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SOLARIZATION/CONSERVATION
TECHNOLOGY DEVELOPMENT
PROGRAM FOR EXISTING
HOUSING

Progress Report

For
Community Development Office
City of Ann Arbor
Barry Tilmann, Director

by
Architectural Research Laboratory
The University of Michigan
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Project Director

1 February 1981

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Project Objectives

1. Develop a method for evaluating existing residences for their energy Solarization Conservation potential as well as carrying out the S/C work within the context of the Community Development program.
2. Demonstrating appropriate methods of utilizing solar energy in existing Ann Arbor residences beyond that obtainable in a good conservation program.

Section 1.0 INTRODUCTION

Section 2.0 TASK PROGRESS

Section 3.0 RESEARCH STRATEGY

Section 4.0 TECHNICAL STUDY

Section 5.0 APPENDIX

This report covers a four month period of project organization, data file examination, development of concepts and technical study of S/C components. Several conditions have been encountered which were not anticipated or in effect changed since this proposal was formulated.

a. At the start of the project 188 residences were considered appropriate for study in this program, i.e., the owners were eligible for assistance from the CD program. All of these houses in the course of three years including the present have had code update assistance. This has included some conservation retrofit.

b. The City of Ann Arbor has been selected for a pilot study of the RCS Audit program. As of this date an initial 200 audits have been completed. Also, the C D office is presently undertaking the conservation retrofit of several residences in accordance with RCS recommendations. The set of residences selected for the S/C program presently does not involve any direct conflicts although such is possible before the completion of this contract.

c. Project start up and normal operations time requirements have delayed the securing of historic fuel and electrical consumption data. Thus, this data has not been available for the residence selection process as originally planned, rather it will be used in subsequent evaluation and analyses.

d. Available aerial photographs have proved to be inadequate for solar-site evaluation.

The conservation updates and the RCS audits present an opportunity for evaluation and comparisons. By obtaining consumption data on and after update, we hope to identify the benefit of these updates. The RCS audit, focuses more on conservation and this project logically places a major emphasis on solarization.

SECTION 1.0 Introduction

The present state of the project in reference to the project proposal section 3.2 Technical Description, Figure 2.0-A, is as follows:

Phase I Community S/C Characteristics

Tasks 1.1 Survey Audit 100% complete

A basic set of 188 houses were available for the study, i.e., those homeowners who would be eligible for assistance with the solarization retrofit. Letters were sent to each of these homeowners asking for permission to obtain utility data from Detroit Edison and Michigan Consolidated GAs Company (refer to the appendix). Sixty-three (63) replies were received.

Data from C D O files have been collected on the 188 houses. However, 63 homeowners now comprise the basic set of houses for the study. Data from the assessor's file have been collected on this basic set.

Task 1.2 Unit Sampling 100% complete

The basic set of 63 houses has been divided into two groups on a random selection basis. One of the sets is to comprise the control group while the others are to be the subject of the audit. The latter group will be used in the subsequent solarization selection and development. The two sets have been compared with the parameters available using the computer based U of M-MIDAS statistical program.

Task 1.3 User/Site/Building Audit 20% complete

The building and site survey will be accomplished in two steps. In the first step the site and homeowner/residence survey will be used to screen the residences for the feasibility of solarization. The second survey which is to be conducted on ten (10) residences will be such that computer models can be developed for each of these residences. A sample of the first step survey is included along with the letter of introduction. Refer to the Appendix.

Phase II Community S/C Systems Analysis and Development

Task 2.2 Technology Survey/Selection 15% complete

Data collection on solar systems and/or components appropriate for existing houses has been approached in a general manner pending an examination of the results of the audit. Emphasis has been placed on the wall air collector, examining its performance in detail. Refer to Section 4.0 on Technical Study.

A crucial question posed by this project relates to cost effective thermal performance of the appropriate technologies in the City of Ann Arbor. There is little documented information on solar energy performance of active solar components in this region let alone passive components. It is assumed that the demonstration in this project is to be related to the total process of S/C for the existing housing in the City of Ann Arbor. Further, it is assumed that the "solar furnaces" must work.

SECTION 2.0 Cont'd.

