

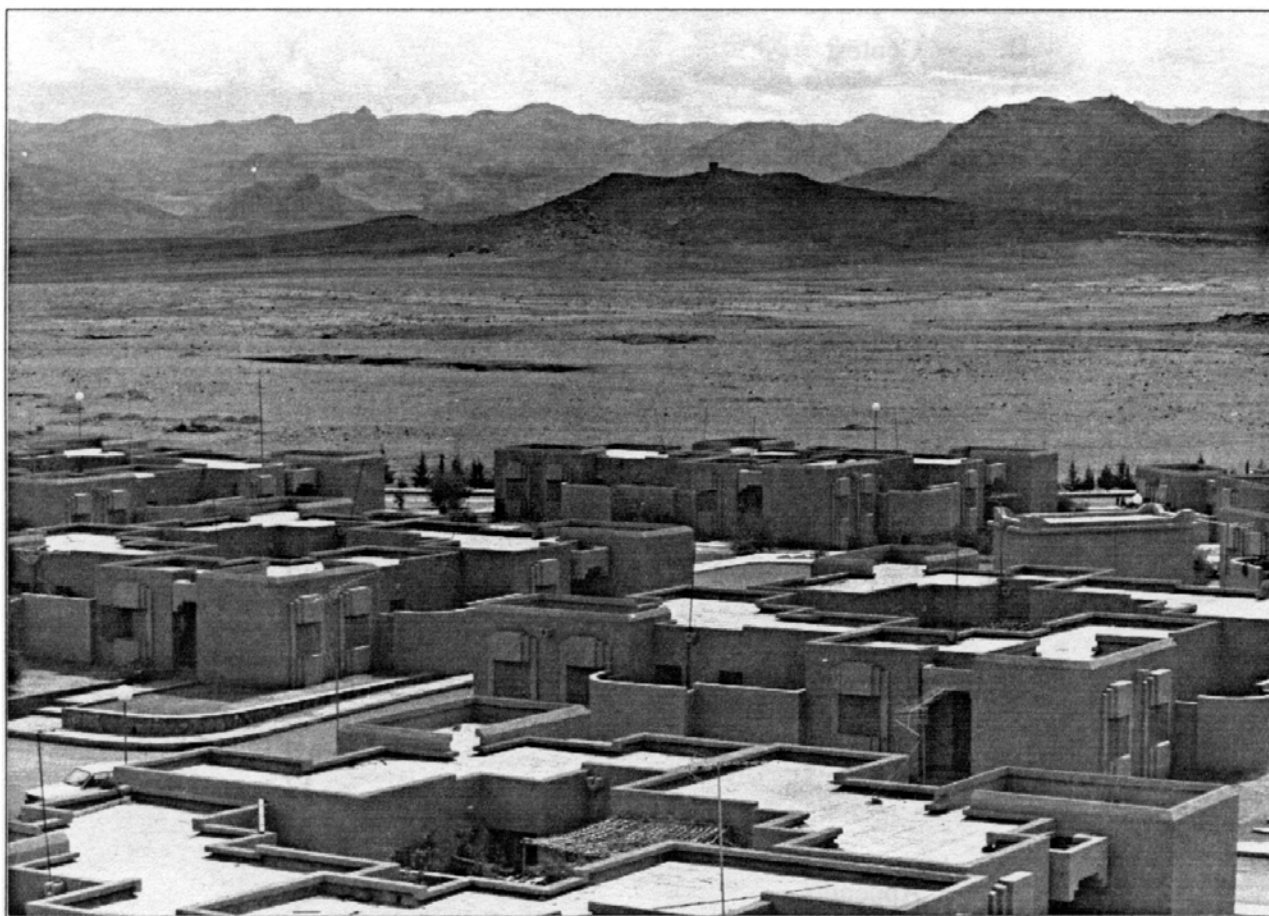


1992 Technical Review Summary
by *Darab Diba*

1135.MOR

Tinghir Miners' Township

Ouarzazate, Morocco



Architect

Taibi Jaadri
Rabat, Morocco

Client

Société Métallurgique d'Imiter
Tinghir, Morocco

Completed

1987

Tinghir Miners' Township, Ouarzazate, Morocco

I. Introduction

Tinghir Mining Township was conceived in 1984 by the Société Métallurgique d'Imiter (SMI) after analysis and exploration showed that reserves of silver in the region could be exploited at least until the year 2'000. The investment by SMI in modern extraction equipment and a treatment plant was paralleled with substantial investment in the construction of staff housing and associated social infrastructure. Tinghir, an existing rural population concentration, is some 32 km from the mine itself. Chosen after consultation with mining employees, it had the advantage of offering existing services and social infrastructure and avoided isolating the mining community in a "satellite" town. Local administrators offered the land, some 200'000 m², at a token price, seeing the incoming mining population as an important source of revenue.

The programme comprises:

- 220 miners' houses
- 20 bachelor's flats
- 41 middle management houses
- 13 executive villas.

complemented by:

- an executive club
- a mosque
- a cultural centre
- a *hammam* (public baths)
- sports facilities
- 2 swimming pools.

The architecture is simple. Cubic, solid forms, with small, recessed window apertures, offer a play of light and shade derived from the aesthetics of indigenous earth architecture. Sober, rustic, local materials combine with courtyard planning in a simple response to climatic constraints and the whole blends with the landscape. Reinforced concrete post and lintel frames on localised foundations support light-weight, cavity wall, concrete block-work infill, with an earth-coloured cement render finish. Situated some distance from the mine, the complex has acted as a catalyst to the development of the existing township at Tinghir, and provides the miners and executive personnel with living and hygienic conditions quite new to this deprived social class in Morocco.

II. Context

a. *Historical Background*

Tinghir is situated at a distance of 160 km from Ouarzazate, in the distant province of the Tafilalt, in the pre-Saharan region. Historically, it assures the communication between the Drâa valley and the Tafilalt oasis. This oasis has played a fundamental rôle in Moroccan history, for it was the origin and destination of the caravans of the trans-Saharan commerce that linked Morocco with black Africa. (The African gold trade transited Morocco via the Tafilalt oasis, by way of Tinghir, and particularly Sijilmassa, a town which dates to the Middle Ages but no longer exists.)

Under French occupation in the early 20th Century, Tinghir became a major French garrison, in view of its elevated position which allowed control of the Tafilalt region, which at the time was not subjugated. During that period, it was a strategic point that dominated the Drâa valley, where an imposing *kasabah* (fortress) was erected by the famous Pasha of Marrakesh, El Glaouia. Dominating Tichka Pass (in the High Atlas mountains), the Pasha had, in 1912, concluded an alliance with the French to "pacify" on their behalf the mountains and valleys of southern Morocco.

In the first decades of the century, Ouarzazate became a French military garrison, housing a detachment from the *Légion Etrangère* (French Foreign Legion), for whom Tinghir acted as the principal relay.

Tinghir Mining Township was conceived in 1984 by the Société Métallurgique d'Imiter (SMI) after analysis and exploration showed the existence of important reserves of silver in the region. Remains of an ancient mine are perceptible on the site. Research carried out since 1980 raised the figure of known ore reserves and led to the discovery of a new, economically exploitable bed containing an estimated 2'470'000 tons of ore rating 528 g of silver per ton.

b. Local Architectural Character

Traditional Architecture

Traditional architecture of the region essentially uses earth, pisé, and sun-baked and kiln-fired bricks. Walls are made of earth, and the timber roofs are covered with reeds, bushes, and two layers of earth.

