

## V.3 HOUSING AND THE CONSTRUCTION INDUSTRY

## Progress Report

June 1, 1977 - September 1, 1977

I. SYNOPSIS OF PROJECT. (See initial project proposal and progress report of June 1 for detailed description.): The project includes three subprojects with each covering a particular aspect of the housing situation in Egypt. The work program for the projects is essentially in three phases: Phase 1) familiarization with situation of Egypt, identification of data required, initiating collaborative contacts with appropriate government agencies, and detailed structuring of research; 2) collection of required data through field surveys, published reports, discussions with the various ministries, and outlining tentative areas of conclusions and recommendations; and 3) evaluation and analysis of data, preparation of recommendations, discussions of preliminary conclusions with informed officials and professionals, preparation of final report, and identification of areas/issues which require further detailed research.

The subproject "Housing and Public Policy" is concerned with national housing policy with the objective of developing a model for evaluation of public policy options. A basic model of the housing market has been developed based on extensive discussions with ministry experts, previous studies, and field research. Sufficient specific data which are required to test alternatives have been collected to allow initial limited computer runs to test the model as well as to suggest preliminary recommendations. The final phase of the work will focus on calibration of the parameters of the computer model through inputs of more refined detailed data. Various alternative scenarios will be tested for consideration of the ministries concerned with housing.

The goal of the subproject "Housing Construction Industry and Materials Supply" is to determine priorities for the allocation of resources and investments to increase the availability of building materials. The focus is on resources, production, distribution, and consumption of selected materials, both conventional and non-conventional. Extensive data have been collected on cement, bricks, steel, glass, and gypsum, and

data are almost complete for lumber, floor tiles, and sanitary fixtures. Consumption data are still being prepared. The data will give some indication of housings' share in production and consumption of major building materials and allow the determination of alternative scenarios of materials usage in housing. Recommendations will be developed in the final phase for maximizing the efficiency of use of both traditional and alternative materials.

The final subproject, "Housing Construction Systems and Design Norms," is concerned with developing guidelines/references for appropriate housing and physical planning. There are two primary areas: 1) a study of the industrialized building systems in Egypt with focus at the dwelling scale; and 2) a study of the larger scale aspects of the planning of settlements. In gathering data for both areas, particular stress has been given to a field survey undertaken in six selected low-income areas. These surveys are intended to be the prime source for determination of user needs, physical characteristics of dwellings, existing space standards and costs, and income correlations. Close collaboration has been established with one of the plants producing prefabricated panels and the study of industrialized building systems which allows direct applicability in recommendations and possible testing of modified designs in future research. Also, direct working collaboration has been initiated with the group concerned with settlement patterns/standards and the General Organization for Physical Planning which is responsible, among other tasks, to assist towns throughout Egypt in preparing master plans and housing subdivisions. The planning group intends to develop alternative planning models for low-income areas based on existing and proposed codes, existing settlement realities, and developer/financing mechanisms in the last phase of the work.

Joint recommendations will be prepared combining inputs from all subproject areas for the final phase of the work.

**II. STATUS OF PROJECTS:** All of the subprojects are now in the final phase of analysis/evaluation of data, and preparing conclusions and recommendations.

**A. Activities completed:** Most of the data have been collected by the subprojects, and several field trips have been undertaken directed toward securing the required data.

*Data collection* - all subprojects have essentially gathered the bulk of data required as support for their interest areas. The Housing Economy group has gathered information in two areas: a) material for determining the structure of the housing model; b) data for the calibration of the parameters of the model. This information has allowed the initial structuring of the model and the testing of the computer program. The Materials group has nearly completed its data collection for cement, steel, brick, gypsum and glass, particularly in the production area. Sanitary fixtures, lumber, and floor tiles are in the process of being surveyed and should be completed in September. The study on Industrialized Systems has been focusing its efforts on only one of the pre-fab systems imported from East Germany as a test case. Intensive meetings have been held with both the company's technical experts as well as with the designers of the first buildings with that system. The Site Planning group has focused its data collection efforts on reference case studies of existing settlements, existing and proposed standards for housing and planning, and utility infrastructure standards and costs. Only the utility information is not yet complete at this point.

*Field trips* - All subprojects have had several working trips to Cairo. The emphasis was for M.I.T. team members to work in Cairo during the summer to participate in the data collection efforts. Cairo members will meet with counterparts at M.I.T. during the fall during the preparation of the initial summary report.

**B. Activities planned:** The focus of the last phase of the work is on the preparation of specific, clear recommendations for the use of the various ministries. The "product" from each of the subprojects will be as follows:

**From Economy Study:** a model of the Egyptian housing economy with various public policy alternatives tested through a computer analog.

**From Materials Study:** a) detailed data on specific materials including production, distribution, and consumption. b) specific recommendations as to possible causes of shortages and inefficiencies, and potential means to alleviate such constraints in building materials for housing.

**From Industrialized Systems Study:** a) development of an evaluation system for prefabrication systems in Egypt. b) analysis and redesign of specific system in Egypt as pilot study to serve as model for other systems to be analyzed in future.

**From Site Planning Study:** a) documentation of 6 selected low income areas studied through field surveys carried out during the summer 1977 b) a comparative evaluation of old Cairo, a public housing project, and an informal sector areas as a basis for developing alternative physical planning models for future large scale housing developments.

**Field trips:** Field trips are planned by Cairo University personnel to M.I.T. to discuss/prepare the final report as well as to bring remaining data which were collected.

**Conference on Construction in Developing Countries:** Members from both M.I.T. and Cairo University are planning to attend a 4 day conference sponsored by the World Association for Element Building and Prefabrication. Presentations will be made by industrialized housing experts who have experience in developing country situations. In addition factory visits will be made to several of the parent companies whose panel factories are now being imported into Egypt.

**Joint M.I.T./Cairo University Meeting:** Working sessions are planned to be held at M.I.T. during the 2 week period of September 26 through October 7. The purpose of the sessions is to discuss the progress/status of the research up to this point, to make plans for the completion of the initial phase of the research, and to investigate alternatives for future long term proposals. Participants from Cairo University will be a member from the Materials group and all members of the Economy, Industrialized Systems, and Site Planning groups. Three ministry officials from the General Organization for Physical Planning, Ministry of Housing

and Reconstruction, have also been invited to attend. Aside from the specific seminars devoted to present and future phases of the work, group meetings will be devoted toward discussions of specific housing issues critical to the Egyptian situation. Side trips would also be arranged to specific housing interest areas in Boston including a pre-casting factory, on-going housing projects, and meetings with various experts from area universities.

C. Initial Preliminary Conclusions: Tentative recommendations which will be made at the end of the initial phase of the work can already be narrowed down into several areas: 1) Particular emphasis/study should be directed toward the informal sector of housing. This group, roughly estimated at 50-75% of all new construction, must be considered in any future development plans of Egypt; 2) The demand for several building materials is already exceeding the present actual production and emphasis must be placed on more efficient use of existing materials/methods and investigation of alternative, non-conventional materials; 3) The prefabricated housing systems imported into Egypt must undergo extensive modifications, both in the design of prefabricated elements and in the design of the dwelling unit in order for them to be acceptable for low income housing; 4) The problem of low income housing is not with the individual dwelling itself, but one of government provided services/utilities. Government efforts should be directed toward providing basic infrastructure, services, and more appropriate land distribution and subdivision, and should focus on larger scale issues at the settlement scale instead of the individual dwelling.

III. APPLICABILITY OF WORK TO GOVERNMENT MINISTRIES. The research of all of the three subprojects is intended to assist the various ministries in their work. The Housing Economy group's result should be of particular use to the Ministry of Planning as well as the Ministry of Housing and Reconstruction. The model being developed should allow experimentation with various public policy options before actual implementation. Specific policy changes could be tested, for example, relaxation of rent control, and their impact on other sectors of the economy could be ascertained.

The work of the Materials group should be of direct use for the Ministry of Housing and Reconstruction, the Ministry of Planning and the Ministry of Industry. Priorities of investments, areas of shortages for the specific building materials and realistic alternatives with non-conventional materials will be included in some of the recommendations of the work of the initial phase.

The work of the Industrialized Housing group should be of direct use to the various government owned companies charged with using the imported prefabricated systems. Appropriate policies of use as well as specific recommendations for modifications should be of interest to each company.

The Site Planning group is focusing its work for specific use of the General Organization for Physical Planning (GOPP) in the Ministry of Housing and Reconstruction. Use of the work is for government housing investment policies to emphasize land control and provision of infrastructure. The work would be directly used in that the strong ties established include 2 full time architects/planners from the Ministry to assist in the work.

IV. FUTURE DIRECTIONS/TOPICS. Specific areas considered for future research included the following:

*From Housing Economy study:* further refinement of model with the addition of more specific data.

*From Materials study:* further research in new uses of conventional and non-conventional materials with the testing of new materials in real applications; further research into productivity of building materials production and use: evaluation of the efficiency of materials themselves as now used as well as that of labor, capital (equipment) and other materials used in production and installation; research into other non-material constraints on housing production: manpower, construction equipment, and capital.

*From Industrialized Systems study:* expansion of study to include the other large panel systems now being erected in Egypt; testing of actual redesign of panel systems with full size prototypes.

*From Site Planning study:* three areas were identified as appropriate to both MIT and GOPP interests: teaching, research, and practical applications.

*teaching:* discussions centered around offering a seminar in the GOPP during March of next year; participants would be approximately 10 people from the GOPP in an intensive 10 day session evaluating a specific project as a vehicle for discussion and as a means of presenting planning issues. Also, possibilities were discussed, where an outstanding junior member of the GOPP could attend M.I.T. as a student in the Master of Architecture program.

*research:* continued development of basic documentation of reference areas of land/dwelling systems; development of planning models of new areas considering staging, low income people, and cultural and economic situation.

*practical:* demonstration of principles in a specific site, both in a desert area of development, and in an expansion area in the agricultural region.

*A brief summary of the status of each of the three subprojects follows. Each includes Synopsis of Project, Status, including activities completed and planned, Applicability of work to ministries, and Future directions/topics.*

**Subproject:****HOUSING ECONOMY AND PUBLIC POLICY**

**I. SYNOPSIS OF PROJECT.** The subproject represents an attempt to develop a working simulation model of the Egyptian housing economy, and to use this model in establishing and evaluating Egyptian housing policy. The proposed model departs from traditional modeling efforts in developing countries in several respects. The first and most important is that the model is not a direct normative or planning model. It contains no objective function which is either directly or implicitly maximized. Instead the model is a positive forecasting tool, although unlike those developed before. This is the unique feature of the model -- it directly models the institutions that characterize Egyptian housing. These include severe rent control, partial public control over investment and prices, and an extensive black market. The model takes these institutions as given and tries to predict individual behaviour within them. This raises the third advantage of the model -- it contains a wide range of policy parameters. In the short run these include government set housing rents and material prices, public housing investment and factor supplies. In the longer run, the model can be adopted to study the consequences of institutional changes such as the elimination of rent control.

A model so structured offers a number of advantages as a tool in public policy making. Because it is set within the local institutional framework, it cannot be discarded as "unrealistic". Secondly, it in principle can provide policy makers with rough estimates about the long run consequences of alternative policies. As such, the Housing Economy Subproject intends to try to develop a local, Egyptian capacity to run and modify the model--and to integrate it into portions of the housing decision making process.

