roads.[5] This condition results from the increased economic activities of these properties due to their location on roads.

The first step in the procedure is to establish broad zones of properties fronting on each side of the major road. The depth of these zones should be the average depth of plots. If the plots are too irregular to permit use of an average depth, an arbitrary depth should be established, possibly ranging from between 30 to 50 meters. This zone will represent plots which will receive maximum benefits from the improvement.

In a similar fashion, successive zones of property should be established each more or less equidistant from the major road until the boundaries of the zone of intervention are reached.

When these zones of property are defined, benefit factors representing relative difference in benefits (property values and access) should be established for each. These factors should be weighted to take account of the fact that direct benefits decrease with distance from the road. In our illustration, Zone A, in which properties are located directly on the primary road, is assumed to have a 30 percent higher relative benefit than Zone B. Similarly, the factor for Zone B is higher than Zone C.

Within a zone, further distinction among relative benefits of the road could be achieved by weighting properties according to their frontage on the road.

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[5]The study conducted by PADCO of land values during PADCO's Bangkok Land Management Study clearly demonstrated this factor. Properties directly fronting on major roads had property values roughly 30 percent higher than similar properties just 40 meters away from these roads. Similarly, properties on secondary roads had values roughly 30 percent higher than properties 40 meters away, while values of properties with no road access were 45 percent lower than those of properties 40 meters from secondary roads.

In the example shown, we have not done so because this is a fairly detailed exercise beyond the intent of the illustration.

If information about likely vehicle ownership per household or plot is available, this can be used to further allocate benefits further among different project beneficiaries. In the example, we have assumed that one in four households is likely to have a vehicle. This average vehicle intensity was first used to allocate the costs of primary roads between the developer's project and the municipality.

To recover the municipality's investment from properties in the zone of intervention, we then made different assumptions about vehicle intensity. For example, it is likely that vehicle intensity will be higher in Zone A. It has greater commercial potential since its plots front directly on the primary road. These plots may attract vehicles from the city as a whole and thus would receive a higher benefit from the road.

As part of this exercise, a model was developed for recovering costs of major road investment as is shown in Annex 2, Table 2. Parts I and II present sample data in the developer's proposed development area as well as data for the zone of intervention. Part III concerns the off-site road costs and part IV concerns the cost recovery options for each area. Part V presents the distribution of costs to be recovered based on area and vehicle intensity.