Lines are generally simple and cubic. Apertures are minimal, to protect against excessive heat and light, and also to preserve the privacy. The geometry is based on the square or the rectangle, adapted to a simple construction mode and allowing the creation of fresh, ventilated micro-climates within inner courtyards.

Vaults are practically non-existent. Traditional buildings are one or two storeys in height, and all grouped around the *kasabah* (fortress) which has a similar general typology, though on a larger scale, with well de-lineated walls and crenellations.

Ksour (plural of *ksar*) are compact, fortified villages closely spaced on the edge of oasis-like river beds, against a background of inhospitable, barren mountains. Built of mud and inhabited by a sedentary farming population, the *ksour* display a very compact fabric with an urban appearance marked by *borjs* (towers).

There are no clear patterns to the streets of the *ksour*. However, the narrow streets are sometimes laid out according to a grid-like pattern, or there are a few dead-end alleys connected to main streets. The *ksour*'s darkness and the residents' ability to control light within houses and public spaces to protect them from the bright desert sun are important features of this type of architecture.

At times, the light in the streets in between the *sabats* appears as a spotlight in a tunnel, while the light of the courtyards within the houses is diffuse and central. Long, narrow rooms are arranged around the central open space (courtyard), which is usually walled by a low parapet that rises above the roof terrace, and receives a modicum of light that is controlled by placing mats over the opening.

Cumbersome furniture is normally absent. The only common piece of furniture is a very low, round table used for eating meals. Mats are placed to create a space for sitting, eating or sleeping. Infrequently, mud platforms are used as seats or beds. Most objects, such as water jars, pots, pans and copper water basins, are found in the kitchen.

Recent Architectures

In some of the modern architectural realisations in the region, the pisé walls are replaced with a cement and concrete structure. Walls are made of agglomerated cement (hollow bricks), finished with smooth plaster on the inside and with a rustic cement cover on the outside. Floors are composed of reinforced concrete beams and agglomerated cement *hourdis*.

Flat terrace roofs predominate. The windows remain small and the colour of the architecture is an ochre that emulates that of the earth.

The typology is often faithful to ancient traditional spatial configurations: simplicity of forms, cubic geometry, scale and proportions reduced to one or two storeys.

c. *Climatic Conditions*

The desert climate, extremely hot in summer. Temperatures are as follows:

	Day	Night
Summer	40°C	10°C
Winter	20°C	5°C

The air is dry. Air currents exist near the mountains. The altitude above sea level at the foothills of the High Atlas mountain range is 1'200 m. Rainfall is scarce, and snow is exceptional.

d. *Immediate Surroundings of the Site*

The site is located on the periphery of the town of Tinghir, which has a population of 10'000, and lies along the valley of the Todgha (south of Tinghir). The architecture of Tinghir has a traditional earthen character. It is often a barren landscape with remote views of the Atlas mountain range. Around the complex (north-east), several ancient, time-worn earth constructions can be distinguished, which are temporarily inhabited by poor people.

The site is accessible from the west and the north through two principal, existing roads. It is situated 160 km from Ouarzazate and 32 km from the silver mine. Transportation is provided by bus.

III. Description

a. *Conditions Giving Rise to the Programme*

While Morocco has limited industry, and limited agriculture, it enjoys a relative wealth of natural resources (coal, gas, copper, iron, zinc, silver, phosphates and magnesium) whose exportation offers important economic potential. In the framework of territorial and governmental programmes, studies concerning the exploitation of such mines are being carried out and implemented in various regions of Morocco.

The conditions of the miners are characterised by unacceptable levels as regards hygiene, pollution, security, food, housing and income. The nature of their work causes rapid health deterioration and severe physiological degradation. Even today, the miners work and live under harmful, antiquated, inhuman conditions imposed by the degree of his poverty and his obligation to take up employment and earn income. Recently, better social conditions for miners are being studied, and have been implemented, in a number of Moroccan mines. The remainder are deficient in this regard.

In 1984, in an effort to ameliorate this situation, the Société Métallurgique d'Imiter (SMI) decided, in the framework of an important social development programme, to create a miners' town that groups personnel housing and other communal equipments (mosque, cultural centre, sports centre) and enjoys an operational infrastructure (electricity, drinkable water); this, in parallel with the development of silver ore extraction.

Three alternatives for the town's location were considered:

- on the mine site (current model),
- in Imiter, a small village 7 km away from the mine,
- in Tinghir, a large rural centre 32 km away from the mine and rapidly developing.

After discussions between the management and with the employees, the latter option was preferred as it offered the following advantages:

- existence of drinking water infrastructure;
- existence of peripheral social equipments (school, dispensary, shops);
- integration of the miners within the social fabric of Tinghir, which avoids the sense of social claustrophobia that frequently occurs in isolated mines;
- distance from pollution areas;
- possibility of constructing adequate housing.

Another element which favoured the choice of Tinghir was the provision by the local administrators of a sizeable land plot (20 ha) at a token price. The municipality are aware of the revitalisation and development which can result from such an investment.

b. General Objectives

- To create a residential complex equipped with an adequate infrastructure (water, electricity), and provide housing and communal facilities for the personnel of Imiter mine.
- To enhance the social level of the miners by the provision of adequate housing and facilities for community life.

c. Functional Requirements

To create a miners' town that groups the dwellings of the mine personnel and the socio-cultural installations needed for community activities.

The programme comprises:

- | | | |
|--------------------|--|------------------|
| - Staff housing | - 220 miners' houses | 148 3-room units |
| | | 72 4-room units |
| | - 20 bachelors' flats | |
| | - 41 middle-management houses | 31 3-room units |
| | | 10 4-room units |
| | - 13 executive villas | |
| - Common buildings | - executive club | |
| | - mosque | |
| | - cultural centre | |
| | - hammam with oven | |
| | (a common source of energy that allows bread to be baked on the oven side and heat to be provided for the water and the space of the public baths) | |
| | - sports facilities | |
| | - 2 swimming pools (adults & children). | |

d. *Building Data*

On the site, three distinct residential areas are adjoined. They are demarcated as follows:

- Executive villas to the north
- Middle-management houses in the centre
- Miners' houses to the south.

The mosque, the cultural centre, the *hammam* with communal oven, and the shops are located in the central area of the site; the executive club stands near the main entrance; and the sports centre lies on the extreme right, on the periphery of the plot. The residential and communal buildings follow a low, single-storey scale, and this creates a shallow skyline in which the only significant volumetric element is the mosque, whose minaret is a dominant arrow pointing to the sky.