**II. STATUS OF PROJECT.** During the first 9 months of the subproject, four tasks or goals were identified. To date two of the tasks have been successfully completed.

1. The first task involved developing an "understanding" of the Egyptian housing economy: How it works, public-private responsibilities, regulation, etc. Such "knowledge" was acquired through several trips and extensive talks with contractors, builders, academics, and government officials. At this point, project staff feel that they have a good understanding of the logic and structure of Egypt's housing economy.
  
2. The second task involves translating this understanding into a specific computer-based model. Over the last several months, the project staff have been designing and programming such a model, in Fortran, on MIT's IBM360 series computer. The model is still being tested and debugged now, but the staff feels this portion of the project is progressing well. This final model will be operable on several Egyptian computers. A more detailed discussion of the model is found in Attachment A.
  
3. The third task is to develop close working relations with academics at Cairo University and government policy makers in various ministries, who would aid in the development of the model and be likely candidates to later use it. The project staff feel to date that we have not been very successful in accomplishing this. So far, no economists have been found with sufficient experience in housing problems, and no architects or planners seem to have experience in economic modeling. Our only successful academic contact to date is Professor M.A. Barrada. Things are not appreciably better at the ministerial level. The Ministry of Housing and Reconstruction is a very "administrative" organization, with few planning functions. As such, their responsiveness to some of our overtures has been weak. The Ministry of Planning offers a potentially greater link, but we are only now beginning to explore this.
  
4. The final task is to assemble, from various sources, data needed to calibrate the model. The project is fully aware of what data are and are not available, but to date we have been only moderately successful in acquiring them. We currently have data requests in at the Ministries of Housing and Planning, and at the official census agency, CAPMAS.

III. FUTURE DIRECTIONS. The housing economy subproject currently envisions an extension through the summer of 1978. It is felt that the time is necessary to finish the model, acquire data, expand the Egyptian contacts and actually begin using the model to analyze policy. The following timetable is suggested for these tasks:

-Finish model: Sep. '77 - Dec. '77

-Expand Egyptian contacts: Sep. '77 - Feb. '78

-Acquire data: Sep. '77 - Feb. '78

-Model simulations and policy analysis: Feb. '78 - July '78.

We feel this framework is quite reasonable and anticipate preparing a formal proposal for extending the project.

## Attachment A:

## MODELING THE EGYPTIAN HOUSING ECONOMY

Any attempt to develop a model of the Egyptian housing economy must recognize two important constraints. First, the government plays a major role in regulating the private sector as well as operating a separate public sector. Secondly, there is insufficient data for the application of sophisticated econometric techniques. Both of these constraints are discussed below, and each suggests that an algorithmic simulation approach is the correct and most realistic mode of modeling. A proposed model is then described along with a tentative system of equations.

I. Egypt's housing economy is clearly divided into a public and a private sector, each with its own set of institutions and behavioral parameters. The public sector currently builds essentially a single kind of middle class housing and rents these at approximately 1/5 of cost. Naturally there is excess demand, and waiting lines are long. There appears to be no monetary arbitrage in this market, despite occasional statements in the press that some units are illegally sublet at higher rents. Most local housing offices seem to enforce the law and so it may be assumed that the excess demand is semi-permanent.

Egypt's private sector operates in quite a unique manner. To begin with, one may imagine three submarkets existing within it: one for luxury housing, the other for standard middle class housing, and the third for lower class or "informal" housing. Within each submarket, the standing stock of housing has rents set by law. Units built before 1968 have fairly uniform and extremely low rents. Units built since 1968 have rents set ostensibly at marginal production costs (generally several times higher than old units). For each category of housing, therefore, there is a distribution of official rents.

The important institution that holds this system together is a strong tenants' rights law that prevents a tenant from being evicted as long as he meets the official rent. Landlords, therefore, cannot raise rents (even with a lease) because tenants will simply refuse to pay. The landlord response is to charge a one time entrance fee. Although this is illegal, as are rents above the prescribed level, it occurs only once, as a cash transaction, and is impossible to police. A landlord letting an apartment, therefore, is

essentially selling it or permanently leasing it for an initial fee plus the official rent.

Such a system severely discourages turnover and locks a landlord into a one-time opportunity to cover the lifetime "costs" of his unit. Individuals rarely leave an apartment because they can at best split the new "key money" with the old landlord and will be forced to pay full key money for a new apartment. Each year a few old units do turn over, however, and these plus new units constitute the supply of housing available for occupancy. The "price" such units command is determined by demand, and once rented (effectively sold), that price becomes part of the distribution of prices observed in the standing stock. There is thus a substantial current divergence between the average price of units within a submarket and the marginal price of new or turnover units. Consumer decisions over whether to seek a new unit are based on a comparison of the average-vs.-marginal price. Supplier decisions are based purely on the marginal price.

This system has a number of interesting features to it. For example, if the marginal price of housing is not rising, eventually, as units turn over, the average price will equal the marginal. As this happens, more and more people enter the market since old housing is no longer cheaper than new. In short, the existence of key money eliminates rent control in the long run. The continued existence of units with depressed rents is due more to tenants' rights in conjunction with the steady inflation of housing costs and prices. In such a situation average and marginal prices continue to be different although each moves upward over time.

The system also results in some dead weight efficiency loss. The lump sum fee which is lost if a unit is vacated prevents individuals from freely trading with others, and thus units may be unoptimally distributed to families. The net distributive effect of the system is difficult to ascertain. A great many poor people benefit by probably living in units they could not now afford. At the same time, those poor people who are forced to seek housing at the margin are much worse off paying fixed key money rather than rent. Wealth among the poor is scarcer than income.

A final escape valve is the opportunity to double up with relatives. If the number of households vacating units plus new family formation exceeds the units vacated plus new construction, prices rise until the excess demand is temporarily forced to seek shelter with others. Families who have doubled up represent a continual pool of those looking for final homes.

II. In any economy which is characterized by multiple sectors -- some of which have permanent excess demand -- supply and demand curves are discontinuous and difficult at best to identify. Such features are hard to capture with a system of econometric equations. Thus even if adequate data were available, an algorithmic simulation model might more realistically portray the features of Egypt's housing market.

Reinforcing this methodological approach is the fact that a usable time series on housing production, consumption, price and so forth simply does not exist. Scattered pieces of information are available for selected years and there is a wealth of small-sample or impressionistic information, but these are clearly inadequate for econometric work. An algorithmic simulation with "guestimated" parameters appears to be about the best that could be expected.

III. The model will begin by taking the current period distribution of people into houses ( $N_{ij}$ ), the previous period's set of factor prices and rents ( $P_{\ell}$ ,  $R_1$ ,  $\bar{R}_1$ ) and the growth in urban families ( $\Delta H_j$ ). Based on previous prices some households do decide to improve their housing and others are forced to vacate for random reasons. The closer average rents are to marginal ones, the more this occurs (III. A., B., C.). This group, plus new families and those in group quarters, constitutes each period's demand. The supply of units for occupancy in each period is composed of those units vacated plus new construction ( $CI_1^T$ ). New construction depends on profits which in turn are estimated by the previous period's price of housing and the current prices of materials. It is assumed that suppliers pay black market prices for factors, either directly or implicitly with waiting costs (in the case of queues). Official government prices for materials set a floor, but not a ceiling on factor costs. Given construction intentions, factor demands are developed (II. A., B.).

Factor supplies are fixed in the short run since they are determined by previous prices (if the factor is private) or by government action (if public) (II., C.). The allocation of factors to contractors is determined by a short-run market equilibrium in which prices adjust to distribute to those contractors willing to pay the most (based on expected profits) (II., D.). Construction proceeds (II., E.) and the new units are added to vacated ones for "sale" (IV., D.).

The pool of demanders is then allocated to the available stock with a logit choice model (III., D.). Since most people will seek to locate in the few public units that are available, this excess demand must be re-allocated to the private sectors (IV., A.). Short-run housing prices, in this marginal market, are then adjusted to clear the market (IV., B.). Again, excess demands are eliminated through doubling up.

The pattern of allocation that results in this marginal market is then used to update the overall configuration of families in units (IV., C.), and the housing prices that were necessary to clear the marginal market get averaged in with those of the standing, non-active stock (V., A.). Finally, of course, these marginal housing prices form the basis of consumer and developer decisions in the next period. Similarly, prices established in factor markets are used to establish the next period's factor supplies (II. A., C.; III. A., B.).

This forms the tentative structure of the model. The lag structures are certainly subject to change and numerous values of the various parameters (I. E.) will have to be estimated. Our current view is that this will be done from ad hoc data -- and then evaluating model forecasts in light of recent actual market behavior.

## I. Notation

## A. Subscripts

1.  $i = 1, m$  categories of housing supply

(Example:  $i = 1, 5$ , #5 is doubling up, 4 is public housing, 1-3 are various private types.)

2.  $j = 1, n$  classes of families

(Example:  $j = 1, 3$  low, medium, high income)

3.  $t$  = time period

4.  $l$  = type of factor  $l = 1, p$

## B. Prefixes

S = supply

D = demand

C = consumption (ex post)

## C. Variables

$\Delta H$  = increase in number of families

M = units of factor

F = units of housing (stock)

I = units of housing investment

R = housing rents

N = number of families living in standing stock

$r$  = rate of return on capital

P = factor prices

- D. Variables with a  $\hat{\phantom{x}}$  over them (e.g.  $\hat{I}$ ) are exogenous.

## E. Behavioral Parameters

$\alpha_j$  = utility parameter = share of income spent on non-housing items

$\beta_{1l}$  = prod. coefficients

$\pi(\ )$  = profit function

$m_l(\ )$  = supply function for non-public factors

$\gamma_1$  = short-run adjustment coefficients for rents (prices)

$d_1$  = exogenous rate of annual unit vacancies

$\delta_l$  = short-run factor price adjustment coefficients

## II. New Construction

### A. Desired construction of new units as a function of expected profits

$$\pi_i^T = \frac{R_i^{T-1} - \sum_l \beta_{il} P_l^T}{\sum_l \beta_{il} P_l^T} \quad i = 1,3$$

$$DI_i^T = \pi(\pi_i^T) \quad i = 1,3$$

### B. Factor demand as a function of desired construction

$$DM_{il}^T = DI_i^T \beta_{il} \quad \begin{array}{l} i = 1,3 \\ l = 1,p \end{array}$$

### C. Factor supplies as a function of factor prices and government usage for public sector construction

$$SM_l^T = \hat{M}_l^T - CI_4^T \beta_{4l} \quad \text{if } l \text{ is public factor}$$

$$SM_l^T = M_l^T (P_l^{T-1}) - CI_4^T \beta_{4l} \quad \text{if } l \text{ is private factor}$$

### D. Determine current period market factor prices to equilibrate demand with fixed factor supply (based on previous period prices).

$$\Delta P_l^T = P_l^T \delta_l \left[ \sum_{i=1,3} DM_{il}^T - SM_l^T \right] \quad l = 1,p$$