Figure 2.0-A Project Plan

Reference Page A-56 Grant Proposal

FIGURE 3.0-A S/C Selection Strategy

The research strategy for the selection of S/C target residences is diagrammed in Figure 3.0-A. In each case computer based data files have already or will be developed for each of the sets.

Approximately one third of the owners have elected to participate in the S/C program. Utility data have been requested for the 1978-1980 period. A brief, comparative report will be sent to each of those in the S/C base set.

The basic set of 63 houses has been divided into two sets on a random selection basis.

The S/C first level audit which is in progress together with the technology survey will form the basis of the selection of the 10 S/C target houses. An additional detail survey will be required to support the modeling of each of these houses as part of the design development. The success of this process will be the first test of the S/C selection process. A sample of the first-level audit form is included in the appendix.

Finally the strategy includes the development of construction documents for four of these houses. Two of the ten will be selected on the basis of 1) the practicality of immediate implementation for solarization and 2) the optimum demonstration value.

Figure 4.0 A

Figure 4.0 B

Testing of an air collector* and rock storage has been conducted during the cold winter months. Professor Kenneth Lee's dissertation study** on the use of scale models for the comparison of passive solar components has progressed to a point that his method is to be used in refining and selection of an appropriate wall solar-air collector. He has made two of his medium size test cells available for the study. Two other cells have been borrowed from W. K. Porter of Holland, Michigan, the manufacturer of all the cells. The four instrumented cells will be used to compare the following:

- a) a direct gain system with double glazing;
- b) an air collector as manufactured by SUNTEM ENERGY SYSTEMS of Plymouth, Michigan;
- c) a U of M design using double glazing; and
- d) a U of M design using plastic glazing.

The performance of the test walls in the instrumented 4 ft. cubes test cells will be compared directly and refined as required. The results from the testing will also be useful in formulating and developing the computer logic for these and other passive components.

* Air collector and storage developed in 1979 by Gary Cook, former U of M student.

** "Development and Evaluation of Thermal Modeling Technique" by Kenneth Lee, Associate Professor of Architecture, Ohio State University.

Figure 4.0 C

Figure 4.0 D

The following photographs are in reference to this work.

Figure 4.0-A Building Technology Laboratory Work Area.

A general view of some of the test cells and rock storage bin.

Figure 4.0-B Rock Storage Test Cell

Test cell located at south wall door opening. This is connected to the inclined collector shown in Figure 4.0-D. Two one-ton rock bins are presently in place in the partitioned portion of the cell.

Figure 4.0-C Test Cell With Standard Residential Wall

The 3 ft. x 3 ft. stud wall with siding is to be retrofitted with an air collector and inserted into the test cell opening. Other conditions in the cell will be set to simulate a residence.

Figure 4.0-D Test Cells on South Side of BTL

Various sizes of test cells of Professor Lee's study are shown during January test. The 4 ft. cells are at the right.

SECTION 4.0 cont.

Exhibit A - Homeowner mail survey

Exhibit B - S/C audit survey form

PLEASE SIGN THIS FORM AND RETURN IN THE ENCLOSED STAMPED ENVELOPE AS
SOON AS POSSIBLE.

To: Architectural Research Laboratory
College of Architecture and Urban Planning
2000 Bonisteel Blvd.
Ann Arbor, MI 48109

This is to authorize the ARL to obtain utility data from Detroit Edison
and Michigan Consolidated Gas Company for the years 1977-1982 for my
residence.

Signed _____

Date: _____

Address: _____

Please furnish this additional data on your residence.

	1977	1978	1979	1980
Number of persons living in the house				
Fireplace use Yes or No				

Note: If you use an oil heater or furnace, please check, and we will
call you as to the supplier.

Use oil yes no

Thank you,

W. A. Oberdick
W. A. Oberdick

Exhibit A - Homeowner mail survey

SECTION 5.0 Cont'd.

 HOME-OWNING EDUCATION

 INSTITUTIONAL RESEARCH - LITERATURE
 THE UNIVERSITY OF MICHIGAN
 IC
 DATE: 1/1/84
 LOCATION: 1000 N. ZEEB
 1000 N. ZEEB
 1000 N. ZEEB

PHOTO - FRONT STREET

PHOTO - BACK STREET

Exhibit B - S/C audit survey form

SECTION 5.0 Cont'd.

SECTION 5.0 Cont'd.

SECTION 5.0 Cont'd.