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P/JRB ARCHITECTS
A Subsidiary of Science Applications, Inc.

FORWARD

This supplemental and concluding report summarizes the activities and major decisions performed from the conceptual design phase through the construction contract award.

It is also the final end item to be submitted to A.I.D. and thereby concludes A/E deliverables under contract agreement (NEB-0001-C-00-1045-00) between P/JRB Architects and the U.S. Agency for International Development.

This project has been funded at least in part with Federal funds from the United States Agency for International Development (U.S.A.I.D.) under Contract Number NEB-0001-C-00-1045-00. The content of this publication does not necessarily reflect the views or policies of the U.S.A.I.D., nor does mention of trade names, commercial products or organization imply endorsement by the U.S. Government.

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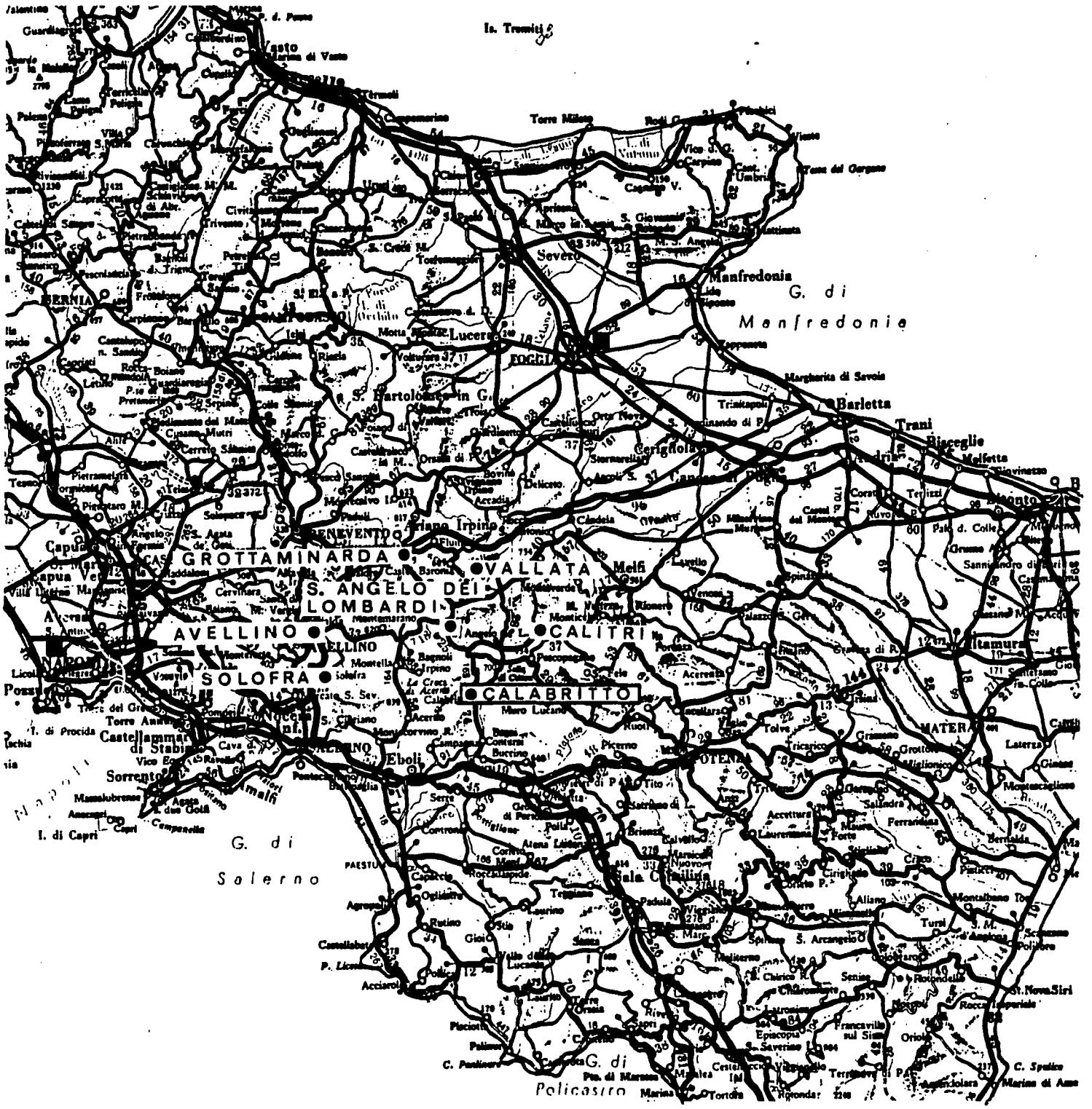


Vicinity Map

I. INTRODUCTION

This report is a supplement to the Final Report prepared December 1983 which summarized the activities performed and the major decisions made throughout the term of A.I.D. Contract NEB-0001-C-00-1045-00.