Executive and middle management housing consists of individual dwelling units, whereas the miners' groups four habitation units around a central courtyard. Individual volumes express the the interior functions of the rooms, to create great visual variety and individualised pathways.

	m ²
- Overall site	200'000.00 (20 ha)
- Total ground area	30'197.00
- Built storey area	282.00
- Total built area (basement, ground floor, storeys)	30'425.00
- Table of surface areas per construction unit:	
Miners' houses (3 room)	80 m ² x 148 = 11'840.00
Miners' houses (4 room)	90 m ² x 72 = 6'480.00
Single persons flats	58 m ² x 20 = 1'160.00
Gallery	= 295.00
Middle management houses (3 room)	116 m ² x 31 = 3'596.00
Middle management houses (4 room)	130 m ² x 10 = 1'300.00
Executive villas	225 m ² x 13 = 2'925.00
Executive club	729.65
Club cloakroom	104.12
Mosque	558.57
Cultural centre	538.52
Hammam and communal oven	232.00
Commerce	324.30
Cloakroom (sports centre)	312.59
Total	30'425.60 m ²

e. *Evolution of Design Concept*

Response to Physical Constraints: Climate

Situated in the pre-Saharan region, Tinghir has a warm, dry climate and intense sunlight. In response to these factors, the following dispositions are adopted:

- Create an introverted architecture, with courtyards and interior gardens;
- Limit the number and area of wall apertures (windows);
- Protect the windows (recesses, wooden shutters);
- Provide air circulation by cross ventilation to the interior courtyard or garden;
- Construct thick walls (32 cm) resistant to thermal shock and temperature differences between day and night.

Well sheltered from the heat, the mosque too follows an introverted architecture with an interior patio which diffuses a soft, subdued light.

Response to User Requirements: Spatial Organisation

Single-storey house typology was adopted because the mining population is largely rural; the extensive site area permitted the adoption of such an approach.

In the habitations, the typology of the plan respects the traditional features of the Arab house; the private area is in consideration of *mahramyyat*; the public areas allow contact with visitors outwith the household (entrance, reception room). One part of family life revolves around the kitchen, which opens onto a courtyard where daily cooking and laundry activities are carried out.

In the plan of the houses, private areas are separate from the spaces that assume other functions. Every dwelling has an entry porch, which delimits the home from the street. The rooms and spaces are simple, and allow the variation of the families' necessities and limited expansion of the houses.

Traditional furniture, which most often comprises a shallow table and peripheral cushion-lined benches, constitutes another element in the spatial conception which, by its cubic shapes, is to allow the economically restricted occupants to benefit from this facility.

The miners' houses group four habitation units around a central courtyard, which, while it preserves cellular individuality, generates neighbourhood relationships and communication between families.

Common facilities buildings are scattered throughout the site. The dominant element is the mosque, with its large congregational space and superior scale, which make it the principal landmark of the site.

Formal Aspects: Massing, Articulations, Decorative Features, Use of Traditional Motifs

The general composition follows the formal configuration of the traditional villages of the region: small articulated rooms volumetrically linked in a rather organic manner according to the needs and functions of the dwelling.

In order to satisfy the primary needs, and in view of the simplicity of local construction modes and available materials, the spatial conception remains simple; cuboidal, but horizontally and vertically articulated to accord with the rooms' importance. This animated, free composition gives liveliness to the ensemble, and avoids the monotony of the current, systematic alignments visible in peripheral towns of the Third World.

Between dwellings, zones of social interaction and playgrounds for children provide contrasts, apertures, spatial goals. No decorative element has been used, except in some reception rooms or kitchens where traditional geometric ceramic tiles are found. Yet it is interesting to note that combinations of simple construction materials (entrance porches, window frames), well integrated with the façade decoration of popular dwellings in African architecture, have been adequately utilised here. This is significant when one considers the economic and material limitations of the project.

The ochre (earth) colour of the buildings blends perfectly with the site, the older constructions and rural dwellings. The project constitutes a good continuation of the landscape.

Landscaping

The semi-desert climate, and the temperature differences are not favourable to the maintenance of green areas, which are almost absent here. Nonetheless, the inhabitants keep some trees (cypress, wild mimosa, acacia, olive, orange, almond, prune), shrubs and flower plants in their interior gardens. The communal spaces have been arranged as playgrounds and social areas.

Structural Systems

- Frames Reinforced concrete posts and beams; *poteaux poutres*.
- Foundations By isolated slabs approximately 1.50 m above ground level. Stiffened by reinforced concrete members, 20 cm of hard-core fill and 10 cm of floor-tile covering.
- Floors Traditional reinforced concrete beams cast in-situ.
- Roof 20 x 40 cm concrete beams.

Materials

- Foundations Insulated reinforced concrete slabs.
Reinforced concrete beams.
Reinforced concrete paving.
- Infill Walls: hollow cement blocks.
Floors: cement slabs.
- Finishing of surfaces Smooth cement cover inside.
Rustic cement cover outside.
Painted concrete block.
- Floors, ground surfaces Quarry gravel inside.
River gravel outside.
- Ceilings Smooth cement plaster.
- Roof/Covering Terrace roof-top: reinforced concrete beams, pre-cast slabs, two layers of bituminous jute cloth.
- Kitchens/Water closets Ceramic tile wall covering.

Construction Technology

Reinforced concrete cast in-situ. Timber formwork. Propped with 12 cm diameter eucalyptus posts. 7 x 15 cm formwork planks. The materials are fabricated and moulded within the workshop.

Building Services, Site Utilities

- Water Running water is provided by the municipality in charge of water distribution. An underground cement/asbestos pipe network is in place. Connection is by direct supply and individual counter.
- Electricity Underground electricity network by shielded cable under 10 cm diameter cement base laid 40 cm deep on a sand bed. Medium-tension transformer for the entire town, high-tension by aerial network.
- Sewage Connected to municipal sewage network on the western access road.
- Streets 30 cm multi-layered cold surfacing of bitumen and gravel.
- Pedestrian ways 10 cm concrete slabs on a 20 cm stone bed.

- Heating No central heating system is installed. Individual radiators and waters boilers are used (see note below).
- Cooling/Air conditioning No central system. Individual electric cooler units are occasionally used in some houses (executive villas).

As concerns heating and cooling, if one considers the imposed material constraints, the budget and the climate, a good thermal capacity (wall thickness) of the buildings and the creation of air-circulation, allied with individual electric appliances, appears to be the most judicious, accessible approach for the short periods and seasons when these appliances may be necessary. Heating is necessary only for two months per year and such appliances are not indispensable.

g. Origin of Technology

Technology

Both the technology and the materials are of local origin.

Note:

Electric appliances such as water heaters, heating radiators, and air-conditioning units, are imported from Europe.

Materials

- The materials are local and come from Tinghir.
- The cement comes from Marrakesh.
- The steel comes from Nador (centralised production for all of Morocco).

Labour Force

Local:

- 80% from the Tinghir region.
- 20% from other regions of Morocco.
- Specialised manpower: 220 technicians and workers.
- Non-specialised manpower: 540 workers.

Professionals

Architects, contractors and consultants are all local (Moroccan).

IV. Construction Schedule and Costs

a. History of the Project

1980-84	Studies and intensive research on the mine of Imiter (deposits, extraction, production, economy.)
1984-85	Design of the mining township.
1985-87	Construction.
1987 onward	Occupancy.

b. *Total Cost and Main Source of Finance*

Costs

	Moroccan Dirhams	US Dollars
- Land (symbolic price of MAD 1.50/m ² in 1985)	300'000	35'000
- Total cost:		
Excluding the land	71'200'000	7'530'000
Including the land	71'500'000	
- Construction cost per m ²	1'740	184

1 USD = MAD 9.45 Moroccan Dirhams (1985-87).

Financing

- 100% private capital
- 55% bank credit
- 45% self-financing.

c. *Comparative Costs*

Compared with the recent constructions in the cities of Morocco (MAD 4'000.00 per m²), this construction is cheaper by over one half (MAD 1'750.00 per m²) and can be considered low-cost. In comparison with rural earth constructions, and bearing in mind the modern materials utilised the project can be considered medium-cost.