ANNEX I

SYNOPTIC TABLE: INSTITUTIONAL AND LEGAL CONTEXT OF URBAN DEVELOPMENT

ITEM	INSTRUMENTS	LEGAL REFERENCES	PARTICIPANTS	COMMENTS
1. Urban Planning				
1.1 Spatial Organization				
-Master Plans	Regional Urban Plan for Urban Development (PDU)	Decree No. 80-732 dated 5/28/80	COGEDRAT--District of Tunis	
-Land Use Plans	Master and Detailed Land Use Plans (PAU and PAD)	Decrees No. 80-733 and 80-734 dated 5/28/80	Municipalities -- COGEDRAT District--Land Agencies--ARRU (for the PAD)	
- Infrastructure Plans				
Roads	Organizational Chart		Department of Roads and Bridges of the Ministry of Public Works	
Sewage	Infrastructure Plan	Law No. 74-73 dated 8/3/74 creating ONAS	ONAS	
Drinking Water	Infrastructure Plan for Water	Law No. 68-22 dated 7/2/68 creating SONEDE	SONEDE	
Electricity	Organizational Chart	Decree Law No. 62-8 dated 4/3/61 creating STEG	STEG	
1.2 Site Development Operations				
- Land Use Supervision	Pre-emption	Law No. 73-21 dated 4/14/73 Article 34 of Urban Development Laws Articles 31 to 34 of Urban Development Laws	Lend Agencies--ARRU-Municipalities State--Municipalities--Land Agencies --ARRU	Length of time: 4 yrs.; may be prolonged 2 yrs.
- Subdivisions	Zone of Intervention (PIF) Subdivision documents	Decree No. 81-1817 dated 12/22/86	Municipalities--public/private subdividers	
- Project Facilities				
State Facilities	National Plan--State budget		Ministerial department concerned	
Public Agencies Facilities	Investment programs/budget			
Municipal Facilities	Municipal development plan/budget		Government agencies concered Municipalities--Interior Ministry	PDM are inoperative
2. Project Implementation				
2.1 Land Acquisition				
- Financing	State Endowment, FIAT	FIAT: Articles 62 and 63 of Urban Development Laws	Land Agencies, ARRU, State, Municipalities	Finance Law for FIAT to vote on.
- Implementation	-Expropriation	Law No. 76-85 dated 8/11/76	State Municipalities--Governorates Municipalities	Government agencies.
	-Inclusion in Public Property.	Article 39 of Urban Development Laws	State, Governorates--Municipalities	
- Recovery	-Sales of lots	Article 35 of Urban Development Laws	Municipalities, Governorates Government Agencies, Land Agencies, ARRU	Fixed settlement Lot attribution criteria
2.2 Primary Infrastructure				
a. Roads	State Property for Roads	Law No. 86-17 dated 3/7/86	Roads and Bridges Department (DPC) or credit attribution to agencies ARRU, AFH	Classification of roads by decree or statute.
- Financing	State budget, International aid			Allocation of credits to municipalities possible in theory.
- Implementation			Public or private contractor under DPC control.	The municipality can implement under DPC control.
- Recovery	National Taxes		State--citizen.	
- Maintenance/Usage	State budget	Article 2 of Law 86-17 dated 3/7/86	DPC/Ministry of Public Works	Think about article 35 Road Development Fund.
b. Sewage				
- Financing	State/loans Int. aid		ONAS (or directly ARRU/AF)	Loans guaranteed by the State.
- Implementation		Framework agreements with ARRU or AFH.	Private or public contractors under ONAS control.	Five percent paid to ONAS for control
- Recovery	National taxes		State	
- Maintenance/Usage	Sewage fees	Decrees 78-972 dated 11/7/78 and 75-492 dated 7/26/75	User through SONEDE	

SYNOPTIC TABLE (continued): INSTITUTIONAL AND LEGAL CONTEXT OF URBAN DEVELOPMENT

ITEM	INSTRUMENTS	LEGAL REFERENCES	PARTICIPANTS	COMMENTS
c. Drinking Water				
- Financing	State Endowment own funds/loans		State/SONEDE/Int. aid	Own funds stem from sale of water
- Implementation	Payment for water consumption	Decree No. 73-515 dated 10/30/73	Contractors--SONEDE	
- Recovery	National taxes.			
- Maintenance/Usage	Water consumption fee		SONEDE through the user.	
d. Electricity				
- Financing	State Endowment/own funds-consumers			
- Implementation	STEG specifications		STEG/State Contractors	
- Recovery	National taxes			
- Maintenance/Usage	Fixing of rates			
2.3 Secondary Infrastructure	Municipal Property			
a. Roads	Classification	Articles 120 to 128 of Legal Framework Article 123 of Legal Framework	Municipalities through subcontractors	Urban and neighborhood roads
- Financing	Municipal budget proposal. . .		Municipalities. Public or Private subdivider/municipality	
- Implementation				
- Recovery	Sale of lots	Decree dated 1/31/1887. Article 36 of Finance Law No. 79-66	Beneficiaries/Municipality	
- Maintenance/Usage	Municipal budget		Municipality after project delivery	
b. Sewage				
- Financing	ONAS/beneficiaries		Contractors under ONAS control	
- Implementation				
- Recovery	Decree proposal	Decree not approved	Beneficiaries 20dinars/meter	
- Maintenance/Usage	Sewage fee	Decrees 78-972 dated 11/7/78 and 75-492 dated 7/28/75	ONAS	
c. Drinking Water				
- Financing	State/SONEDE			
- Implementation			Contractors under SONEDE control	
- Recovery	Fixing of rates		Beneficiaries	
- Maintenance/Usage	Water Consumption Fee		SONEDE	
d. Electricity				
- Financing	Own funds/loans		State/SONEDE	
- Implementation			Contractors under SONEDE control SONEDE control	
- Recovery	Fixing of rates.		Consumers	
- Maintenance/Usage	Extra Charge on electrical power. Municipal budget for lighting by electrical bill by network.	Article 36 of Decree 76-826 dated 9/13/76	Municipality or STEG agreement.	20 millimes/kwh
c. Drinking Water				
- Financing	State Endowment own funds/loans		State/SONEDE/Int. aid	Own funds stem from sale of water
- Implementation	Payment for water consumption	Decree No. 73-515 dated 10/30/73	Contractors--SONEDE	
- Recovery	National taxes.			
- Maintenance/Usage	Water consumption fee		SONEDE par le biais user.	
2.4 Social/Collective Facilities				
a. State Facilities				
- Financing	State budget/credits allocated to governorates		Concerned ministerial department	
- Implementation			Ministerial department or governorate.	
- Recovery	National taxes.			
- Maintenance	State budget.		Concerned ministerial department.	Municipality sometimes intervenes at this level.
b. Municipal Facilities				
- Financing	Municipal budget/state.		Municipality under contract. Facilities.	State may help municipality complete cultural facilities