Section 1 of the Final Report discussed the objectives of U.S. relief efforts under the direction of A.I.D.'s Office of U.S. Foreign Disaster Assistance through which this school construction program was funded, and the overall objectives to be accomplished in the schools' design. Section 2 provided a brief chronological History of the Project from initial authorization to proceed up to the contract modification for design of the seventh school. Section 3 of the Report detailed the design criteria and the responsibilities of the A/E design team. The Educational Program is detailed in Section 4 of the Final Report.

This Supplemental Report summarizes the activities and decisions involved in production of the seventh school at Calabritto for Southern Italy's Avellino Province under A.I.D.'s successful program to assist the people of Italy in recovering from the disastrous November 23, 1980 earthquake.

2. HISTORY OF PROJECT

In September 1982, the Agency for International Development notified P/JRB Architects that a seventh school was to be built in the town of Calabritto under the Southern Italy Earthquake Reconstruction Program and requested P/JRB as prime architect to select from among their six designs already submitted one which could be adapted to suit the configuration of the Calabritto site with minimal redesign effort and to submit a cost proposal and the suggested design modifications considered necessary for adaptation of the design.

A.I.D. previously had decided to select a school design from among the six designs already completed that could be modified and adapted to the Calabritto site.

An educational program was developed based on the standards set by the Italian Ministry of National Education for a student population of 375 and then reviewed for compatibility with the six designs already completed by the P/JRB and Studio Castore team. The junior high school of the Sant'Angelo dei Lombardi project was determined to be the most adaptable design. Many of the elements used in the construction documents could easily be adapted for the new design, such as:

- Structural framing module
- Construction techniques
- Mechanical, electrical and plumbing systems
- Building finish materials
- Standard details for windows, doors, floor, roof and schedules
- Specifications

Several site visits were conducted to obtain available information. The visits revealed that the site had a very steep topography requiring additional floor levels to be introduced to the original design. Nevertheless, major design elements such as the gymnasium, two levels of classrooms, assembly hall and administration were incorporated. Additional space had to be provided for a dining hall and related kitchen functions. At the time no geological and topographical study had been performed on the site. Unlike the requirement for the previous schools, the architect would be responsible for having these tests performed .

At a meeting held Wednesday, 6 October 1982, Passantino/JRB Architects and Studio Castore presented to A.I.D. the proposal for A/E services and a preliminary schematic design solution.

Present at this meeting were the following:

Richard Dangler	C.O.T.R., A.I.D./Naples
Tibor Nagy	A.I.D. Director of Project/Naples
Richard J. Passantino	Project Director P/JRB Architects
Italo Castore	Architect, Studio Castore
Miguel Aparicio	Project Manager P/JRB Architects
Piere Louigi Rizzi	Architect, Studio Castore

By the end of the day A.I.D. had reviewed the proposals submitted and notified P/JRB that they would be awarded the contract for the Calabritto School. On 19 November 1982, modification to the A/E contract for design and development of construction documents was signed.

A tentative schedule for major end items was developed with A.I.D., contingent upon access to the site to perform topographic and geological studies. In January 1983 access to the site was finally arranged and a preliminary geological soils report, prepared by Dr. Luigi De Iasi was completed and submitted to A.I.D./Naples.

During the period between mid-January and February 1983 a series of meetings was held between A.I.D./Naples and the architects to finalize the schematic design of the Calabritto school. A final review and approval was conducted at the Studio Castore offices in Florence, Italy, on February 10-11, 1983 with P/JRB, Studio Castore and A.I.D. representatives attending. Following this meeting preliminary and final working drawings were immediately started with a scheduled completion date of May 20, 1983 established. During the month of April 1983 all of the required drawings were filed with the Gene Civile and other city officials of Calabritto.

On May 13, 1983 with the project approximately 90 percent complete, A.I.D. issued a stop work order. Two problems had been identified which impacted the continuation of the project and required resolution. One problem was that the foundation system designed by Cygna Consulting Engineers required to offset the poor soil conditions of the site was too expensive and contributed to an overrun of the projected project budget. The second problem was the inability of the City of Calabritto to expropriate the total land required for the project, causing a reduction in the available site area and forcing the relocation of the building.

Representatives of the City of Calabritto were requested to re-evaluate the previous site options to see whether they would be more suitable than the one chosen. After several site visits it was concluded that the present site still provided the largest available land area and offered the best street visibility and access for pedestrian and vehicular traffic.

AID re-evaluated the project scope, greatly reduced the school building program to better accommodate the reduced site area, reduced the student population from 375 to 250 and established a reduced construction budget of one million dollars. Based on this new project work scope, P/JRB was requested to submit three new schematic designs.

The continuation of this report discusses the particulars of the project from this phase through the construction contract awards.

3. EDUCATIONAL PROGRAM

The educational program developed under the new work-scope was based on the standards set forth by the Ministry of National Education for a student population of 250 and the new guidelines established by A.I.D./Naples.

The educational program, including background and objectives, planning and design considerations, and educational concerns was based on the same criteria as specified for the six schools previously designed by P/JRB under the A.I.D. earthquake reconstruction program. (Refer to Section 4 of the December 1983 Final Report.)