In view of the modern technologies and materials used in its buildings, Tinghir Mining Township is one the most serious, and most coveted, realisations in the region. Indeed, most local earth constructions are quite flimsy and have a limited life-span. Clearly, being totally or partially built of earth, these constructions cost less than those of the township, but, comparatively, they also display obvious construction deficiencies.

d. *Qualitative Analysis of Costs*

	Moroccan Dirhams
Land	300'000
Infrastructure	11'258'815
Material	52'840'709
Site equipment	3'477'877
Fees	3'677'770
Total cost: - excluding the land	71'200'000
- including the land	71'500'000
Price per m ²	1'740

e. *Maintenance Costs (heating, cooling, etc.)*

Since there is no heating or cooling system, no relevant maintenance costs are involved. The inhabitants pay the amounts recorded on their individual counters for the consumption of their home appliances, which they rarely use thanks to the climate. A technical maintenance team (plumbing, electricity, equipments, construction, hygiene, town cleaning, garbage collection), comprising workers who reside in the township and who work in shifts, is employed by the *Société Métallurgique d'Imiter* (SMI), to assure full-time maintenance.

The costs of this employment and the drinking water are symbolically paid by the inhabitants to SMI, who control and subsidise the monthly occupancy and maintenance fees. This method

allows the inhabitants to live in a modern, practical, clean township for a symbolic, relatively small, monthly expense.

V. Technical Assessment

a. Functional assessment

The township and its dwellings function well. Of course, the executive villas and middle management houses are more comfortable (area and space quality) than miners' dwellings. Adjacent habitations do not create annoyance for each other and are visually and acoustically protected, providing comfort and respect for privacy.

From the functional aspect, miners' dwellings have problems with the windows which are located at the eye-level of passers-by; theoretically this allows the house interiors to be viewed from without. Consequently, the shutters of the windows remain closed most of the time though this is also in reaction to climate.

Although rather small, the rooms are nevertheless well-proportioned and the separations of living zones are judiciously distributed. Meeting places and playgrounds are vast, appreciated, and well-utilised, and bring a feeling of enjoyment to the inhabitants.

Communal buildings perform their functions properly, and the peaceful, fresh space of the mosque is used several times in the day. The management system must be well designed and followed-up, since the town is very clean and the equipments are all in working order.

b. Climatic Performance, Lighting, Ventilation, Acoustics

The conception of an introverted architecture, the thickness of the walls, and the small window apertures, are important factors which have been respected, to create a micro-climate with a pleasant temperature inside the home. In African architecture, light is an element that has to be controlled and filtered, and this has been sensitively dealt with. Also notable is the cultural character associated with dimly lit spaces; symbols of peace, rest and coolness, which are imperative in hot regions.

Air circulation inside dwellings is adequately induced by connections between interior courtyards and gardens. These small, well-protected interior courtyards, enhanced with water and planted with trees, diffuse an efficient air circulation at the centre of the dwelling.

In terms of climatic performance, the interior space of the mosque is also well protected, and offers ample freshness and quiet. The other communal spaces (cultural centre, executive club) and temporary utility spaces present no problem.

c. Choice of Materials, Level of Technology

The materials are simple and locally available in the country. The technology used and the construction modes are common in this type of new construction which uses hard materials. It is an appropriate and available construction technique (concrete, cement) currently used in new realisations in Morocco. It is a technology which requires no specific technical skills. The finishes (cement, plaster, paint) are equally simple and readily accessible.

d. Ageing and Maintenance Problems

The houses all function well and have no maintenance problems. This is mainly due to the simplicity of their architectural conception and the avoidance of failure-prone technical equipments (heating, cooling). Electric appliances (fan-coil thermostats) and bathroom

equipments (water-mixers) used in the executive club do create operation problems and must be regularly adjusted. Such devices involve techniques that are sophisticated for the region. The problem of the sporadic utilisation of electric appliances or sophisticated plumbing elements in some of the communal buildings, and their malfunction, confirms, at the levels of the project, the architect and the client, the wise decision to refrain from the installation of electric appliances and complicated plumbing items. The widespread installation of such elements within the township would undoubtedly have given rise to excessive problems of repair, control, adjustment and maintenance.

Maintenance provision (estimation of Technical Reviewer) can be formulated as follows:

- Main construction 50 years
- Insulation every 20 years
- Paint-work every 5 years
- Interior pipe-work every 20 years
- Electrical circuit every 20 years
- Street pavings every 15 years.

e. Design Features: Massing and Volume, Articulation of Spaces, Integration with the Site

The succession and articulation of simple, cubic, solid forms creates a varied perspective in virtue of a master plan that groups the dwellings in an organic rather than a linear order.

The volumetric hierarchies are judiciously distinguished from one house to the next, and generate secondary rhythms which avert the monotony problem that is almost inevitable in this kind of towns.

By its respect for the region's forms, colours, materials and scale (one and two storey houses), the Mining Township is a good continuation of the general panorama of Tinghir. Integration has been effectively achieved. Two landmarks are dominant in the landscape: the main mosque of Tinghir and the mosque of the Mining Township. The minarets, built following the traditional square plan, are easily distinguished on a flat site where the houses have been designed with a low profile.

VI. Users

a. Description of The Users

The inhabitants/users of the Mining Township comprise:

- 5 % Executive personnel, engineers, engineering technicians who direct and run the mine. They have completed higher studies in Morocco and particularly in France. Their salaries vary between MAD 5'000 and 10'000. They live in villas.
- 15 % Middle management workers. They embody the link between the executive engineering team and the miners. They have completed primary or secondary studies and occasionally include technicians. They are workers who, by experience, have acquired a specialty in mining operations. Yet 30 % are illiterate. Their salaries vary between MAD 3'000 and 5'000.
- 80 % Miners
They provide the manual, physical labour of the mining operations. The majority among them is illiterate. Their salaries vary between MAD 2'500 and 3'500.

b. *Response to Project*

Due to the general strike of Moroccan miners, reservations prevented the Technical Reviewer from establishing human contacts and true dialogue with the miners. The nervous miners are observed - directly and indirectly - by the agents of the mine direction and the jeeps of the *gendarmerie* (police), who have established surveillance posts in the neighbourhood and on the heights of the mines. The contacts the reviewer had with the miners were controlled and supervised by the direction and security agents; themselves quite worried by the progression of our questions, inclusive of questions concerning architectural problems related to the performance of the site.

Thanks to intermediary persons, comparative surveys of other mines, contacts with a few miners, and deciphering the responses of direction agents, we were able to draw the following conclusions:

- The Tinghir Miners' Township enjoys a choice, almost unique situation in Morocco for its social equipments, hygiene, workers' dwellings, food, transportation and cultural education. Imiter effectively provides subsidies and social security for the workers of this silver mine.
- Living and working conditions are entirely correct, in terms of free enterprise models.
- The houses, built of hard modern materials as opposed to temporary earth dwellings, as well as the effective equipments and infrastructure, are appreciated and aptly maintained. The dwellings are allocated to the workers for the duration of their engagement at the mine and can be purchased after 10 years employment.

One of the miners' demands, in view of the quality of the houses, was the right to acquire their dwellings by bank credit to create material patrimony and security for their families.

- The mining township appears to be an experimental, pilot project of the Moroccan government with the view of applying the formula (labour, living) to other mines. The results are quite conclusive.