ANNEX II

ASSESSMENT MODEL

For Table 1, different sections, or models, were developed to help assess the feasibility of potential pilot projects. Data have been introduced for illustration only. In Table 1, parts I and II require information and assumptions about the proposed project, for instance, project area, population, and densities for both the developer's project area and the zone of intervention or impact zone.

For the hypothetical case presented in Table 1, the overall project area is 60 hectares (20 in the developer's project and 40 in the impact zone). The total population of the area is anticipated to be 6,500: 2,500 in the developer's project and 4,000 in the impact zone. In addition, it is assumed that 10 percent, or 4 hectares, in the zone of intervention will not participate.[1]

In part III, the cost of each infrastructure element is introduced. The costs for the off-site infrastructure are based on imputed per capita costs. The costs are broken down by population-based and area-based services. Assumptions are made in part IV as to when cost recovery will take place (i.e., based on surcharges on subdivision and building permits). Part V represents a disaggregation of the off-site infrstructure costs between the developer and the municipality (zone of intervention).

Finally, in part VI, a municipal debt servicing chart is presented based on the beneficiary repayment assumptions made in part IV. Footnotes to the table provide additional details about the assumptions which have been made.

Table 2 presents a model for recovering costs of major road investment. Parts I and II present sample data in the developer's proposed development area as well as data for the zone of intervention. Part III concerns the off-site road costs and part IV concerns the cost recovery options for each area. Part V presents the distribution of costs to be recovered based on area and vehicle intensity.

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[1]The percentage of non-conforming or non-participating owners is reflected in part IV, where only 90 percent of the potential connections in the impact area are realized. This is also reflected in the repayment proforma presented in part VI.