### E. Final factor consumption and unit construction

$$CM_{il}^T = DM_{il}^T \quad \begin{array}{l} i = 1,3 \\ l = 1,p \end{array}$$

$$CM_{4l}^T = CI_4^T \beta_{4l}$$

$$CI_i^T = \min_l [\beta_{il} CM_{il}^T] \quad i = 1,3$$

$$CI_4^T = \hat{CI}_4^T$$

### VII. Final Housing Demand

A. Utility to families of renting new units at competitive private "rents

$R_1^{T-1}$ :

$$U_{1j}^T = U_j(y_j - R_1^{T-1}, Q_1) \quad \begin{array}{l} i = 1,3 \\ j = 1,3 \end{array}$$

$$UMAX_j^T = \max_{i=1,3} [U_{ij}^T]$$

B. Utility to families of continuing to live in units at controlled rents

$\bar{R}_1^T$ :

$$\bar{U}_{1j}^T = U_j(y_j - \bar{R}_1^{T-1}, Q_1) \quad \begin{array}{l} i = 1,5 \\ j = 1,3 \end{array}$$

C. Determine what proportion of families living in the standing stock will seek relocation in any period:

$$\begin{aligned} H_{1j}^T &= d_j N_{1j}^T & \text{if } \bar{U}_{1j}^T > UMAX_j^T & \quad \begin{array}{l} i = 1,4 \\ j = 1,3 \end{array} \\ &= N_{1j}^T & \text{if } \bar{U}_{1j}^T < UMAX_j^T & \end{aligned}$$

$$H_{5j}^T = N_{4j}^T$$

$$H_j^T = \sum_{i=1,5} H_{ij}^T + \Delta \hat{H}_j^T$$

D. Determine the pattern of housing demand from this "pool" of families

$$DF_{1j}^T = \frac{e^{U_{1j}^T}}{\sum_i e^{U_{ij}^T}} H_j^T \quad \begin{array}{l} j = 1,3 \\ i = 1,5 \end{array}$$

$$\text{where } U_{1j} = U_{1j}^T \quad \begin{array}{l} j = 1,3 \\ i = 1,3 \end{array}$$

$$U_{1j} = \bar{U}_{1j}^T \quad \begin{array}{l} j = 1,3 \\ i = 4,5 \end{array}$$

## IV. Short-Run Equilibrium

## A. Distribute excess demand from public sector to private sectors

$$\text{If } \sum_j DF_{4j}^T > SF_4^T \quad \begin{array}{l} j = 1,3 \\ i = 1,3,5 \end{array}$$

$$\text{recompute } DF_{1j}^T = \frac{e^{U_{1j}}}{\sum_{i=1,3,5} e^{U_{1j}}} (H_j^T - SF_4^T)$$

## B. Adjust private prices so that excess demands are zero

$$\Delta P_i^T = \gamma_i [\sum_j DF_{1j}^T - SF_1^T] P_i^T \quad i = 1,3$$

## C. Final consumption of new and vacant houses in period T is added to those remaining in standing stock

$$N_{1j}^{T+1} = N_{1j}^T - H_{1j}^T + DF_{1j}^T \quad \begin{array}{l} i = 1,5 \\ j = 1,3 \end{array}$$

## D. Available housing supply in each period equals vacated units plus new construction

$$SF_1^T = \sum_j H_{1j}^T + CI_1^T \quad \begin{array}{l} i = 1,4 \\ j = 1,3 \end{array}$$

## W. Long-Run Equilibrium

## A. Price of new and turnover units gets averaged into current stock

$$\bar{R}_1^T = \bar{R}_1^{T-1} \frac{[\sum_j (N_{1j}^T - H_{1j}^T)] + P_1^T (\sum_j DF_{1j}^T)}{\sum_j (N_{1j}^T - H_{1j}^T + DF_{1j}^T)} \quad i = 1,3$$

*Subproject:*

## HOUSING CONSTRUCTION INDUSTRY AND MATERIALS SUPPLY

I. SYNOPSIS OF PROJECT (see the initial project proposal for a detailed description): The focus of the study is materials as an input to construction and the technology and economics of their production, distribution, and use. Products after the first year are to be in three areas: (1) a survey of the availability and utilization of major construction materials in Egypt; (2) tentative recommendations pertaining to the alleviation of the constraints imposed on housing production by particular materials; and (3) suggestions as to directions for future investigations. Concentration is to be on conventional as well as non-conventional materials, assessed as to their future potential in Egypt.

Research activities for the first year have been divided into three general phases. The initial phase consists of overall structuring of the research, identification of the materials traditionally used in housing construction in Egypt and those which might be used, and data identification. The second phase is detailed data collection and compilation. These phases are anticipated to extend through September or longer if necessary. The third and final phase, identification of apparent materials shortages and inefficiencies in their use in housing construction and the underlying causes and formulation of recommendations to alleviate these difficulties, is to proceed through November, with some preliminary findings and tentative conclusions by September. December is reserved for the preparation of the first year report.

II. STATUS OF PROJECT: At this point, Phase 1 activities have been completed, Phase 2 is well underway particularly in the traditional materials area, and Phase 3 is just beginning. All activities are expected to be completed, as scheduled, during the coming period. Three trips to Cairo have been made to date, with at least one trip to MIT scheduled for the remaining quarter as well as perhaps another trip to Cairo.

A. **Activities Completed:** Phase 1 activities were finalized in July when the Egyptian and MIT teams met in Cairo. The type of data to be collected for the traditional materials is basically in line with that in the initial data list presented in the June progress report, with a few modifications, particularly in the consumption area, as indicated below. It was agreed that data collection efforts would continue to be focused on cement (used in concrete work, mortars, and plastering), steel (reinforcing bars), and bricks (red, sand-lime, cellular concrete, and new clay bricks), proceeding to glass, lumber (used in both the final structure and in its construction), sanitary fixtures, and floor tiles (primarily cement tiles) as time permits. As for the non-conventional materials, some preliminary work had been done on plastics, gypsum, and other materials, and it was agreed to focus future activities on stabilized earth, gypsum, and lightweight concrete, among others.

The status, present and future, of Phase 2 activities, data collection and compilation, is summarized below with respect to, first, traditional materials and, then, non-conventional materials. A list of the tables and figures summarizing much of the data gathered to date on (1) general information, (2) cement, (3) steel, (4) bricks, (5) glass, and (6) gypsum is included as Attachment A. The sources of information were recorded for each type of data for reference purposes and are noted below in the discussion of the data collected and that remaining to be collected on the various materials. Lumber, sanitary fixtures, and floor tiles remain to be surveyed as time permits. In gathering the necessary information, certain guidelines were set forth, including: (1) recording, whenever available, the same type of data from more than one source, leaving the judgment of reliability to the data analysis stage; (2) avoiding, as much as possible, the duplication of any data that was included in the on-going Ministry of Industry studies of the building materials sector (referred to as the Booz, Allen, Hamilton study) and of the metallic products sector (referred to as the Atkins Planning Study), unless there was a necessity for comparison; and (3) concentrating, whenever possible, on the consumption and trade data compared with local production and on production cost against official and current sales prices with time. Activities in gathering data have also included monitoring and translating articles from local newspapers, dealing with the housing

problem and with suggestions by authorities for its solution, which are of help not only to the materials group, but to the entire housing project.

Much of the basic production, trade, and planned investment information per the data list in the June progress report has been gathered for cement, steel, bricks, and glass. The major sources have been visits to the four cement plants as well as other materials plants, a Ministry of Planning report on steel, and updating of the Building Research Institute's study of bricks, as well as a few other sources like the Central Agency for Public Mobilization and Statistics' Statistical Yearbook, Federation of Egyptian Industries' Yearbook, Ministry of Housing and Reconstruction's Programme of Reconstruction and Development, Joint Housing Team's (MOHR, MOP, A.R.E. and Office of Housing, US AID) Immediate Action Proposals for Housing in Egypt and Housing and Community Upgrading for Low Income Egyptians, and various tables and figures collected from the Ministries of Housing and Reconstruction (MOHR), Industry (MOI), and Planning (MOP). The Booz, Allen, Hamilton and Atkins Planning reports have been particularly useful sources. In the case of the red bricks produced mainly by private sector factories, a special approach was adopted for collecting data on production, whereby data was based both on official records for brick factories (from General Organization for Industrialization) and on selective field surveys of the factories themselves. In some cases, the full time series remains to be completed; for example, volume of production and imports/exports of materials in quantity terms will, if possible, cover the years 1960, 1966, and 1970-1976. Furthermore, planned expansion of production capacity up to 1985, with an indication of the status of the project (e.g., under construction, financed, or planning stage), is still missing in some cases. These particular items are needed for the housing economy model subproject as well as for our own work. Various other items of information, such as an indication of inputs into production, have been collected for some materials and are of primary interest to the materials project.

An item of information which we had thought was not available, but which we found at least for cement in the Booz, Allen, Hamilton report, is the sale of materials to housing as well as to other sectors. This gives us the share of production legally going to housing. With it and our estimates of housing's consumption of materials, we can get some estimate of the quantity of materials

flowing into the housing sector from other sectors via the black market. The sales distribution offices are probably the best sources for this information for the regulated materials, cement, steel, glass, and lumber; the unregulated materials are unlikely to have such central offices. The Booz, Allen, Hamilton and Atkins Planning reports are also possibilities. If these fail, it should be possible to estimate sales of at least structural materials on the basis of cement sales to housing. These data will be obtained for 1960, 1966, and 1970-1976 where possible.

The collection of consumption information is more difficult but very important, as this sets our study apart from the other on-going materials studies. That is, we agreed we should focus on materials usage in housing, and how it might be made more efficient by, for example, using traditional or alternative materials in new ways. The list of data pertaining to consumption in the data list in the June progress report needs some revision in light of our findings. As for consumption of materials on an aggregate basis, some information has been collected for cement, steel, bricks, and glass, and more is available in a report, entitled Consumption Estimates of Some Building Materials in A.R.E. up to the Year 1982, prepared by Dr. Youstri Khedr Ismail of the Faculty of Commerce at Cairo University, for the General Egyptian Organization for Building Materials and Ceramics. The Booz, Allen, Hamilton and Atkins Planning reports also have some such figures. The difficulty with this type of data is that the basis for such figures is generally not made clear in the published source.

For aggregate consumption of the seven materials for 1960, 1966, and 1970-1976, it is probably best just to use production plus imports minus exports plus any change in inventories as an estimate (local sales might alternatively be used). Projections to 1985 can be done on an investment basis using the MOHR's and MOP's figures on materials use per LE of investment and planned investment in various industry categories; the Booz, Allen, Hamilton report used this as one approach for estimating future cement consumption, but then estimated other materials on the basis of their cement figures. We have some data on this from MOHR and MOP, but they are inconsistent with each other and incomplete; we are presently trying to clear up these questions and get further information.

Most important is consumption of materials by housing. This is best estimated on a disaggregate basis using technical coefficients (i.e., volume of materials per square meter of housing) and volume of housing production. This should be done for a couple different types of housing, such as 3 or so kinds of formal housing (i.e., public/private, low/medium/high income level, load-bearing/skeleton-frame construction), 1 or 2 kinds of informal housing, and 1 prefabricated model. The housing economy model subproject is trying to obtain estimates of housing production on this disaggregate basis for 1960, 1966, and 1970-1976 through the MOHR, and their model will project housing demand to 1985.