VII. Persons Involved

Promoters of project (Developers/Client)	<ul style="list-style-type: none">- Mohammed Chahid, General Director of BRPM (until 1987), Research and Mining Participation Bureau.- Assou Lhatoute Ex-Secretary General of BRPM (until 1987), presently Director of BRPM.- <i>Société Métallurgique d'Imiter</i>, SMI, Tinghir, Morocco.
Regional co-ordination	<ul style="list-style-type: none">- Tinghir Commune, Ouarzazate Province, Morocco.
Design	<ul style="list-style-type: none">- Taibi Jaafri, concept, co-ordination, design.
Workshop supervision (execution)	<ul style="list-style-type: none">- Ali Arji.
Consultants	<ul style="list-style-type: none">- <i>Bureau d'études BETEC</i>, Casablanca, Morocco.
Contractor	<ul style="list-style-type: none">- Bachiri Enterprise, Meknes, Morocco.- Hakkou Enterprise, Ouarzazate, Morocco.

Enterprises

- VRD SETRAV/SNGC, Casablanca, Morocco.
- Adyel, Casablanca, Morocco.
Sanitary plumbing
- TEM, Casablanca, Morocco.
Interior/exterior electricity.
- El Fath Carpentry Cooperative, Ouarzazate, Morocco.
Wood works.
- Moussaada s.a., Rabat, Morocco.
Paint work, glass panes.
- Corsin Aquatra, Casablanca, Morocco.
Swimming pool.

Darab Diba
Ouarzazate, Morocco.

List of persons involved/Addresses - Telephone numbers

a. Promoters of Project

- Mohammed Chahid
Ex-director general of BRPM (until 1987)
Research and Mining Participation Bureau
- Assou Lhatoute
Director general of BRPM
Research and Mining Participation Bureau
- Mohammed Khalki
Administrative and financial director of BRPM
Research and Mining Participation Bureau
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Rabat, Morocco
Tel. 76-30-34 / 76-44-10
Tlx. 310-66
- Mohammed Cherrat
Director of Imiter mine
BRPM, *Société Métallurgique d'Imiter*
Imiter mine
PO Box 30, Tinghir
Tel. (04) 83-40-50
- BRPM, Research and Mining Participation Bureau
Société Métallurgique d'Imiter (SMI)

Social headquarters:
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P. O. Box 99, Rabat, Morocco
Tel. 630-35
Tlx. 310-66

Direction:
11, Zankat Tanja
P. O. Box 38, Rabat, Morocco
Tel. 676-76
Tlx. 326-64

Mining centre:
Imiter (via Tinghir)
P. O. Box 30, Morocco
Tel. (088) 22-56
- *Société Métallurgique d'Imiter* (SMI)
Project developer
11, Rue de Tanger
Rabat, Morocco
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b. Design, Workshop, Enterprises

- Taïbi Jaafri
Architect
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Rabat, Morocco
Tel. 73-86-22 / 73-28-58

- Ali Arji Architect (workshop)
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- BETEC
Bureau d'études Techniques d'Engineering & Coordination
228, Boulevard Rahal El Meskini
Casablanca, Morocco
Tel. 3W8-26 / 30-8-47

- V.R.D. SETRAV/SNGC
25, Allée des Eucalyptus
Aïn Sebâa
Casablanca, Morocco

- Bachiri Abderrahmane Enterprise
Main construction, 1st and 2nd phases
15, Avenue Allal Ben Abdellah
Meknes, Morocco
Tel. 52-25-67 / 52-07-46

- Hakkou Mohamed
Main construction, 3rd phase
B. 10, Villa Sidi Hssain
Quarzazate, Morocco
Tel. 88-24-81

- Adyel enterprise
Sanitary plumbing
6, Rue Mont-Cinto Maârif
Casablanca, Morocco
Tel. 25-05-24

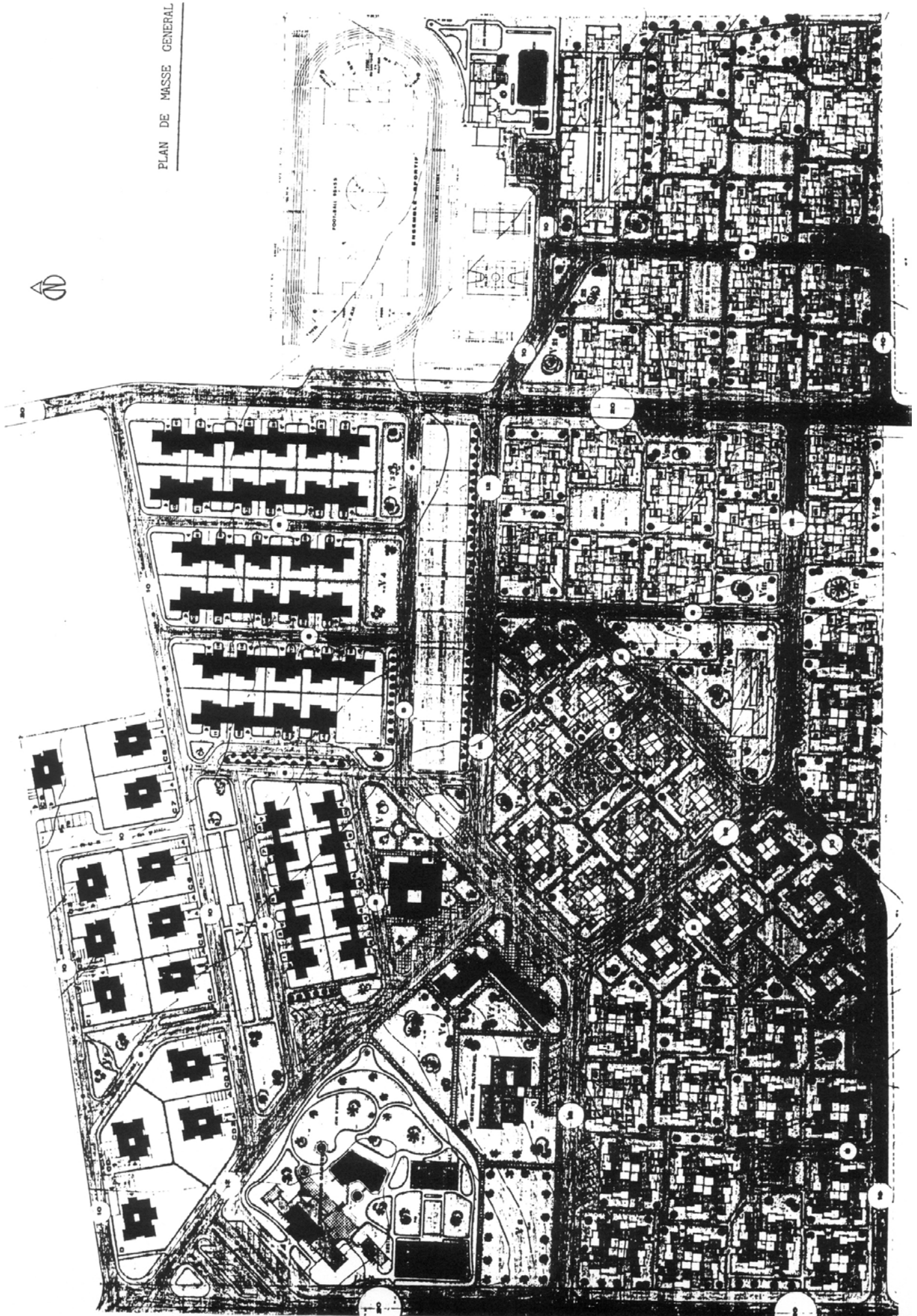
- T.E.M. enterprise
Interior/exterior electricity
433, Boulevard Mohamed V
Casablanca, Morocco
Tel. 24-29-53