The following are the space requirements for the final building design:

Activities	Area
• Ten Classrooms @ 45 sq. meters	450 sq.m.
• Special Classroom	160 sq.m.
• Teachers' Lounge	33 sq.m.
• Gymnasium/Locker Room/Showers	330 sq.m.
• Kitchen and Related Services	50 sq.m.
• Administration	60 sq.m.
• Doctor's Office	11 sq.m.
• Boiler Room and Mechanical	60 sq.m.
Total Net Area of Activities	1,154 sq.m.
Total Net Area Including (Services, Circulation @ 42%)	1,639 sq.m.
Total Gross Area @ 11%	1,820 sq.m.

4. SCHEMATIC DESIGN PHASE

A. Site Description.

The site is located between the old destroyed town of Calabritto and the newly developing commercial and residential center. It is serviced on the south side by Strada Provinciale, a main thoroughfare connecting the old and the new town. A new road being designed adjacent to the southern property line will become the future major road through this area and be the main access from which entrance to the school will be made.

The site's steep contours tilt from the south property line down to the north property line, averaging a slope of 18 percent with a total drop of 17 meters from one end of the property line to the other.

The site lends itself to a beautiful panoramic view of the valley. In the distance, ruins of the old city of Calabritto are still very much evident. All of these site characteristics were influential in the design of the school.

Geologically the site was not ideally suitable for development of a school. As discussed in the soil report, the site was comprised of a series of "slippage planes" reaching three to six meters in depth, creating the possibility of landslides. The surface characteristics of the site were also not uniform. In various locations rock upcroppings exist and the slope varies between 14 to 22 percent. Given these site conditions, a series of retaining walls, a drainage system, and landscaping were all incorporated to protect the existing hillside from the danger of future land movement.

B. Schematic Design Presentation

As requested by A.I.D. in a May 20, 1983 telex, three schematic design solutions were developed over a three week period and presented on June 10, 1983 to the C.O.T.R, A.I.D./Naples.

The development of the schematic design for the Calabritto project was organized in the same manner as the first six schools. Two schemes were prepared by the architectural office of Studio Castore - one in Florence, Italy, the other in Houston, Texas. A third design was developed by P/JRB Architects and Martin, Cagley & Middlebrook, Consulting Structural Engineers at the Florence office of Studio Castore. This arrangement of placing the American A/E design team in the Florence office worked out very well since all structural and site information was readily available. This eliminated time delays in transmitting information, misunderstanding, and provided for clarity of information.

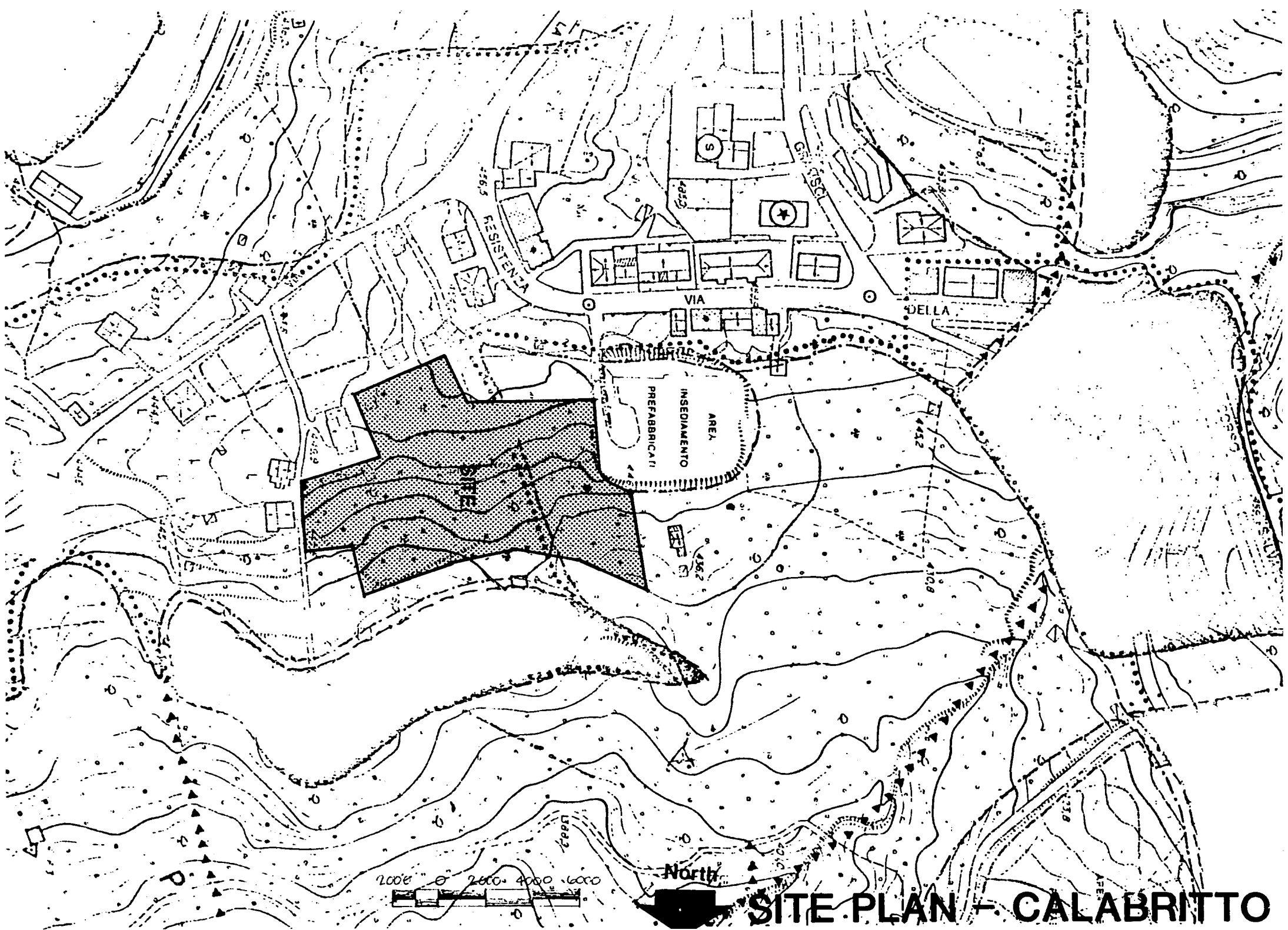
Refer to Section 5 of the December 1983 Final Report for general background information.