As for the technical coefficients, several possible sources exist. For formal housing, these include: (1) the Joint Housing Team's Immediate Action Proposals for Housing in Egypt; (2) an estimating book, prepared by the General Organization of Building Contractors, available in the library of the Building Research Institute; (3) the work which Mr. Ahmed Gharib's group at the MOHR is doing; and (4) data used at the governorate level for their allocation of materials (obtainable by visiting one or two governorates). The 1962 and 1977 (not yet passed) building code and specifications law and 1969 modification of the law might also be helpful. The suggestion was also made by the Egyptian team that we develop our own technical estimates based on typical plans which can be obtained from the MOHR; this has been done for brick usage in low-cost housing, and could be expanded to include various types of housing and various materials. As for informal housing, the Joint Housing Team's Housing and Community Upgrading for Low Income Egyptians has some information. Secondly, the informal sector survey of the housing project is to produce the raw data on materials usage (e.g., structural type, internal and external wall thicknesses, wall height, and dimensions of rooms for units surveyed -- from this brick usage can be estimated) and to develop typical housing types with materials usage indicated; some of these figures have already been developed. Finally, we also had an interview with a small contractor who detailed, in price and quantity terms, the materials used in very low-cost (though not specifically informal) housing. One thing which needs further investigation still is what percent of these materials in the informal sector are recycled. As for prefabricated housing, we have some figures on cement and steel use in the shell from Dr. Adel Fareed of Prefabricated Houses

Company and a table from the MOHR giving cement requirements for production and erection of the units by various plants. This should be sufficient for getting at least a rough estimate of the technical coefficients for such housing; the architectural component of the housing team may be able to give us some further information as their project progresses.

One last item falling under the consumption category in our initial data list is official and black market prices of the seven materials for 1960, 1966, and 1970-1976. Some information has been collected on this. Sources we have include the Joint Housing Team's Immediate Action Proposals for Housing in Egypt and Housing and Community Upgrading for Low Income Egyptians and Battelle's Egypte Resume and Egypte: Statistiques de la Construction. Additional sources pursued or being pursued in Egypt include the sales distribution offices, the ministries, the Central Organization for Prices in Nasr City, and talking to some contractors who purchase materials regularly.

In summary, these various data will give us an indication of housing's share in production and consumption of major building materials, as well as a clear picture of alternative scenarios of materials usage in housing. Based on this and our knowledge of materials availability in Egypt, we can begin to develop recommendations for maximizing the efficiency of use of both traditional and alternative materials in housing.

Phase 2 activities of data collection and compilation in the area of non-conventional materials have also been progressing. In order to start discussions respecting possible non- or under-utilized materials for housing, preliminary exploratory reports were prepared, respecting: (1) plastics, (2) gypsum, and (3) other materials. The rationale behind the plastics and composites report was that, with the growing petrochemicals industry in the Middle East, polymeric materials and the composite materials employing them are at least of potential interest in housing. They have exhibited rapid growth in the United States, Europe, and Japan, particularly in the form of composites. Whether or not this is a potential source for the future depends upon the growth of the industry, particularly in Egypt. Prospects look somewhat promising though in that it has been learned that plastics are to be locally produced by a joint venture company for the petrochemicals industry, providing Egypt with nearly 300,000 tons yearly of plastics such as PVC, polyethylene, polystyrene, and polypropylene, and that a limited amount of

melamine resin is already being produced by a public sector company at Mansoura City.

With respect to gypsum, Egypt has large deposits and a long history of use, but its potential appears not to be attained. This is particularly true of some of the newer developments in gypsum such as fiber reinforcement, which greatly increases its strength and resistance to impact. Others are newer plasters and hard cements derived from gypsum. As indicated by the list of tables and figures in Attachment A, much data has already been gathered regarding the availability and use of gypsum in Egypt.

Among the materials briefly noted in the third paper are: stabilized earth, surface-bonded block, sulfur, high-strength mortars, bamboo, high-speed paint spraying, and lightweight wall and partition construction. Stabilized earth is of great interest as a low-cost, widely-available material, particularly for single-storey or low-rise housing in towns, villages, and rural areas. A great deal has been done in other parts of the world that should be examined preparatory to possible development in Egypt. In surface-bonded block, masonry units such as concrete block and brick are laid up rapidly without mortar, and fiber-reinforced mortar is then plastered to the surface, bonding the wall and providing a weather and wear-resistant surface. Although glass fiber has been used most, natural fibers available in Egypt may perform satisfactorily. Sulfur is becoming available in many parts of the world as a by-product of oil extraction. It has been shown that building blocks and mass concrete bonded with sulfur rather than portland cement can be achieved at low cost. If sulfur is available in Egypt at low cost, as it appears it might be, it may help to ease the cement problem for concrete and concrete block. The promising work at the Building Research Institute respecting the new and improved clay bricks brings up the question of improved mortars. The incorporation of polymeric materials can greatly increase the tensile and shear strengths of mortars, as well as their adhesion to brick and block. Other additives and replacements for cement and lime may also result in improvements, leading to improved quality and more efficient methods of construction with masonry. Bamboo has already been well-studied in Egypt as well as elsewhere; its potential and problems are well known. Methods of painting entire rooms by power spraying have been developed which greatly reduce the time and materials involved in finishing buildings. This might be

particularly appropriate for the new prefabricated housing soon to be erected in Egypt. Wall and partition construction, involving light metal framing and a variety of wallboards, including gypsum, and making provision for utilities such as electrical lines, greatly reduce the weight of buildings and accelerate the construction process.

As a consequence of these three preliminary reports and the joint meetings in Cairo in July, it was decided that stabilized earth, gypsum, and lightweight concrete would receive special emphasis in the immediate future. In addition, consideration is also to be given to sulfur, high-speed spray painting, surface-bonded block, improved bonding of masonry, plastics as adjuncts to other materials, and sandwich construction. In search of further information in these areas, letters have been written to various agencies, such as the East-West Center in Hawaii, United Nations, Bandung Institute of Technology in Indonesia, and CENAC at Ciudad Universitaria in Colombia, and some replies received, as well as a review of the available literature begun. Investigation of the availability of the requisite materials, in both raw and manufactured forms (e.g., gypsum, materials for lightweight aggregate, sulfur, water glass, and flue ash) is underway in Cairo, with much data already collected on gypsum as indicated in Attachment A.

Phase 3 activities are just beginning. Tentative conclusions and recommendations concerning each building material studied, leading to a developed technical and economic basis for a national housing policy, will be included in the final report ending the initial year's work. According to the preliminary analysis of the data gathered to date, however, two very general observations can be made: (1) the demand for building materials in many cases is already exceeding present actual production; moreover, the rate of increase in the demands in coming years is expected to widen the gap between production and consumption, unless serious and active solutions are taken for alleviating building materials shortages and/or inefficiencies; and (2) the need is essential, therefore, for the improvement of the efficiency of locally produced building materials as well as for the introduction of new concepts for the utilization of locally available raw materials. The following sorts of issues will be taken into consideration in developing our final recommendations: (1) defining any shortage or inefficiency in use of raw materials needed for building materials processing, and the amount of their reserves on short and

long-term bases; (2) identifying, if possible, any obstacles hindering building materials production to establish means for their alleviation; (3) determining local production through time and planned investments, and comparing these with actual consumption to determine needed expansions or new projects; (4) establishing production costs against sale prices through time to detect any exaggerated profits; (5) studying the flow of materials distribution from producing plants to the consumer to locate transportation problems/distribution gaps; (6) determining materials allocation to the housing sector compared with actual materials consumption by that sector to locate any attraction to or from competing sectors; and (7) estimating the technical coefficients upon which the allocation of building materials to housing is based and the actual coefficients for formal and informal housing to locate any waste or shortage in materials usage or distribution.

As for travel in this quarter, in late June/early July, Professor Dietz and Dr. Rossow, along with several other members of the housing team from MIT, went to Cairo for the purpose of conferring and planning with their counterparts. In the course of his week-long visit, aside from meetings at the university, Professor Dietz met with Dr. Moustafa El Hifnawi, Chairman, and others at the Building Research Institute and toured the facility; visited a traditional brickyard and a modern asbestos-cement plant; met with Mr. Ahmed S. Mourad, President, and Dr. Adel Fareed, Project Manager, of Prefabricated Houses Company and with them visited their new plant, one of eleven such plants being erected in Egypt, and a housing site where domed and vaulted roof units on concrete molds were being precast; and, on the last day, went to Suez with several other members of the housing group to see the King Faisal housing development and general reconstruction efforts in Suez, as well as the new vehicular tunnel under the Canal. A major portion of Professor Dietz's time in Cairo was spent in discussions with Dr. Mahmoud Reda, Professor Hassan Fahmid Imam, Dr. Mohamed Ramez, and Professor Ahmed El Erian regarding the three preliminary reports he had prepared and the direction of activities and division of responsibilities for the remainder of the year in the area of non-conventional materials. On his return to Boston, Professor Dietz stopped in London to visit the Building Research Establishment Laboratories at Watford; there, he discussed their work in fiber-reinforced gypsum and its possible application in Egypt and the subject of stabilized earth, as well as obtaining pertinent literature.

Dr. Rossow's two-week visit overlapped with the last couple of days of that of Professor Dietz, during which time meetings with their counterparts and the trip to Suez were the major activities. Most of the rest of Dr. Rossow's first week was also spent at the university. In the course of our various meetings, the materials group reviewed the data on traditional materials that had been gathered, identified the gaps remaining and potential means of filling them, and discussed some preliminary findings and conclusions, as well as confirming our work schedule for the rest of the year. A couple of meetings with the housing group as a whole were also held during the first week in order to bring everyone up to date on the status of the various subprojects. Collaboration among the subprojects is particularly important with regard to the survey of the informal sector. In the course of our general meetings, the details of the survey were discussed and changes incorporated as necessary; meetings with the students actually doing the survey were also held, and trips were made by the MIT team to two formal and two informal areas to be surveyed.

During the second week more of Dr. Rossow's time was spent in the ministries and in meeting with a couple of industry people, although a final wrap-up meeting was held on the last day at the university with the materials group. It was during this week that she had a chance to review the Booz, Allen, Hamilton and Atkins Planning Phase 1 reports (market studies basically). The general feeling was that they have good data on the production side, but focus less on the consumption side. Moreover, they are aimed at total consumption, and are not so concerned with housing's share and how materials are used in housing, whether or not their use is efficient, etc. In the Booz, Allen, Hamilton report, for example, consumption of all materials appears to be based on cement consumption, which might be reasonable if one is considering a particular type or mix of construction and structural materials, but seems less reasonable if one is looking at aggregate consumption with a potentially changing product mix and all materials including finish items. Also, consideration of the informal sector in housing construction appears to be rather vague; in the case of the Booz, Allen, Hamilton report, for example, a figure of 12 percent is added to the official consumption figures to cover repairs, minor works, and other. It was at this point, then, that we decided our efforts should be focused more on the usage side, both in formal and informal housing.