- El Fath carpentry co-operative
Wood works

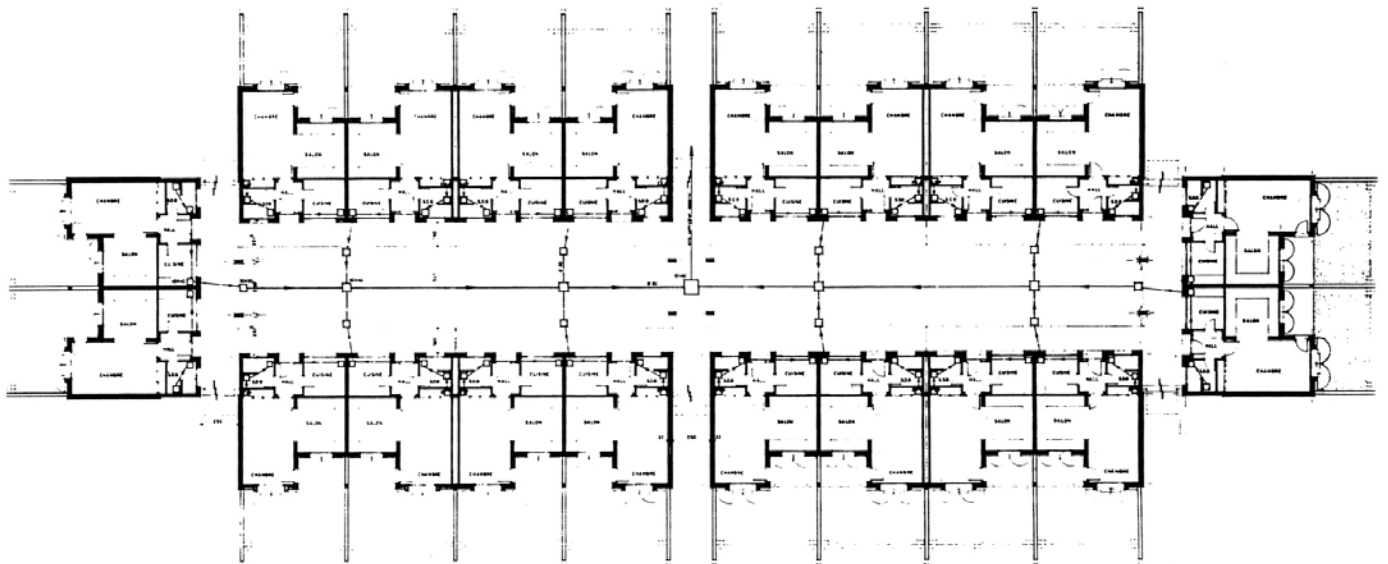
Artisanal Carpentry Co-operative
Quarzazate, Morocco

- Moussaada s.a.
Paint work, glass panes
6, Rue d'Iran
Rabat, Morocco
Tel. 73-17-33

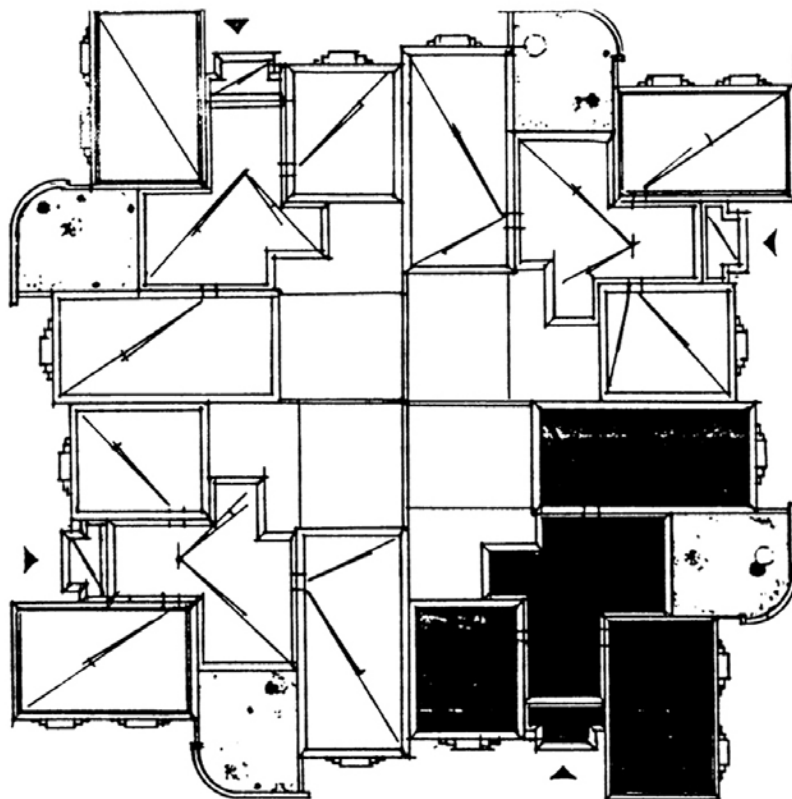
- Corsin Aquatra
Swimming pool
57, Boulevard Ben Yacine
Casablanca, Morocco
Tel. 30-10-62 / 30-42-22