Present at the June 10, 1983 schematic design presentation meeting in Naples, Italy, were:

Richard Dangler	C.O.T.R. AID/Naples
Tibor Nagy	A.I.D. Director of Project/Naples
Stantan R. Nevin	A.I.D. Contracting Officer
Richard J. Passantino	Project Director P/JRB Architects
Miguel Aparicio	Project Manager P/JRB Architects
Eric Moy	Architect, P/JRB Architects
Piere Louigi Rizzi	Architect, Studio Castore
Stefano Merilli	Architect, Studio Castore
Franco Pareti	Structural Engineer, Studio Castore

Each of the schematic designs comprised a site plan, floor plans, building sections and four building elevations at 1:200 scale. Submitted with these documents was a revised educational program with related space requirements, a site analysis, design guidelines, and an outline explaining the design features for the design solutions. A verbal description for the third design was presented.

The design solution for schemes A and B as presented to A.I.D./Naples follow.



SITE PLAN - CALABRITTO

1. Calabritto Scheme A - Design Description

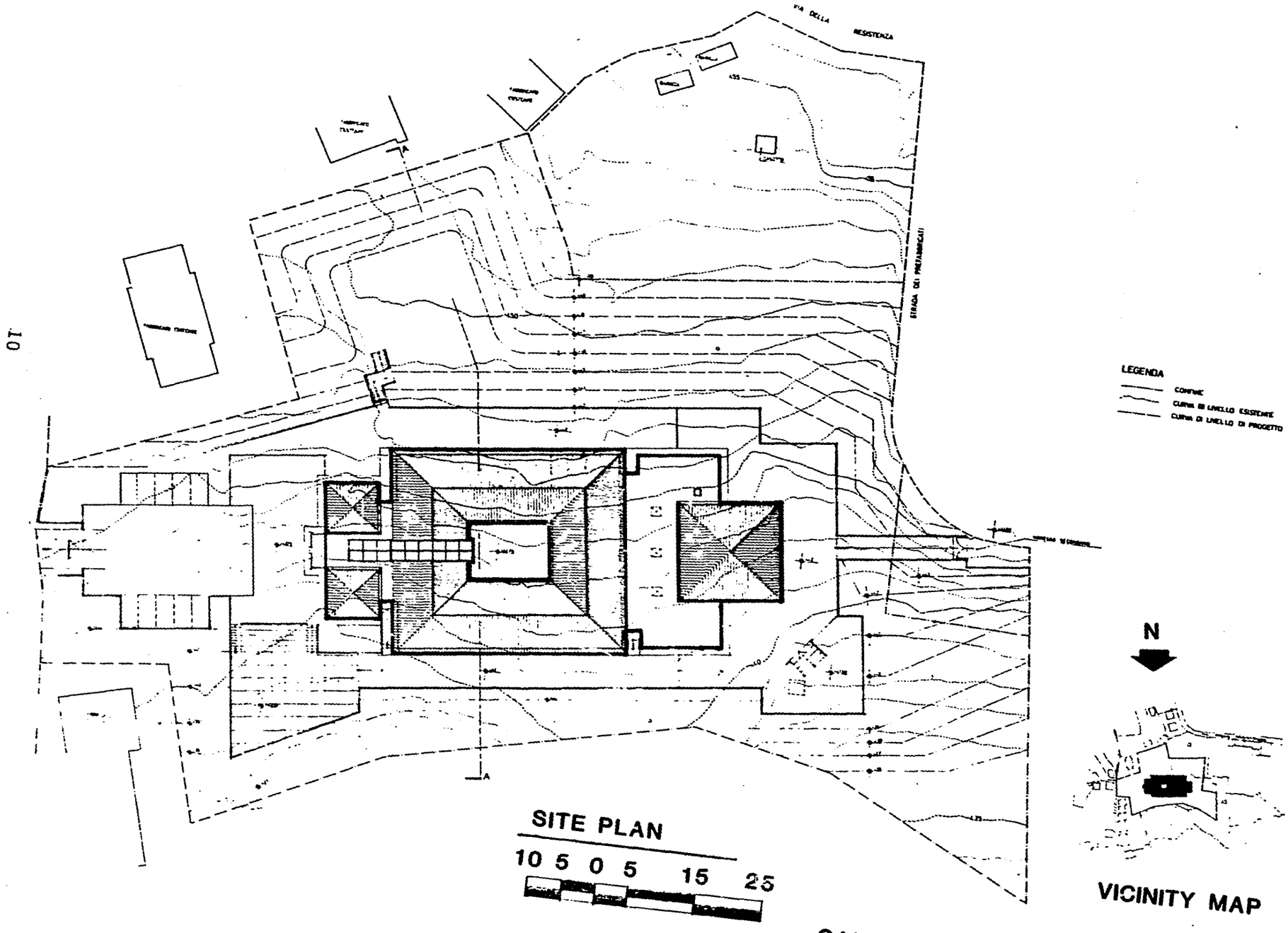
- One story - dropped gymnasium level
- Grading foundation keyed to site - less grading work - follow contours, building tied into ground strata
- Maximum play area obtained by sliding building to edge of site. (Separately zoned playareas for younger/older students)
- Good relationship between gym and playfield for older students
- Community use of gymnasium at lower level
- Good exiting from classroom areas
- Simple foundation design/simple span structure
- Flat roofs to be decorated with colored gravel for higher level viewing
- Elimination of double roof support system
- Minimal use of retaining walls
- Isolated use of special purpose classroom. Acoustically separated from rest of academic area
- Indoor - outdoor uses well developed
- School orientation toward new comune road (proposed)
- Simplified roof design
- Building placed on better load bearing portion of site