B. Activities Planned: Activities required to complete this first year's effort fall into three categories: Phase 2, Phase 3, and final report writing activities. As indicated in Section II.A, certain data, particularly that pertaining to consumption, remain to be collected on cement, steel, bricks, and glass, while the full set of data is yet to be gathered for lumber, sanitary fixtures, and floor tiles. To the extent possible in this first year, these Phase 2 activities will be completed by the end of September, before the visit of Egyptian team members to MIT. Phase 2 activities pertaining to non-conventional materials will continue through the end of October. Activities at MIT will focus on the collection and review of available literature and other sources of information on the technical and economic aspects of developing/adapting for use and actually using stabilized earth, gypsum, and lightweight concrete, among other less conventional materials, in housing construction; activities in Cairo will be more concerned with investigation of the availability of the requisite raw materials and suitability of such materials for use in Egypt. Phase 3 activities, formulation of our tentative conclusions and recommendations regarding building materials and their use in housing construction in Egypt, on the basis of our first year's findings, will continue through mid-November. The joint meetings to be held at MIT in late September/early October will be an especially important time for development and discussion of these ideas. It is at this time also that the final report will be outlined and responsibility for its writing allocated among the team members, such that it can be completed by mid-December.

As for planning next year's work, a proposal concerning our research activities for next year and beyond will be prepared by mid-October. Possible directions and topics for this research are noted below in Section IV. This will be another major activity to be undertaken in our joint meeting in the early fall.

The last item is travel planned for the remainder of this first year. In late September/early October, Dr. Reda, along with several other members of the housing team from Cairo, is to visit MIT for nearly two weeks. Aside from making it possible for the materials and housing groups as a whole to meet in numerous working sessions, this also gives the Egyptian team members an opportunity to observe and utilize the facilities and resources available in

the vicinity of MIT. In the course of the above discussions, several activities have been noted which are expected to be accomplished at this time, including: final gathering of Phase 2 inputs on conventional materials, discussion of Phase 2 findings to generate Phase 3 outputs, discussion and writing of the proposal for next year and beyond, and finally, outlining and allocating responsibility for the writing of the final report for this initial year. A visit to Cairo by Dr. Rossow in late November has tentatively been scheduled to wrap up Phase 3 activities and the final report.

III. APPLICABILITY OF WORK TO MINISTRIES: Concern over building materials availability and utilization is spread among three ministries, the MOHR, MOI, and MOP, whose activities often seem to overlap and sometimes even conflict. The MOHR, for example, regulates the supply of cement, mainly, it appears, through the Egyptian Cement Office. Through Mr. Mesalamy's office (Under Secretary of Supply and Procurement), the MOHR appears to be involved in trade in all controlled materials, combining planned investment in various sectors with their respective technical coefficients to arrive at materials needed which, when compared with materials locally produced, yields trade figures. Allocation of controlled materials to local governorates for housing construction also seems to be handled through Mr. Mesalamy's office; at the governorate level, then, materials permits are issued for particular types of housing and materials quantities. The MOI regulates the supply of other controlled materials, including steel, lumber, and glass, also, it appears, through distribution offices. Licenses for materials production are issued through the General Organization for Industrialization (GOFI) within the MOI at the time a firm commences operation. The MOP plans investment in various sectors; based on this, then, and their respective technical coefficients, it estimates materials needs much as the MOHR does, except that the two sets of numbers appear to conflict. The MOP also appears to plan investment in expansion of materials production, although it is not clear whether the MOP or the MOI/MOHR initiates this.

Several studies involving building materials to varying degrees, aside from ours, are going on in conjunction with these three ministries. Joint MOHR-AID teams are investigating various housing issues: (1) first, in a rather general context in their initial report, Immediate Action Proposals

for Housing in Egypt, where some issues pertaining to materials in housing are raised and some statistics given; and (2) second, in the more specific contexts of their three more recent reports, one each on finance, urban land use, and low-cost housing, where only the latter gets into the subject of building materials, identifying their use in informal housing to some extent and updating some of the statistics presented in the first report. A study just beginning, under the direction of Mr. Charib in the MOHR, is the development of new technical coefficients for materials use in different types of housing construction; as this is directly relevant to our work, we are presently trying to contact Mr. Charib. The GOFI, within the MOI, under the financing of the IBRD, is carrying out six sector studies with in-house people as well as Egyptian and foreign consultants. Two have been repeatedly mentioned as being of particular interest to our project: (1) building materials sector study (excludes lumber and metal products) using Booz, Allen, Hamilton as foreign consultants; and (2) metallic products sector study using Atkins Planning as their foreign consultants. These we have found to be largely focused on the production end, with estimates of consumption on a rather aggregate basis; we are thus relying on them for some of the more production-type data and trying to focus our efforts on identifying housing's share of production and its usage of materials and efficiency thereof. As of July, the MOP was very actively involved in developing its next five-year plan.

With this understanding of the concerns of the three ministries regarding the availability and utilization of building materials, it is clear that the findings of our study are of potential importance and interest to each of them in their future planning activities. They need to know, for example, whether apparent shortages in the supply of particular materials reflect true shortages (i.e., supply is less than demand perhaps because of certain long-term problems, like insufficient capacity, or more short-term ones, like pricing or unusual sector demands) or whether they actually reflect problems in materials distribution or utilization, among other conditions. On the basis of our findings, then, we can begin to recommend actions whereby government and industry might begin to alleviate some of the constraints imposed on housing production by construction materials; these might include, for example, expansion of production of particular materials, development/adaptation of

new materials, setting/lifting of price controls, and adjusting the utilization of particular materials. We further believe that the current project can play a positive role by assisting the ministries in the development of improved data compilation and usage techniques.

Our interactions with all three ministries to date have been reasonably extensive in an effort: (1) to gain understanding of and insight into how the housing and building materials sectors operate and interact, and what problems they face; and (2) to collect data, as the ministries are the source of much accumulated information. A list of some of our ministry contacts to date, as well as an indication of the nature of the exchange, is given in Attachment B. It might also be noted that Mr. Tarek Selim of the Minister's Technical Office in the MOHR will be coming to MIT this fall to participate in the Center for Advanced Engineering Studies program for a year or so, perhaps ultimately entering a graduate degree program in engineering at MIT. As for the future, we need to make our ministry contacts more solid -- to more firmly enlist the support of under secretaries in the MOHR, MOI, and MOP, with the result that personnel under them begin working more directly with us, as has been more the case in the other ministry-related studies noted above. We need to strengthen our three-way team of MIT-Cairo University-Ministry participants. This is of critical importance if we are to continue to gain the active support and endorsement of the ministries and potential implementation of recommendations we might make, because this is the only way we, and they, can continue to be assured that our activities are relevant to and in the interests of the ministries.

IV. FUTURE DIRECTIONS/TOPICS: Potential directions for work beyond this first year lie in three areas, two involving further research in the building materials field and one involving research into the other resources constraining housing construction. The first topic entails expansion of our work done this year in the area of conventional and non-conventional materials along somewhat more technical lines. Some specific items to be researched might include: improvement of the quality of certain traditional building materials through the utilization of plastics, resins, sulfur, water glass, and fiberglass; stabilization of earth; studying the various aspects of utilizing gypsum in the building industry; production of lightweight aggregates from clayey

deposits and their utilization in the building industry; and determination of optimum use of available limestone deposits in building materials production (e.g., in lime production, as an aggregate for concrete, and as regularly shaped bricks). This program of research would be directed toward studying and utilizing locally available raw materials in the building industry in Egypt, materials which are already largely known and applied elsewhere, although they might be relatively new or untried in Egypt. Research activities thus fall into three basic areas: (1) information search on the particular materials (e.g., their use in other countries, resource availability in Egypt, and so forth); (2) development, as necessary, to adapt the materials to Egyptian conditions; and (3) most importantly, application of the materials in actual production and construction. Dr. Adel Fareed, of Prefabricated Houses Company, might be particularly helpful in such efforts, as he is interested in testing new materials and techniques, such as high-speed paint spraying, alternatives to cement floor tiles, and lightweight aggregates, in conjunction with prefabrication.

Further research into the productivity of building materials production and utilization is a second area of potential interest for work beyond this first year. The productivity and efficiency of particular materials as they are now used in Egypt and how this might be improved warrant further investigation. Moreover, the utilization of labor, capital (equipment), and other materials in the production and installation of these materials is also of concern. Given the greater availability of time and better knowledge of the data base, existing and potential, some of the more sophisticated analytic tools, such as production functions and input-output analysis, may be appropriate for investigation of these issues in the future years of our project.

A third direction for research for next year and beyond is to extend the study to include the remaining resources affecting housing production, so as to complete our picture of resource availability and utilization in housing and construction in Egypt. Probably the next most important resource to study is manpower in the form of skilled and unskilled labor, contractors, and professionals; skilled labor for housing construction appears to be in particular short supply, due to its high rate of temporary migration to other Arab countries where wages are much higher. Construction equipment and capital as needed by contractors for equipment purchase and working capital might also be considered. Land and capital for financing represent still two

more resources impacting housing, resources which the MOHR-AID studies have recently been investigating. In any case, it seems clear that more in-depth analysis of these resource problems constraining housing production in Egypt is needed in the near future.

**Attachment A:****List of Tables and Figures Summarizing Data Gathered to Date****1. General Information**

Number of buildings and housing units in Egypt (May 1966 census)  
 Units built for urban and rural housing (1969-74)  
 Quarry production of building materials (1952, 1969-74)  
 Local production of building materials (1952, 1968-74)  
 Private sector production of building materials during the years  
 1975 and 1976  
 Values of building material industries output (1952, 1969-74)  
 Development of production in construction and housing sectors at  
 current prices (1969-73)  
 Development of labor in construction and housing sectors (1969-73)  
 Development of wages in construction and housing sectors at current prices  
 Development of income in construction and housing sectors at current  
 prices (1969-73)  
 Annual increase in prices of building materials (1961-74)  
 Proportionate cost of materials per 100 £E of residential construction  
 (March 1974)  
 Technical parameters and coefficients of informal sectors (1977)  
 Annual increase in construction costs (1961-74)  
 Cost changes of items encountered in housing jobs during years 1962  
 to 1965  
 Official and unofficial market prices of building materials in 1976  
 Public expenditure by housing and utilities sector as related to  
 total expenditure by all sectors (1969-74)  
 Investments in construction and housing sectors at current prices  
 (1969-73)  
 Building materials demands for 1977 based on an investment plan of 1300  
 million £E of which 715 million £E specified for building and con-  
 struction sector  
 Imports demand estimate for building materials in 1977 based on a 715  
 million £E investment plan  
 Building materials demands for 1977 by private and public sectors based  
 on an alternative investment plan 600 million £E for building  
 and construction sector  
 Five-year plan of investment in building materials for years 1976 to  
 1980  
 Exports and imports of stone, plaster, cement, asbestos and glass  
 (1969-74)  
 Building materials imports (1975 and 1976)  
 Imported building materials during the years 1975-77