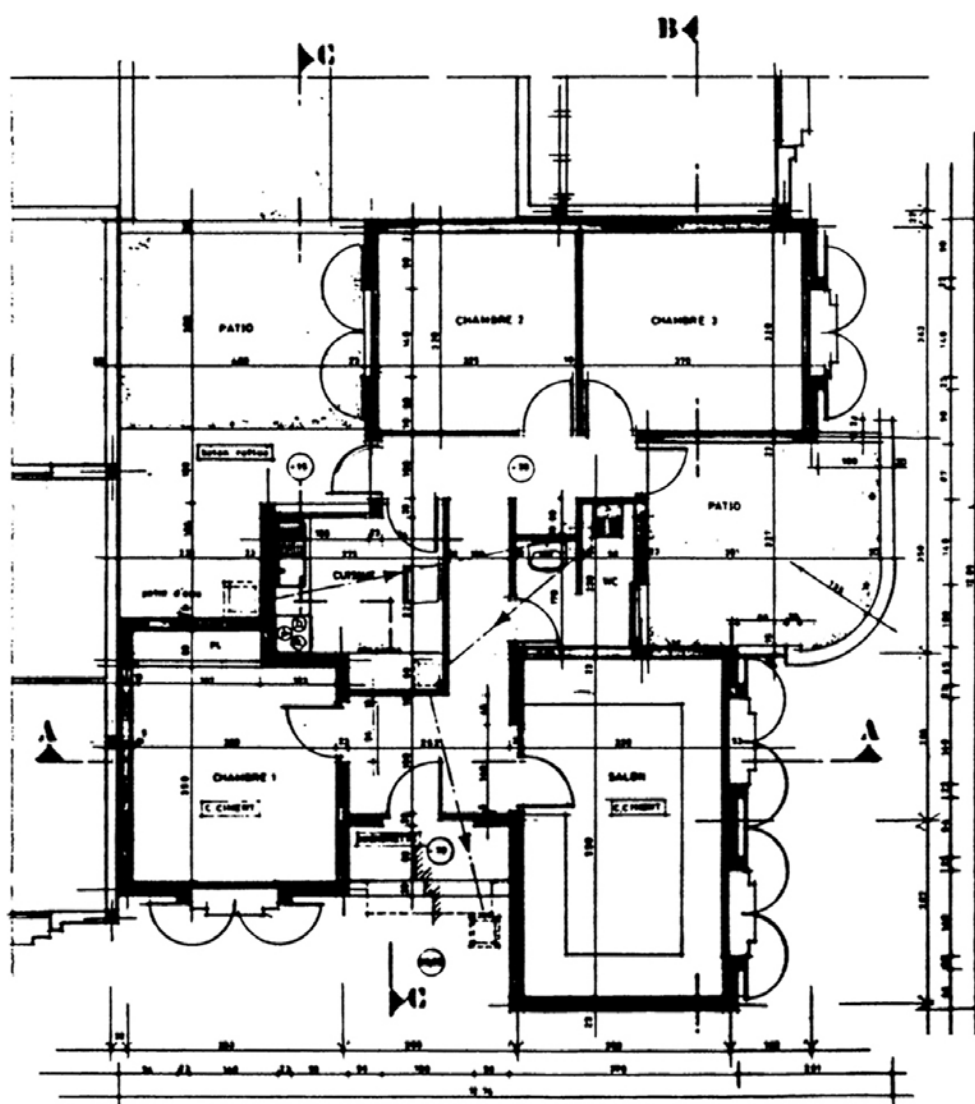
Tinghir Miners' Township, Ouarzazate, Morocco



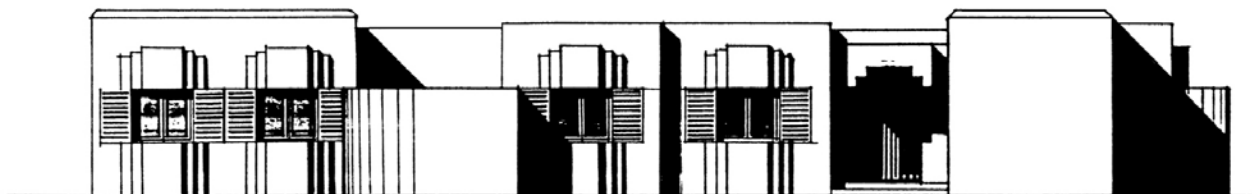
Single person housing, ground floor
plan