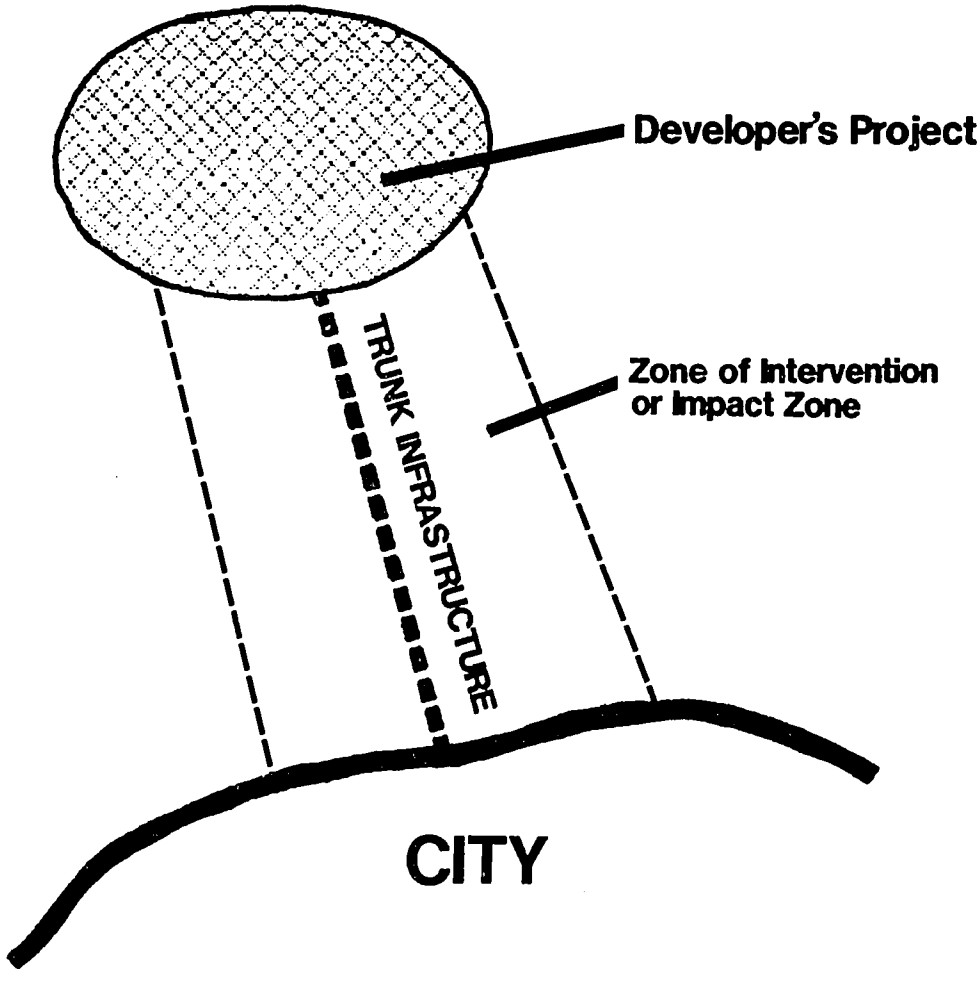

Diagram Showing Developer's Project and Zone of Intervention

TABLE 1
ALLOCATION OF INFRASTRUCTURE COSTS BETWEEN DEVELOPER AND MUNICIPALITY

I. DEVELOPER DATA

Area (ha)	20
Population	2500
Density (calculated)	125

II. ZONE OF INTERVENTION

Area (ha)	40
Population	4000
Density (calculated)	100
Area Represented by Non-conforming Owners (ha) *	4
Percent (calculated)	10.0
Distance from existing Infrastructure	--

III. COST OF OFF-SITE INFRASTRUCTURE

	TOTAL	PER CAPITA
Population Based Services		
Water	$ 65,000	$10
Sewerage	130,000	20
Electricity	97,500	15
Solid Waste **	13,000	2
Subtotal	$305,500	
Area Based Services		
Drainage	$ 65,000	$10
Roads	65,000	10
Subtotal	$130,000	
Grand Total	$435,500	

IV. RATE OF CONNECTION TO OFF SITE INFRASTRUCTURE IN ZONE OF INTERVENTION *

Year 1 (percent)	10%
Year 2 (percent)	45%
Year 3 (percent)	10%
Year 4 (percent)	20%
Year 5 (percent)	5%
Year 6 (percent)	0%
Year 7 (percent)	0%
	90%

V. DISTRIBUTION OF OFF-SITE INFRASTRUCTURE COSTS BETWEEN DEVELOPER AND MUNICIPALITY

Developer's Contribution ****	
Population Based Services	
Water	$ 25,000
Sewerage	50,000
Electricity	37,500
Solid Waste	5,000
Subtotal	$117,500
Area Based Services	
Drainage	$ 21,667
Roads	21,667
Subtotal	$ 43,333
Grand Total	$160,833
Municipality contribution	
Population Based Services	
Water	$ 40,000
Sewerage	80,000
Electricity	60,000
Solid Waste	8,000
Subtotal	$188,000
Area Based Services	
Drainage	$ 43,333
Roads	43,333
Subtotal	$ 86,667
Grand Total	$274,667

* Consists of properties where titles are unclear or where owners refuse to participate in project.

** Solid waste off-site infrastructure represents requirements for additional vehicles or increases in final disposal sites to accommodate wastes from the project and zone of intervention.

*** The rate of connection to off-site infrastructure in the zone of intervention consists of the municipality's estimate of the rate at which plots in the zone of intervention connect to infrastructure provided in the zone as a result of the project. If there are non-conforming owners, the total connection rate may be less than 100 percent. In developing this model, it was assumed that all connections would be made in a maximum of seven years.

**** Infrastructure costs are allocated to developer and municipality in two ways: i) services which are demand related are allocated on a population basis using the ratio between the population of the developer's project and the total population of the project and the zone of intervention, and ii) services which are area based are allocated using the ratio of the area of the developer's project to the sum of the project and zone of intervention.