This one level design solution symmetrically arranged along the east/west axis forms a rectangular plan. Entrance to the site is from the east into a spacious parking area, which was intended to be used as a playing area during school hours. A secondary service entrance is from the west.

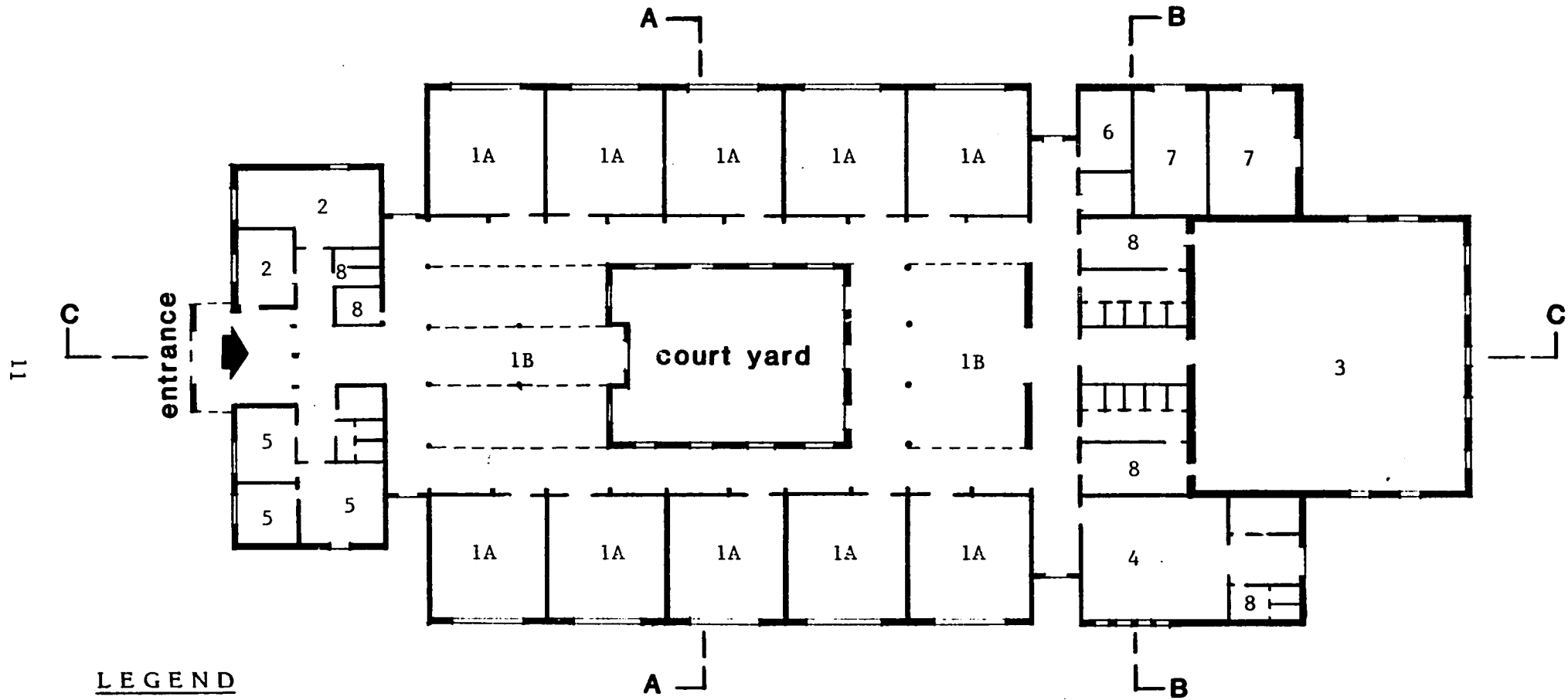
Along the perimeter of the building are wide walkways and a terrace connected with ramps and steps conforming to the difficult site contours. A belvedere located on the north/west corner of the site provides a panoramic view of the countryside and of the ruins of the old town of Calabritto.