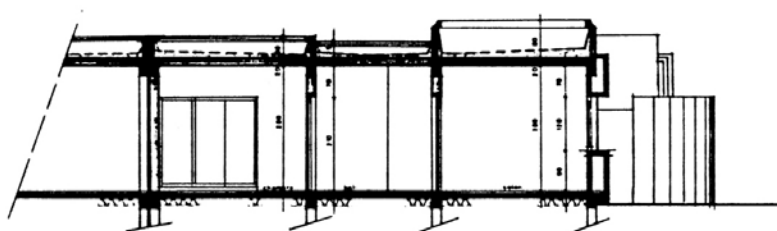
TERRASSES ECHELLE 1/100



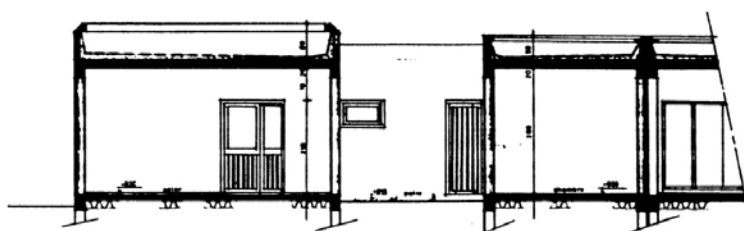
REZ DE CHAUSSEE



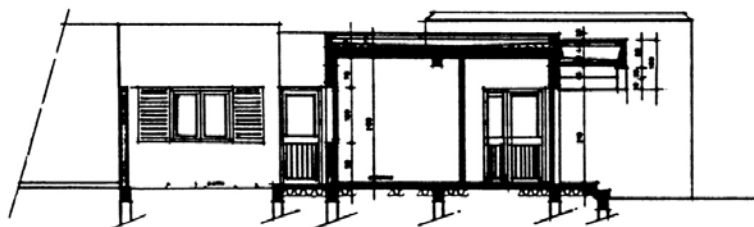
FACADE PRINCIPALE



COUPE AA

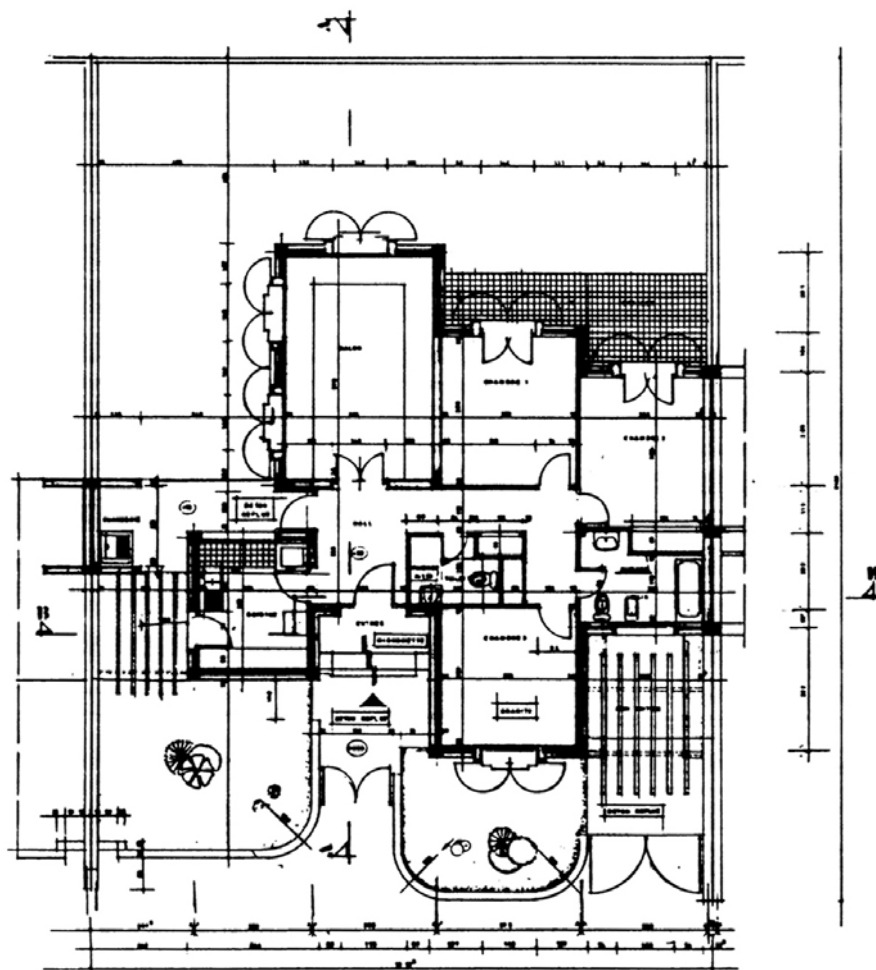


COUPE BB

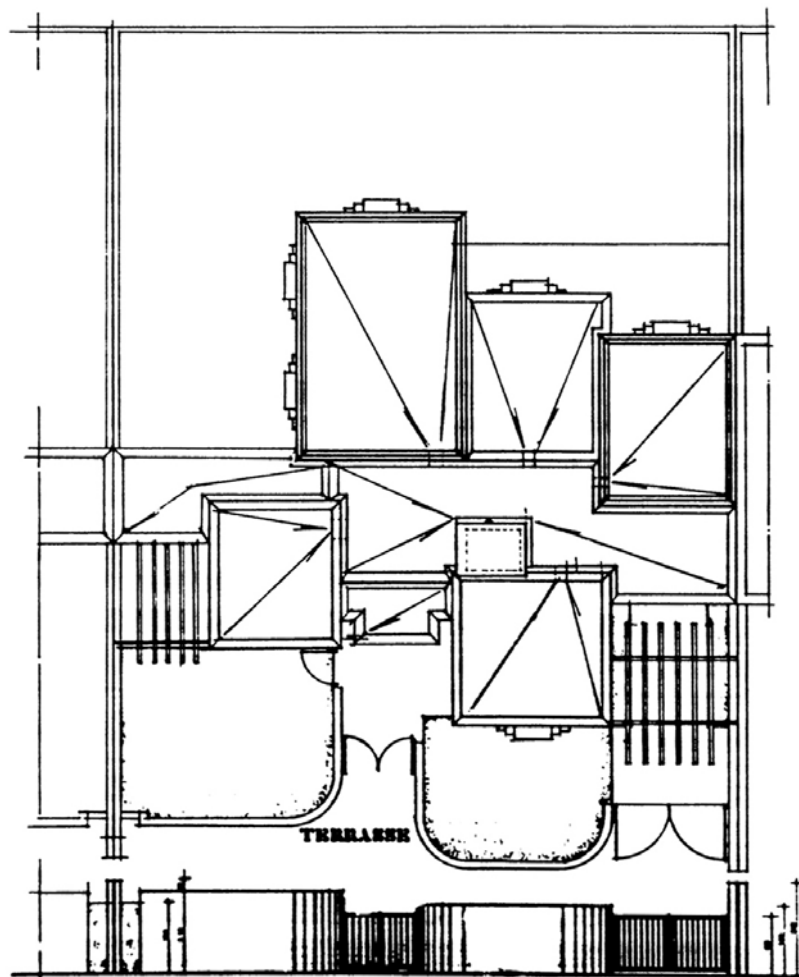


COUPE CC

HOUSING

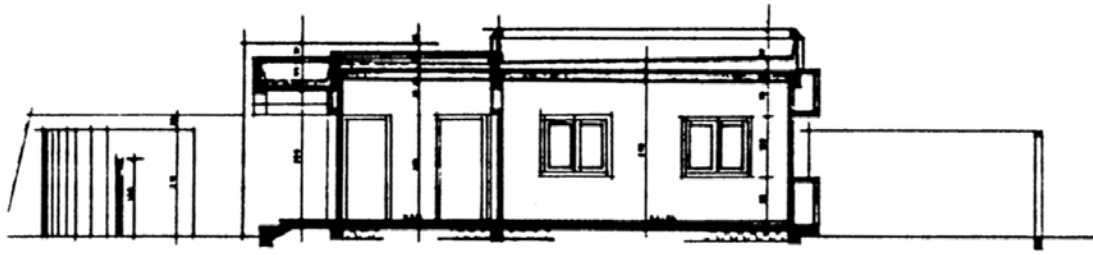


PLAN DE CHAUNNEK

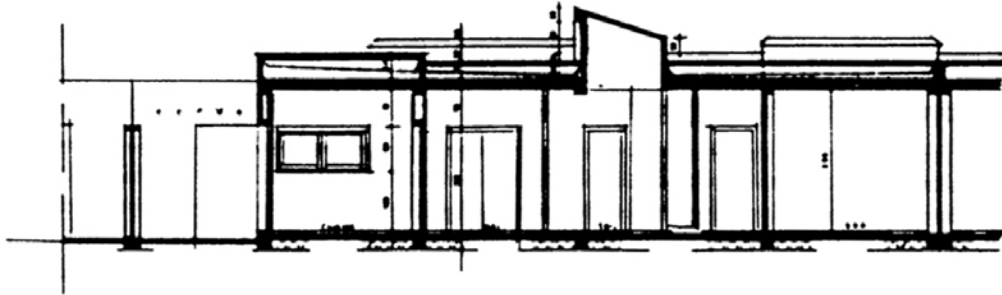


TERRASSE

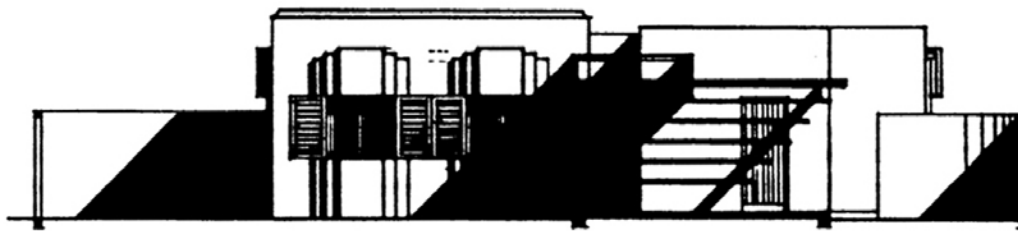
HOUSING



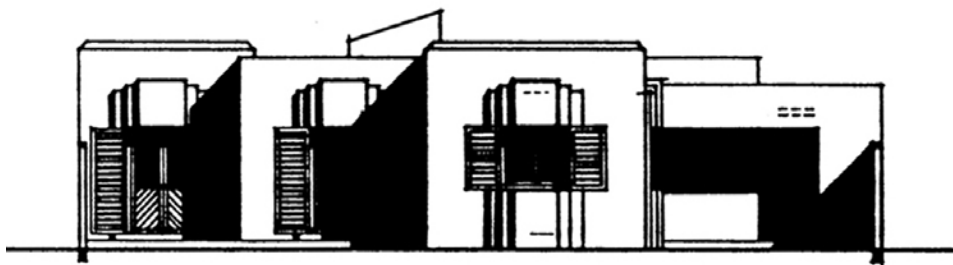
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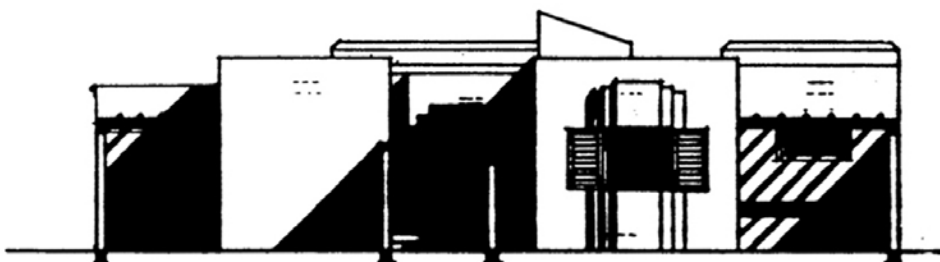
COUPE BB



FACADE GAUCHE



FACADE ARRIERE



FACADE PRINCIPALE