## 2. Cement

Cement producing companies and their production capacities  
 Raw materials quantities and chemical composition utilized  
 in cement producing companies during 1976  
 Development of total local cement production from 1961 to 1976  
 Cement production during years of 1970 to 1976 distributed among  
 producing companies  
 Production of clinker and different types of cement by different  
 companies in 1976  
 Additional and total production capacities expected from 1975 to  
 1984  
 Projects for cement production under execution  
 Predicted total production capacities of cement up to year 1982  
 Means of transportation of cement within the period of 1970 to  
 1973  
 Sales and production costs of locally produced types of cements in  
 1973 and 1974  
 Price changes of locally produced types of cement (1973-77)  
 Production versus consumption of cement from 1970 to 1974  
 Cement consumption of various sectors during years of 1970 to  
 1974  
 Quantities of cement allocated to various sectors from 1960 to 1976  
 Estimated demands for cement from 1974 to 1984  
 Exports, quantity and value, within the period 1964 through 1974  
 Exports and imports of cement compared with local production during  
 1971 to 1976

## 3. Steel

Reserves of Egyptian iron ore  
 Iron ore production (1952, 1969-74)  
 Comparison of working efficiencies of steel producing companies  
 Weight percentages of basic materials needed for producing a ton  
 of steel  
 Reinforcing steel production (1952, 1969-74)  
 Production of steel rebars 37 and 52 by public sector companies  
 (1968-73)  
 Production capacities and actual production of steel rebars by existing  
 companies in 1973  
 Expected steel production from expansion projects 1976-1985  
 New production capacities according to planned expansion projects  
 Total planned production capacities until year 1984  
 Steel rebars production and production costs through years 1973, 1974,  
 and 1975 by public sector companies  
 Price changes of steel rebars during the period of 1963 through  
 September 19, 1973  
 Steel prices to consumer for the steel 37 and 52 during the period  
 from September 20, 1973 to May 24, 1977  
 Steel prices to consumer for steel 37 and 52 starting May 24, 1977  
 Means of transportation of steel during 1973  
 Diagram of the distribution process of steel reinforcement

Allocation of locally produced and imported steel rebars to various sectors in 1973

Steel actual consumption and demands estimate until year 1984

Actual and minimum demands for steel 37 and 52 through 1974-84

Variation in factors influencing steel demands with time

Quantity and value of imported steel during 1960-73

Quantity and value of exported steel during 1960-72

Total production and imports of steel compared with distributed quantities to give inventories (1967-77)

Prediction of surplus production for export (based on steel 37)

#### 4. Bricks

Development of brick production from 1963 to 1980

Red brick production (1963-75)

Sand-lime brick production (1965-78)

Estimation of rate of brick consumption per ton of cement (1970-80)

Development of red brick prices from 1970 to 1977

Total number of bricks used for housing construction within period 1970-75 and estimated demands within period 1976-80

Average number of housing units constructed within period 1970-75 and estimated demands to be constructed within period 1976-80

Total shortage in housing units estimated at three different years

Average number of housing units constructed within three time periods

Distribution of housing units constructed between public and private sectors within three time periods

#### 5. Glass

Demand of glass sand up to 1982 for El Nasr Company for glass and mirrors

Glass and foundries sand total demand (1975-82)

Relative weights of production of different thicknesses of glass sheets (1970-74, 75, 76)

Production of transparent flat glass sheets within the years of 1971 to 1976, estimated by area and value

Production of transparent glass sheets, estimated by weight (1971-76)

Development of production cost of transparent flat glass within the period from 1971 to 1976

Factory and consumer prices of different types of glass

Development of the consumption of glass utilized for building purposes in Egypt during the period from 1966 to 1972

Development of consumption of transparent glass sheets given by local sales and imports (1971-76)

Estimates of glass consumption by using the rate consumed per one thousand tons of cement

Demand estimate for glass consumption (1973-82)

6. Gypsum

Resources data

Chemical analysis of different types of gypsum

Location of gypsum quarries and factories in Egypt

Processing data

Production data

Development of consumption in Egypt during the period from 1966 to 1977

Development of gypsum production for 1969/70 up to 1974

Gypsum consumption related to cement consumption

Present market of gypsum products

Expected total demand of gypsum in 1982

Activity chart of the Egyptian Gypsum, Marble and Quarries Company (GYMCO)

Company's activities development from 1969/70 up to 1974

Company percentages production in tons for the various activities during 1974

Company percentages sales in pounds for various activities during 1974

Development of company production and sales from 1966/67 up to 1974

Development of expected production of the company during 1974-1982

Development of labor and wages from 1966/67 up to 1974

Production capacity of projects

Geographic location of expected production

Geographic location of required investments 1976/80

Market needs for gypsum products

Development of expected production of gypsum up to 1982

Adel El Zorghby, Samir  
Naggar

Trying to collect data on and explanation  
of materials requirements of various sec-  
tors for various years and projected materials  
needed to 1985

Michel Rafael, Ramzy  
Shenouda Morcos

Discussion of materials for housing and  
explanation/expansion of table of technical  
coefficients in MOHR-AID's Immediate Action  
Proposals...Egypt

2. Ministry of Industry  
Kamel Maksoud

Undersecretary of Supply--discussion of  
information available in MOI on materials  
for housing and introduction to Mr. Fahmy

A.M. Fahmy

GOFI liaison on building materials sector  
study--discussion of study and introduction  
to people doing study

Rob Voight, Jean-Yves  
Maillet, Tony Mayo,  
Paul Haskell

Booz, Allen, Hamilton consultants to GOFI  
on materials study--discussion of study  
and possibility of getting copy of Phase  
I report

Munir

GOFI--trying to get or at least see Phase  
I reports of Atkins Planning and Booz,  
Allen, Hamilton sector studies

3. Ministry of Planning  
Dr. Saad Hanafi

Undersecretary--discussion of what informa-  
tion MOP might have that would be useful

**Saleih Gobran**

Trying to collect MOP's data on materials requirements of various sectors, investment in construction in these sectors, and associated materials needs to 1985 as well as planned investment in materials production to 1985

*Subproject:*

HOUSING CONSTRUCTION SYSTEMS AND DESIGN NORMS

I. SYNOPSIS OF PROJECT. (See initial project proposals and June 1 Progress Report for detailed description.): The overall goal is to develop guidelines/references for appropriate housing and physical planning derived from physical and socio-economic realities. There are two primary areas of concern: a) the industrialized buildings systems being developed in Egypt; and b) the planning of settlements, with focus on the provision of housing for the low income groups and larger scale land subdivision issues.

The initial phase of the project included identification of basic land/dwelling categories for evaluation of industrialized systems and determination of design criteria in the settlement studies. Initial contacts were made with appropriate ministries in order to initiate long term collaborative efforts. The data gathering phase took place during July-August, where specific information was required, and field surveys were scheduled. The final phase of the work was intended to include recommendations/conclusions which could be discussed with appropriate officials. Also, areas/issues would be identified for future detailed research.

The expected product at the end of the final phase includes the development of an evaluation system for industrialized housing in Egypt, and the analysis and redesign of a specific industrialized system in Egypt as a pilot study to serve as a model for other systems being developed. The site planning study would prepare alternative physical planning models for low income areas which are intended to be used by government agencies for future large scale housing developments. A descriptive report would also be prepared on the low income areas surveyed in detail during the summer.

II. STATUS OF PROJECT: The project is now in the final phase of analysis and evaluation of the data.

A. Activities completed: The group has concentrated on the collection of data from the ministries and continued familiarization with the housing situation through meetings with government officials, field trips to selected housing areas, and interviews with users, suppliers, and contractors. Project goals and the conceptual outline for the work was further refined. Several field trips were undertaken by the MIT members to Cairo to assist in data collection and continue joint coordination of the work. Close working contacts were initiated within the housing ministry to allow direct application/transfer of the work.

*Field trips* were carried out during July-August by MIT members to Cairo. The initial joint trip by the two members during the first week in July had the following goals: a) Review/collaborate with Cairo University counterparts on progress of informal sector user survey, and industrialized housing evaluation. b) Initiate/develop contacts within Ministry of Housing and Reconstruction. c) Determine specific areas of contribution of subprojects on housing to on-going work in Ministries. d) Outline specific tasks for completion of work during initial phase. e) Collect data from Ministries and continue familiarization with housing situation through meetings with government officials, field trips to selected housing areas, and interviews with users, suppliers, and contractors.

An additional field trip in August was made by one of the MIT members to Cairo to continue data collection and preparation of field survey information.

Meetings were also held in Washington with Dr. Fareed of the Prefabricated Housing Company of Cairo to further discuss the project.

*Field survey:* (See attached summary of areas surveyed.) Six selected low-income areas of Cairo were surveyed with the objective of providing "real" data as well as to check data gathered from other sources. It was not possible to undertake a very large or detailed survey because of time and budget restrictions. Therefore, precise statistical results were not

expected. The objective was to get indications and directions in supporting or refuting various hypotheses proposed in the subprojects.

The survey was intended to collect data for the clearly specified objectives of the subprojects, as well as to allow extraction of additional information to correlate more factors if required in the future. The survey was divided into two general parts:

- 1) Physical planning survey of the selected areas. The information to be collected included densities, land use, type of housing, systems of layout, etc. The information would be correlated to income categories, family size, and other social and economic factors gathered from a family questionnaire. The physical survey also provided the base from which the household samples were selected to be interviewed.
- 2) Questionnaire and direct observation for the households in the selected area.

The results of the questionnaire are intended to provide a reference for the following: testing of hypotheses on low income social grouping; determination of mechanisms for site development; establishment of site layout criteria, demands on public facilities, expected use of areas, etc.; determination of priorities of infrastructure by user in site development; identification of issues requiring further detailed study.

The areas selected were based on the following variables:

- 1) The resident's socio-economic group/housing categories (see previous working paper in June 1 Progress Report): very low unstable; low stable; low unstable; middle stable; middle unstable; high.
- 2) Formal or informal development.
- 3) Age of area: recent (last 5 years); established (5 to 20 years); old (20 to 35 years).
- 4) Type of housing: "Emirates" (blocks of flats); houses; buildings developed on small plots.
- 5) Privately or publicly developed. Some types were excluded as they fall outside the focus of the projects, for example the high income group. Other groups were excluded because they have been covered in other research: the low-stable and middle-stable residents in public housing. Faculty, students, and GOPP personnel were involved in the surveys.

A descriptive report was prepared documenting the areas studied at several levels of information: overall locality scale, block scale, typical dwelling, and typical family profile.

*Refined conceptual framework for industrialized housing study.*

Owing to the limited time available and to constraints imposed by the complexity and scope of the subject, it was decided to develop a more focussed strategy, by retaining the initial aim of evaluating and assessing the relationship between existing prefabrication technology in Egypt and design. This can be achieved by: a) Constructing an evaluation system for all prefabrication systems in Egypt, based on a complete knowledge of their technical, economic, and design characteristics. b) Relating generic design standards, which are specific to well defined housing categories, to a "typical" prefabrication system.

The second strategy was chosen for the following reasons: 1) The methodology remains valid for all systems, thus allowing a more thorough examination of each either concurrently or in the next phase. 2) Design and performance in terms of specific income groups and site choices can be better matched to their built counterparts on a system to system basis, rather than being applied to all. 3) Elements common to all systems can be defined by comparing each singular case study of each prefabrication system matched to specific target populations and sites. Conversely, dependent as well as independent factors may be specified and/or defined for the whole industry. 4) The conclusions of the study will become immediately applicable in the real world, and can be tested for validity, before jumping to unsubstantiated conclusions concerning all systems.

Thus, the current study is intended as a pilot study for application to other systems, either already existing or planned.