The school building is entered from the east side into a small lobby that services the administration and teachers' lounge. Directly ahead is the didactic area. You first enter into a large, high ceiling open area which is one of two indoor activity spaces separated by a central open courtyard. On either side of these spaces are two banks of classrooms served by a single loaded corridor.

Terminating the building at the western end is the gymnasium with the locker rooms and showers, boiler room and the kitchen with storage.



CALABRITTO ELEMENTARY SCHOOL
SCHEMATIC DESIGN – SCHEME A



LEGEND

1A Normal Classrooms
1B Indoor Activity Areas
2 Teachers' Lounge
3 Gymnasium
4 Kitchen and Services
5 Administration
6 Medical Clinic
7 Boiler Room
8 Toilet/Locker Rooms

FLOOR PLAN

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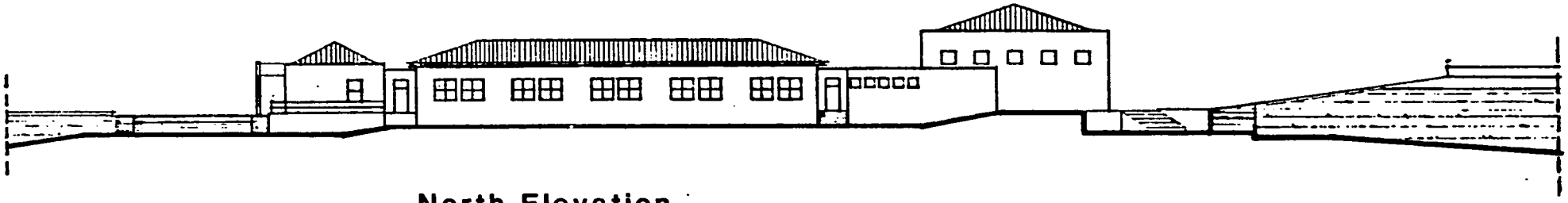
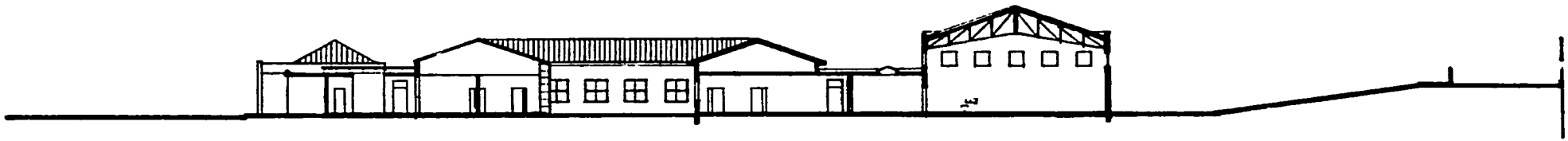
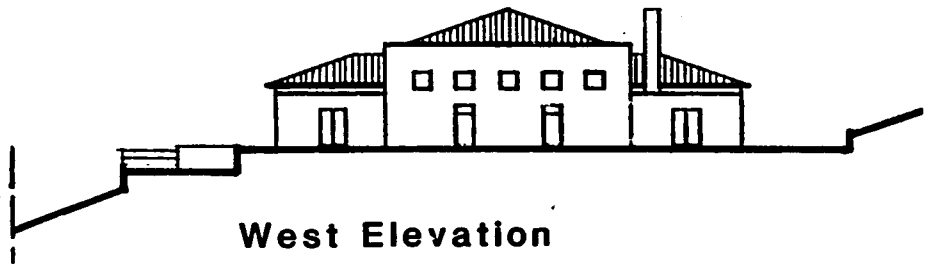