TABLE 1 (continued)
ANNUAL MUNICIPAL DEBT SERVICING AND BENEFICIARY REPAYMENT

Interest rates: 10.0%
Rate of inflation: 10%

YEAR	MUNICIPAL DEBT OBLIGATION *			MUNICIPALITY DEBT SERVICING **			MUNICIPAL SERVICING OF DEBT ***		
	PRINCIPAL ACCOUNT	INTEREST ACCOUNT	TOTAL OBLIGATION	INTEREST	PRINCIPAL	TOTAL ***	BENEFICIARY PAYMENTS	ANNUAL BALANCE	CUMULATIVE BALANCE
Year 1	274,667	27,467	302,133			0	81,686	81,686	81,686
Year 2	271,920	27,192	299,112	14,852	148,521	163,373	367,588	204,216	285,902
Year 3	134,600	13,460	148,060	14,852	148,521	163,373	81,686	(81,686)	204,216
Year 4	51,821	5,182	57,003	14,852	148,521	163,373	163,373	0	204,216
Year 5	8,550	855	9,406	14,852	148,521	163,373	40,843	(122,529)	81,686
Year 6	941	94	1,035	14,852	148,521	163,373	0	(163,373)	(81,686)
Year 7	103	10	114	0	0	0	0	0	(81,686)
Year 8				0	0	0		0	(81,686)
TOTAL COSTS		74,260	816,863	74,260	742,603	816,863	735,177		

* The municipal debt obligation represents the debt occurred to finance the municipality's contribution to off-site infrastructure. In the model, the interest on the debt is the simple interest on the debt calculated on an annual basis. Unpaid interest is capitalized into the principal account making the total obligation the sum of interest, unpaid interest and principal.

** Municipality debt servicing consists of level payments of principal and interest. The period of repayment is based on the rate of connection in the zone of intervention with one year's grace since there may be no connections in the first year.

*** Municipality servicing of debt consists of repayment of the debt (see note two). Beneficiary repayments are the percent of beneficiary connections in each period multiplied times the total municipality debt obligation (principal, interest and unpaid interest). The annual balance is the difference between beneficiary payments and total municipality debt servicing. The cumulative balance is the current year's annual balance plus the previous year's surplus (or deficit). MODEL FOR DETERMINING DEVELOPER PROJECT FEASIBILITY AND ALLOCATION OFF-SITE INFRASTRUCTURE COSTS BETWEEN DEVELOPER AND MUNICIPALITY

N.B.: Year 7 figures for Municipal Debt Obligation are due to rounding.

TABLE 2
MODEL FOR RECOVERING COSTS OF MAJOR ROAD INVESTMENT *

I. DATA ON DEVELOPER'S PROJECT		II. ZONE OF INTERVENTION		III. OFF-SITE ROAD COSTS *** (IN ZONE OF INTERVENTION)		IV. COST RECOVERY OF PRIMARY AND SECONDARY ROADS ****		
							SHARE	AMOUNT
Area (ha)	20	Area (ha)	35			Developer's project		
Population	2500	Population	3500	PRIMARY ROADS	15,000	- Based on Area	41.7%	14,583
Density (calculated)	125	Density (calculated)	100	SECONDARY ROADS (optional)	20,000	- Based on Vehicle Intensity	56.3%	19,688
Number of plots	1500	Number of plots	1400	TERTIARY ROADS (optional)	30,000			
Vehicle intensity ** (number of vehicles per plot)	0.3	Vehicle intensity ** (number of vehicles per plot)	0.25			Municipality share (Recovered from Zone of intervention)		
				TOTAL	65,000	- Based on Area	58.3%	20,417
Total Vehicles (calculated)	450	Total Vehicles (calculated)	450			- Based on Vehicle Intensity	43.8%	15,313

* This table shows two techniques for recovering road costs: plot area or vehicle intensity. In both cases, property owners who benefit the most are expected to pay the largest share of the costs.

** Vehicle intensity is the number of vehicles per plot or household. In our example, we have assumed that the developer's project may have a higher intensity than the zone of intervention because it is designed for higher income groups.

*** Since the combination of the developer's project and the zone of intervention is fairly large, the illustration makes provision for primary, secondary, and tertiary roads in the zone of intervention. The primary road is the major road connecting the developer's project with existing road networks. Both secondary and tertiary roads are optional and can be omitted. If tertiary roads are needed in the zone of intervention becuase of its size, their costs should be allocated only to plots in the zone.