The study will focus on a "typical" simple large concrete panel system of the "closed" category (Helwan) in order to investigate its capability to widen the range in terms of: layout modification; element or component diversification; ability to contribute to other, more "open" systems, both in conventional construction and in prefabrication (industrialized sector); and possible diversification into other building categories (other than housing).

The decision to limit the study to the evaluation and analysis of a "prototypical" large concrete panel prefabrication system during the first year of the project is based on the following considerations:

1) The East German system (Helwan) is the first prefab factory to be put into actual operation this year or early next year, and will be the first one to produce large series. 2) The system is prototypical in all its technical and design aspects of a whole generic range of large concrete panel systems of other origin. It is essentially a "closed" system (i.e., only type-specific floor plans can be produced) and thus may create problems in terms of social and developmental upgrading in the future. 3) Recommendations for greater adaptability, flexibility, and variability in terms of a more "open" system approach can be applied to other systems later, but at the same time may be tested by using the East German system as the first "case study".

B. Activities planned. The final phase of the first year's work focus on the preparation of tentative recommendations for the ministries. The expected product from the industrialized housing study includes two parts: a) the development of an evaluation system for prefabrication systems in Egypt; and b) analysis and redesign of a specific system in Egypt as a pilot study to serve as a model for other systems to be analyzed in the future. The site planning study will develop: 1) alternative planning models for new low income areas based on existing and newly proposed codes, existing settlement realities, and developer/financing mechanisms; and 2) documentation/analysis of the selected low income areas studied in the field surveys carried out during the summer.

*Joint MIT/Cairo University Conference.* A meeting is planned during September 26 - October 7, 1) to discuss the status of the research to date; 2) to outline tasks for the completion of the initial phase of the work; and 3) to prepare future proposals for a long term research program. Personnel from the Ministry have also been invited to attend. The main activities would be working sessions on various topics of concern to the group; some suggested areas are: housing problems focused on the informal sector of Egypt; physical-social-economic surveys, methods, analysis of data, problems; industrialized technology in developing areas considering cultural and economic realities.

*Hamburg Conference on Construction in Developing Countries:* A member of the MIT group and two members from Cairo University are planning to attend the conference sponsored by the World Association for Element Building and Prefabrication. The conference represents a unique and timely opportunity to gather up-to-date information and data in the field of housing systems, particularly in view of the fact that most of the systems planned or used in Egypt are of European origin. In addition, specific visits will be made to several of the parent companies whose factories are now being imported into Egypt.

*Field trips:* An additional meeting in Cairo or Boston is planned for November to discuss/coordinate final preparation of the report for the completion of the first phase.

III. APPLICABILITY OF WORK TO MINISTRIES. Direct working collaboration has been established for both the study of the industrialized building systems and the study on site planning.

*Contacts with the Prefabricated Houses Company:* Mr. A. S. Mourad, President, and Dr. Adel Fareed, Technical Director, have enthusiastically joined with the study on industrialized building systems. Full cooperation has been pledged as noted in "Future Directions" of the work. Weekly meetings have been held with Cairo University counterparts to discuss various technical features of the proposed systems.

*Contacts with Ministry of Housing for site planning study:* Direct working collaboration has been set up with the CU/MIT team working in the area of settlement patterns/standards and the General Organization for Physical Planning (GOPP). Mr. Hafez Ali, Chairman of GOPP, pledged full cooperation with our group and assigned Michael Fouad, vice-President of Research and Regional Planning, and Ramzy-Ezzat Constantin, Director of Planning, and two junior architect/planners, to work with our group. The two junior architects would serve as direct liaison

and assist us in data collection; they are assigned to work with us on a full-time basis as needed. Letters have been sent to Hafez Ali from the Cairo University executive committee reaffirming the offered collaboration. Among other tasks, the GOPP has overall responsibility to assist towns and villages in Egypt in preparing master plans, newly mandated by law, as well as having advisory powers on housing subdivision in the governorates. A strong continuing influence could be achieved with a successful initial project. Immediate interest and use of the work could be as a reference for the World Bank "site and services" projects now being developed under the responsibility of the GOPP. Further "site and services" projects are also being planned for AID funding.

The specific contribution of the subproject on settlement patterns and standards may be identified in three areas: a) redirection of the focus/emphasis of government funds/efforts from involvement/provision of individual houses to larger scale issues: land subdivision and infrastructure; b) development of land subdivision/infrastructure models as alternatives to costly and wasteful large scale planned housing developments currently favored; c) development of a methodology of survey/data techniques to provide a base for future urban planning. The study provides a complement to the other housing subprojects in that both the larger scale settlement implications as well as the individual dwelling would be represented.

IV. FUTURE DIRECTIONS/TOPICS: Several areas are being considered for future more detailed study as a possible continuation of the work.

The study on industrialized systems may readily be expanded into the following areas: 1) further detailed study of the other nine systems being imported into Egypt; 2) testing of actual redesign/modifications of the panel systems with full size prototypes.

Dr. Adel Fareed of the Prefabricated Houses Company (the firm handling the East European system being developed in Helwan) expressed full cooperation and interest in terms of time, expertise, and facilities in the fabrication and testing of prototypes.

Various possibilities exist for future work on larger scale site planning issues. Several areas of collaboration are apparent from the General Organization for Physical Planning (Ministry of Housing) which could be developed into long-term projects. Three areas have been identified as follows:

- teaching: discussions centered around offering a seminar in the GOPP during March of next year; participants would be approximately 10 people from the GOPP in an intensive 10 day session evaluating a specific project as a vehicle for discussion and as a means of presenting planning issues. Also, possibilities were discussed, where an outstanding junior member of the GOPP could attend MIT as a student in the Master of Architecture program.

- research: continued development of basic documentation of reference areas of land/dwelling systems; development of planning models of new areas considering staging, low income people, and cultural and economic situation.

- practical applications: demonstration of principles in a specific site, both in a desert area of development, and in an expansion area in the agricultural region.

*Attachment B*

## SUMMARY OF LOW INCOME SURVEYS

Dr. Barrada, Dr. Zakia Shafie, Dr. Nasamat

August 1977

From the preliminary evaluation of the data available for the subprojects, it became clear that there was much information which was not available; therefore, a field survey was initiated. It was not possible to undertake a very large or detailed survey because of time and budget restrictions. Therefore, precise statistical results were not expected. The objective was to get indications and directions in supporting or refuting various hypothesis proposed in the subprojects.

The team approved of carrying out this survey not only to achieve the above objectives but also because it was felt that it could give the following benefits:

- 1) to initiate a quick interest and involvement of students and faculty in the research through a tangible "product";
- 2) to help establish a general background for all members of the team with a common vocabulary and concepts;
- 3) to quickly establish a working relationship between members of the team and start the communication mechanism.
- 4) to enable all members of the team to get a direct contact, "feeling", and first hand information of part of the housing problem in Egypt, particularly those members from MIT and Cairo University who are new to these problems.

## OBJECTIVES

The survey was intended to collect data for the clearly specified objectives of the subprojects, as well as to allow extraction of additional information to correlate more factors if required in the future. The survey was divided into two general parts:

- 1) Physical planning survey of the selected areas. The information to be collected included densities, land use, type of housing, systems of layout, etc. The information would be correlated to income categories, family size, and other social and economic factors gathered from a family questionnaire. The physical survey also provided the base from which the household samples were selected to be interviewed.
- 2) Questionnaire and direct observation for the households in the selected area.

The results of the questionnaire are intended to provide a reference for the following:

- testing of hypothesis on low income social grouping
- establishment of prototypes/models of dwelling designs
- determination of mechanisms for site development

- establishment of site layout criteria; demands on public facilities, expected use of areas, etc.
- determination of priorities of infrastructure by user in site development
- identification of issues requiring further detailed study.

#### THE SURVEY TEAM

Twenty two students from the Department of Architecture formed three survey groups (8, 8, and 6). Each group was headed by one teaching assistant. Each group was allocated two residential areas (Group 1: two informal; Group 2: two formal; Group 3: one informal and one formal). A member of the staff of Cairo University team accompanied selected students and the teaching assistants in a preliminary identification of the areas.

#### SURVEY PERIOD

The surveys started on July 10, and lasted for approximately 2 weeks. An additional 2 weeks were then required to prepare the plans at the dwelling scale and to complete the site plans.

#### INITIAL PILOT SURVEY

An initial pilot survey was prepared in Cairo for testing before preparation of the final form. The joint team then met in Cairo at the beginning of July for a review of this pilot survey. Based on the pilot survey and comments from joint team discussions, the survey was revised into its final form. Also, it was found that in most cases the areas chosen did not contain enough dwellings from which to select the desired survey sample (40 to 50). Accordingly, the areas were increased to include 120 to 150 buildings in each of the cases.

The purpose of the test/survey that was carried out in late June was to:

- a) familiarize the students with the areas selected for research;
- b) testing of survey format;
- c) determine the approximate time necessary to complete the questionnaire in each area;
- d) prepare a site plan for each area with the buildings, streets, utilities, etc.

The results were encouraging with both student interviewers and the people surveyed enthusiasm.

## SELECTION OF AREAS

The types of localities in Egypt were identified according to the following main variables:

- 1) The resident's socio-economic group/housing categories (see previous working paper in June 1, Progress Report): very low unstable; low stable; low unstable; middle stable; middle unstable; high.
- 2) Formal or informal development.
- 3) Age of area: recent (last 5 years); established (5 to 20 years); old (20 to 35 years).
- 4) Type of housing: "Emirates" (blocks of flats); houses: buildings developed on small plots.
- 5) Privately or publicly developed.

Some types were excluded as they fall outside the focus of the projects, for example the high income group. Other groups were excluded because they have been covered in other research: the low-stable and middle-stable residents in public housing.

The six areas chosen are representative of a type of category. There are many other similar areas in Cairo.

<i>Locality</i>	<i>Housing Category</i>	<i>Type of Development</i>	<i>Age of Area</i>	<i>Type of Housing</i>	<i>Type of Developer</i>
El Haram	Low-stable and unstable	Informal	Recent	Small plots	Private
Meet Okba	Low-stable and unstable	Informal	Old and established	Small plots, emirates	Private
Mataria	Low-stable and unstable	Informal	Recent	Small Plots	Private
Helwan	Low/medium stable	Formal and informal	Established and recent	Houses, small plots	Private and public
Shoubra	Middle-stable	Formal	Established	Emirates	Private
Abbasayia	Middle-stable	Formal	Old	Emirates	Private

## SELECTION OF SAMPLE FAMILIES

The families to be interviewed were determined from the site plan prepared from the pilot survey. The procedure of selection was as follows: The height of each building was marked on the site plan for each area. The total number of buildings of various heights were recorded, and a percentage of each category (equal to the percentage of category to total) was allocated; i.e., if the total number of four-story buildings was a third of the total number (30) then 10 samples would be selected from these 30. The necessary number of each category was chosen at random by each teaching assistant and marked on the site plan, taking into consideration a choice which includes a variety of building locations, i.e., corner, end of street, etc. If the building chosen contained several floors and apartments, the students were left free to choose any of these for the interview. The number of samples selected for each area are as follows: Al Haram 35; Meet Okba 47; Mataria 47; Helwan 43; Shoubra 45; Abbasayia 24.