North Elevation

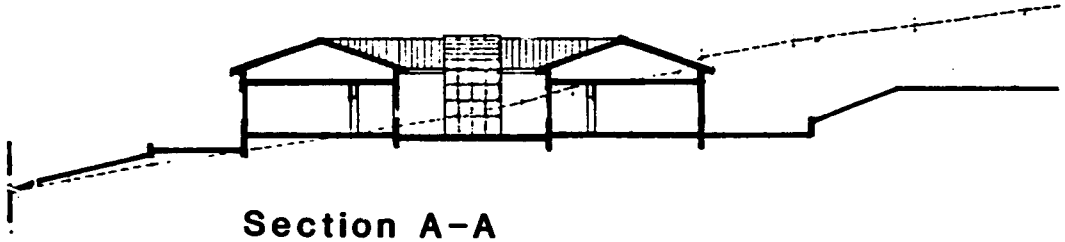


Section C-C

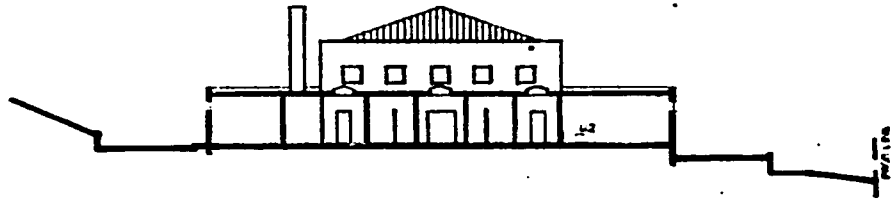
East Elevation



West Elevation



Section A-A



Section B-B

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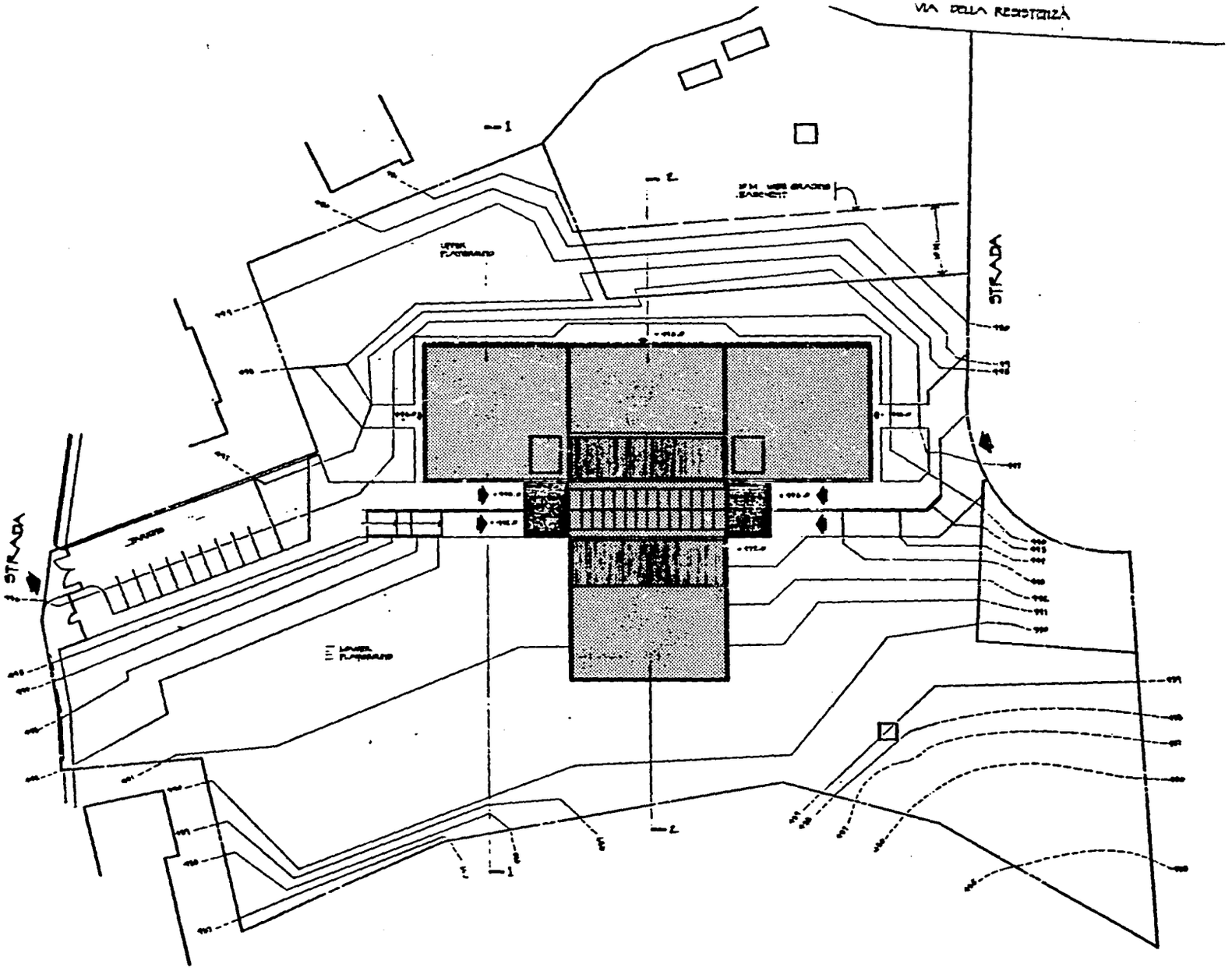
2. Calabritto Scheme B - Design Description

- Interior courtyard
- Unified plumbing
- Good community use of gym with physical separation from balance of school
- Orients toward eastern approach
- Minimal circulation area due to combined use special education areas with corridors, reduction of total gross area to below gross program requirements
- Simple rectangular structure
- Multiple exits
- Two indoor activity areas separated by courtyard
- Accents view to old town
- Does not require grading easement to higher property
- Large terrace areas around building

This small, two-level elementary school, designed to be nestled in the hillside of Calabritto, responded to two influential elements: the steep site and the panoramic view of the old city of Calabritto.