**** This portion of the table shows the allocation of primary and secondary roads between the developer's project and the zone of intervention. It is assumed that the developer would pay for his project's share directly and recover costs from plots within his project when the plots are sold. The share of road costs allocated to the zone of intervention would be recovered from future developers (or owners) in the zone at the time of obtaining either subdivision permits or building permits.

TABLE 2 (continued)
RECOVERY OF COSTS IN ZONE OF INTERVENTION

SUB-ZONAL DISTRIBUTION			DISTRIBUTION OF COSTS						
(1) DATA AND FACTORS	(2) NUMBER	(2) PERCENT	(3) RECOVERY TECHNIQUE	(4) TERTIARY ROADS TOTAL	(4) TERTIARY ROADS /PLOT	(5) PRIMARY ROADS & SECONDARY ROADS TOTAL	(5) PRIMARY ROADS & SECONDARY ROADS /PLOT	(6) TOTAL ALL ROADS TOTAL	(6) TOTAL ALL ROADS /PLOT
Zone A (Highest Benefit)									
- Number of Plots	150	10.7%							
- Zone Area (ha)	3.75	10.7%	- By Area	3,214	21.43	3,500	23.33	6,714	44.76
- Vehicle Intensity (calculated)	0.75								
- Vehicles (calculated)	113	32.3%	- By Vehicles	9,686	64.57	7,910	52.73	17,596	117.31
- Benefit Factor	1.6								
Zone B (Next Highest Benefit)									
- Number of Plots	300	21.4%							
- Zone Area (ha)	7.5	21.4%	- By Area	6,429	21.43	5,688	18.96	12,116	40.39
- Vehicle Intensity (calculated)	0.25								
- Vehicles (calculated)	75	21.4%	- By Vehicles	6,429	21.43	4,266	14.22	10,695	35.65
- Benefit Factor	1.3								
Zone C (Lowest Benefit)									
- Number of Plots	950	67.9%							
- Zone Area (ha)	23.8	67.9%	- By Area	20,357	21.43	13,854	14.58	34,211	36.01
- Vehicle Intensity (calculated)	0.17								
- Vehicles (calculated)	162	46.3%	- By Vehicles	13,886	14.62	7,088	7.46	20,974	22.08
- Benefit Factor	1								
TOTALS			TOTAL RECOVERY						
- Number of Plots	1,400		- By Area	30,000	21.43	23,042	16.46	53,042	37.89
- Zone Area (ha)	35		- By Vehicles	30,001	21.43	19,263	13.76	49,264	35.19
- Vehicles	350								

This portion of the figure shows how the costs of road networks could be recovered in the zone of intervention.

(1) The first step is to divide the zone into subzones according to distance that plots are from the major road. Zone A is made up of plots directly on the primary road. Due to their greater commercial potential, these plots would receive the greatest benefit from the road. Zone B is the next zone from the primary road and Zone C is the most distant zone.

(2) The Benefit Factor reflects the reletive differences in benefits among the three zones. Zone A has the highest factor since it is located directly on the primary road. Because of its likely commercial activities, the zone is assumed to have a higher vehicle intensity: it is likely that plots in Zone A will attract more vehicles from outside the area than other zones. Zone C, since it is most distant from the primary road, is assumed to have the least benefit from the road, thus it has the lowest benefit factor.

(3) In all cases, Zone C plots, area and vehicles are treated as residuals and calculated by the model.

(4) The second part of the table shows the distribution of the zone of intervention's road costs among the three subzones. Tertiary roads are allocated according to the distribution among the three subzones of either area or vehicles. The benefit factors are used to allocate a larger share of the primary and secondary road costs to Zone A and Zone B resulting in higher per plot costs. The model multiplies benefit factors times the share of road costs which would be allocated to the zone on either an areal or vehicle intensity basis.

(5) When vehicle intensity is used to allocate primary and secondary road costs, subzone A has much higher costs per plot because of greater vehicle intensity in the subzone. This reflects to a greater extent the principle that plots benefiting the most from road investment should pay a higher share of the investment. The total recovery by vehicle method is less than by area because a larger share of road costs is allocated to the developer's project using this method and the assumptions shown above.