## LIMITATIONS OF SURVEY DATA

Precise statistical results were not expected from the survey. The objective was to get some indication and directions on specific issues related to the low income sector. Specific comments pertaining to the data are as follows:

- 1) Some of the survey questions were left blank without mentioning the reason, which may be explained by: a) refusal to answer; b) error by interviewer; c) a negative answer and not recorded.
- 2) Most of the chosen residential units from the informal sector were on the ground floor. The residents of the ground floor intercepted the students and wanted to know the reason for entering the house. Therefore, the tendency was to interview them while explaining.
- 3) Some of the answers did not indicate a pattern because they were not answered by all of the people interviewed. This might have been due to: a) failure to grasp the meaning of the question; b) desire of the student to finish the interview quickly; c) answer did not fit in the format, and the student failed to record it as a general remark.
- 4) The questions omitted in all of the samples formed a uniform pattern in the 6 areas, except for the question about income in Shoubra which was not answered in any sample.
- 5) The people were sometimes suspicious when the students wanted to draw the dwelling unit and refused completely. This occurred primarily in the formal areas. In the informal areas the people were quite hospitable and helpful as soon as they were reassured that the interviewers were really students. (Some of them even offered tea or cold drink!)

## Attachment C

WORKING PAPER: NOTES ON EGYPTIAN HOUSING SITUATION  
Reinhard Goethert, 1 September 1977

**Context:**

- 1) The population of Egypt will double by the year 2000.
- 2) The annual population growth is 2.4% for the country. Urban growth is approximately 4%, of which half is from immigration and half is from natural growth. In 1960, 38% of the population was urban; in 1970, 44% was urban (World Bank study, 1972).
- 3) The largest percentage of population is the low income; which is also the sector growing most rapidly.
- 4) Rapid, undirected urbanization is having deteriorating effects on the cities of Egypt. Focus of work on Cairo allows immediate, direct use of the results of the study and, secondly, it is inevitable that Cairo will continue to grow in the immediate future despite efforts intended to retard population inflow. The most severe impact is on Cairo, and perhaps is a forerunner of what will happen in other cities in Egypt.
- 5) Rapid urbanization is also continuing on the limited scarce agricultural land, despite best efforts to stop expansion.

**Housing:**

- 1) According to various studies (including MOHR/AID "immediate action proposals for housing in Egypt"), there exists an acute housing "shortage", which was approximately 1.5 millions in 1975.
- 2) There is a shortage of vital construction materials, in particular cement. There is a shortage of skilled labor due to the attraction of higher salaries in other Middle Eastern countries.
- 3) Under present approaches, including industrialized systems, there exists no way for the government to provide sufficient housing for expected demand. (Within 10 years they could feasibly only produce 172,000 units; AID report.)
- 4) Middle and higher incomes are sufficiently able to acquire and afford housing.
- 5) Cost of existing minimum housing built by the government is around LE 2,800, which is beyond the economic capacity of 76% of the urban population. One consequence is that up to 70% of all urban housing currently built is by the lower income "informal sector" which constructs dwellings illegally outside of the formal housing market.

**Government regulations:**

- 1) It is estimated that 50% of subdivisions and 60% of dwelling activity are in violation of existing legislation.
- 2) Certain conditions are clear: a) building codes, and b) land subdivision regulations, are not compiled with. This is not confined to the low income areas (the so called "informal sector") but also prevalent throughout the income spectrum: middle, as well as high income dwelling construction. The middle and high income builders tend to comply with land subdivision regulations but deviations from the building permits are common. No data/studies are available on the percentage of non-compliance but estimates range very high.
- 3) What is then the purpose of the codes and laws? The promulgation of additional laws, however reasonably intended, generally means more laws are ignored, and the general cynicism of the public toward government efforts is increased.
- 4) A reasonable objective is to identify a minimum acceptable set of rules which must be followed for health, safety reasons. The criteria for the rules involve layout efficiency to minimize present and future costs.
- 5) It may be more appropriate to concentrate efforts on aspects within the direct control/responsibility of the government, i.e., the provision of infrastructure.

**Socio/cultural:**

- 1) Supremacy of the family unit remains the primary social/cultural attribute.
- 2) Lower income and rural people tend to follow and require traditional living patterns. Middle and higher income people tend to emulate/desire European living patterns.
- 3) The traditional village organization has been around the family clan. Several generations from a common descendent often inhabit a specific section of a village known as "Hamula". The traditional rural house is composed of a number of rooms grouped around an open courtyard with high windowless stone or brick walls. The courtyard serves functional purposes of keeping chickens, etc., and suited to the cultural traditions of the family.

**Planning:**

- 1) "Traditional" neighborhoods offer direct pedestrian access to markets, employment, family, and related to climate/cultural/social values with an unequalled vitality. They are rich in social interaction and participation. However, they tend to lack water, proper sewage disposal, and refuse collection services which the city is unable to provide because of limited finances, skills, and materials. Also, there are few recreational open spaces for people to go and sit with families in the evenings as in the custom throughout the urban areas. Coffee shops, which spill into the streets, become the prime neighborhood focus in these areas.

- 2) "Non-traditionally" developed areas (often higher income, but not necessarily) have complete services but require automobile use, and have poor land utilization resulting in higher public costs disproportionate to population served.
- 3) New public and private developments generally follow imported European patterns which do not relate to Egyptian culture, social structure, nor climate. Most of the large scale planning concepts are direct imports from these European models -discrete land uses, low densities, "garden city" illusions, automobile orientation.
- 4) The European "garden city", approach of apartment slabs set in a green common space, is nonsense in reality, particularly in the context of the lower income majority of the population in Egypt.

**Large scale  
housing  
developments:**

- 1) Government and private intervention is required and large scale developments must continue to be implemented. However, the physical product must change.
- 2) Both new developments in desert areas and expansion of existing urban areas will have basic requirements of cost efficiency in layout, encouragement of high densities, and compact planning.
- 3) Large projects imply large numbers of people with varied interests and backgrounds. Large housing projects tend to provide a few restricted dwelling unit types for design/administrative simplicity, stratifying the areas into a narrow spectrum of a social group. However, although redesign of the dwelling unit itself may better accommodate each family's needs, the end result will be the same as seen in the older housing projects for the lower income groups throughout Egypt. For example, they will approach the deteriorated conditions as in the Ain El Sira, Zeitun projects in Cairo. The problem lies in the site planning.
- 4) Although site planning is perhaps in a narrow field of specialization, it has broad implications on urban areas in terms of financial health, physical efficiency, and culture, both present and future.
- 5) The current planning of housing projects has reinforced a bad situation -the excessive amount of undefined open areas/circulation space and unnecessary streets, which exacerbate the lack of maintenance, no refuse collection, etc. These open spaces, "green areas", are under the direct responsibility and control of the city which is the least able to maintain it in terms of finances and interest/motivation for maintenance.

- 6) The change of the arrangement or shape of the apartment slabs is not the issue. The key is the responsibility/control, ownership and use of the land; the building is secondary.
- 7) In housing projects, particularly for the low income, it is contrary to separate commercial facilities/small shops from the dwelling structures. Daily food requirements demand easy access to allow small purchases of perishable food staples. It is a burden to the people to isolate the shops as is found in traditional western planning areas who are dependent on the automobile induced sprawl areas. Shops will develop despite best efforts of authorities to control their development.
- 8) Areas should not be planned for exclusive use of the automobile, with its land wastage and burdens to urban transportation, particularly to the old and the young. The traditional pedestrian methods of planning should be encouraged and continued in new developments.
- 9) Primary issues should not be obscured by purely visual attributes: texture, scale, patterns, decorations, which are only one but immediately obvious aspect of an area's "character". Many of the mentioned characteristics which architects, etc., consider in defining an area, cannot be artificially, instantaneously created, but are subconsciously created over a long period of time.

**Individual  
dwelling  
units:**

- 1) The image that one gets from public housing projects is worse than the actual individual family situation. Dwellings (from observation) generally tend to be clean, well-maintained, and reflect high family pride and investment: fancy light-fixtures, decorated interior, flowers, and fine furniture quite extravagant considering the family's income. The exterior also shows/reflects pride as well as attempts to individualize units in the uniform mass of a project.
- 2) Dwelling construction and the provision of dwellings appear not to be a problem from the physical sense. Evidence through case studies clearly shows that the low income can finance and construct their own 4-5 story dwellings suited to their financial, physical, and social requirements. (This is not to say, however, that financial and technical assistance programs by the government would not allow perhaps quicker, better designed buildings.)
- 3) Dwellings clearly develop into 4-5 story structures, regardless of initial design, income group, or area. Often even in the larger established housing projects, extensions can be seen encouraging onto obviously public land initially intended for public "green" areas. In some cases, people have even added whole rooms illegally on the ground floors. It is clear that planning must consider this transformation into a higher density with its increased demands on schools, utilities, transportation.

- 4) Recommendations for reducing a unit size to 60-80m<sup>2</sup> and smaller should be carefully considered in light of the cultural situation and long term effects. Although initially there may occur savings which lower costs to the individual household (although studies have indicated that this would still not be within reach of the majority), the size is not tailored to the Egyptian culture, as in most traditional cultures, with larger, extended families. Smaller units either force "overcrowding" as families attempt to continue their traditional lifestyles, or families are forced to adopt nuclear family patterns with resultant breakdown of large family groups and long term social deterioration/change.

**Informal  
sector  
housing:**

- 1) The provision of housing by the informal sector should be encouraged and supported by the government. This is perhaps the most effective in terms of cost and within the reach of a greater number of population.
- 2) The progressive nature of informal sector construction spreads the demand for building materials over a longer period of time. There would be no direct, immediate surge in demand on the already over-burdened materials industry.
- 3) Families must be encouraged and allowed to continue to construct their own dwellings. Aside from providing a shelter for a single family, there is a clear trend and incentive for expanding to 4 stories which provides shelter for 4 to 5 additional families while, at the same time:
  - a) improving the financial position of the family;
  - b) providing additional housing units onto the market.
- 4) A possible government policy is to speed up the informally produced dwellings by building a single story unit only (either prefabricated or conventional; whichever cheaper, quicker) and to encourage the owner to expand on own resources. Government costs would be for only one unit, with a net gain of five units.

**Focus of  
policies:**

- 1) The primary focus of the government should be: a) how to provide maximum benefit to most people; and b) how to address the problems which the people are not able to solve/handle themselves and which require a larger scale of organization.
- 2) Policies should concentrate on the urban areas because of the limited agricultural land and the resultant inevitable urbanization process.

- 3) Particular consideration should be given to the low income majority currently outside of the formal housing market.
- 4) The focus should be on larger scale settlements instead of single dwellings.
- 5) The problem clearly lies in the realm of government provided services: water supply, sewage disposal, street lighting, street paving, refuse collection, and electricity supply. Government efforts should be directed toward providing basic infrastructure, services, and more appropriate land distribution and subdivision. The subdivision of land must be assumed by the government to control direction, areas to be used, and to a large extent, to assure future, economically feasible, provision of utilities.
- 6) Planning models should be determined through the study of selected urban areas to determine realistic land policies including land uses, densities, circulation, and dwelling needs.