The school spaces consist of 10 classrooms, a large activity space, administrative offices, kitchen, and gymnasium with locker and shower facilities. The building's main approach is from the upper level. The visitor enters a lofty, skylit central lobby that serves the administration and teachers' lounge to one side and the academic spaces to the other. An open staircase at the center of the entrance lobby connects the upper level with the kitchen and gymnasium area below.

Due to the difficult site conditions, exterior playground spaces were limited to two small areas. One located on the southern portion of the site to serve the smaller children is well protected and accessible from the large activity room. Another playground, east of the school building and directly accessible from the gymnasium, will be used by the older children.



SITE PLAN

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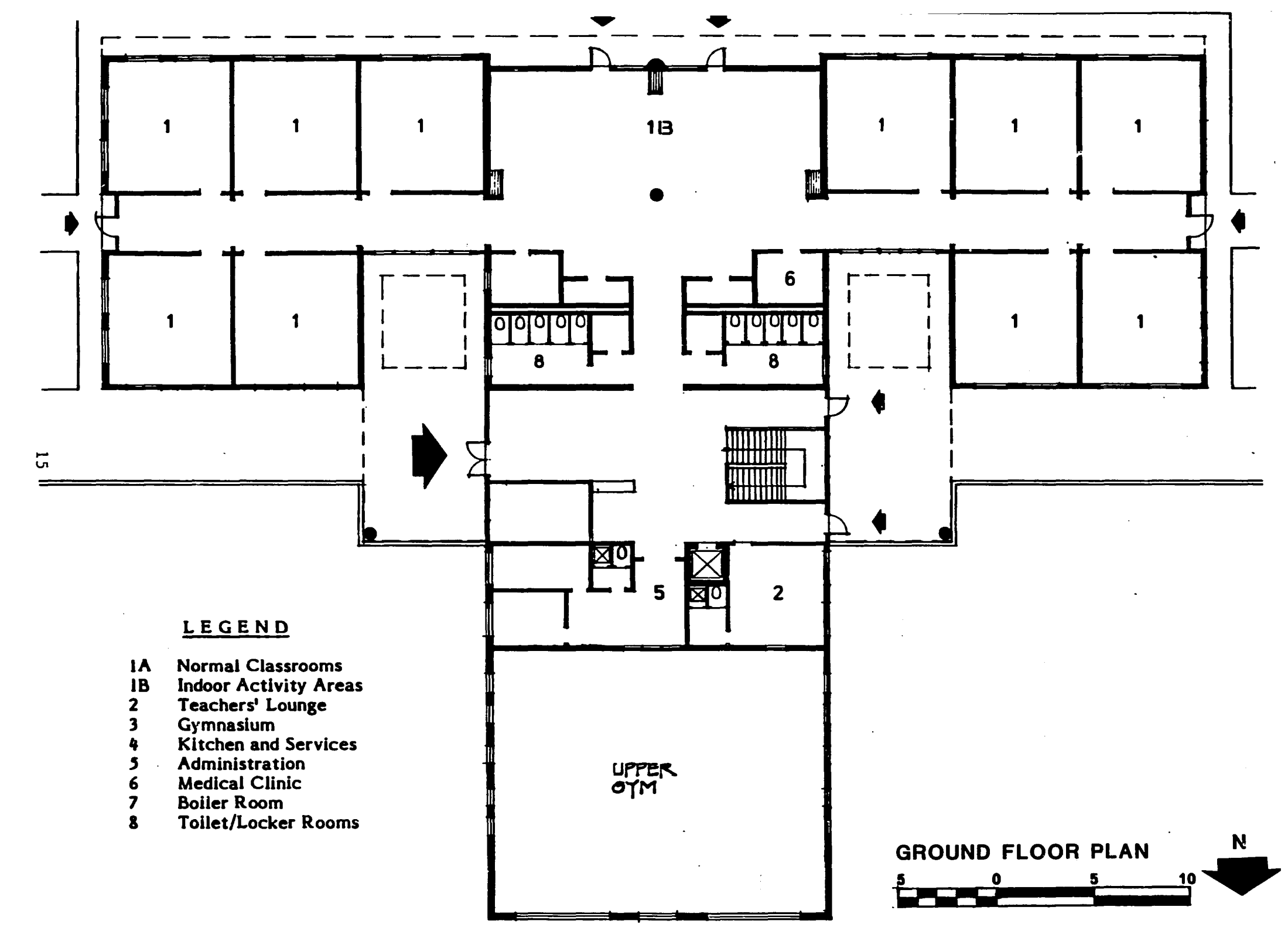
CALABRITTO ELEMENTARY SCHOOL
SCHEMATIC DESIGN – SCHEME B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UPPER
GYM
LEGEND
1A Normal Classrooms
1B Indoor Activity Areas
2 Teachers' Lounge
3 Gymnasium
4 Kitchen and Services
5 Administration
6 Medical Clinic
7 Boiler Room
8 Toilet/Locker Rooms
GROUND FLOOR PLAN
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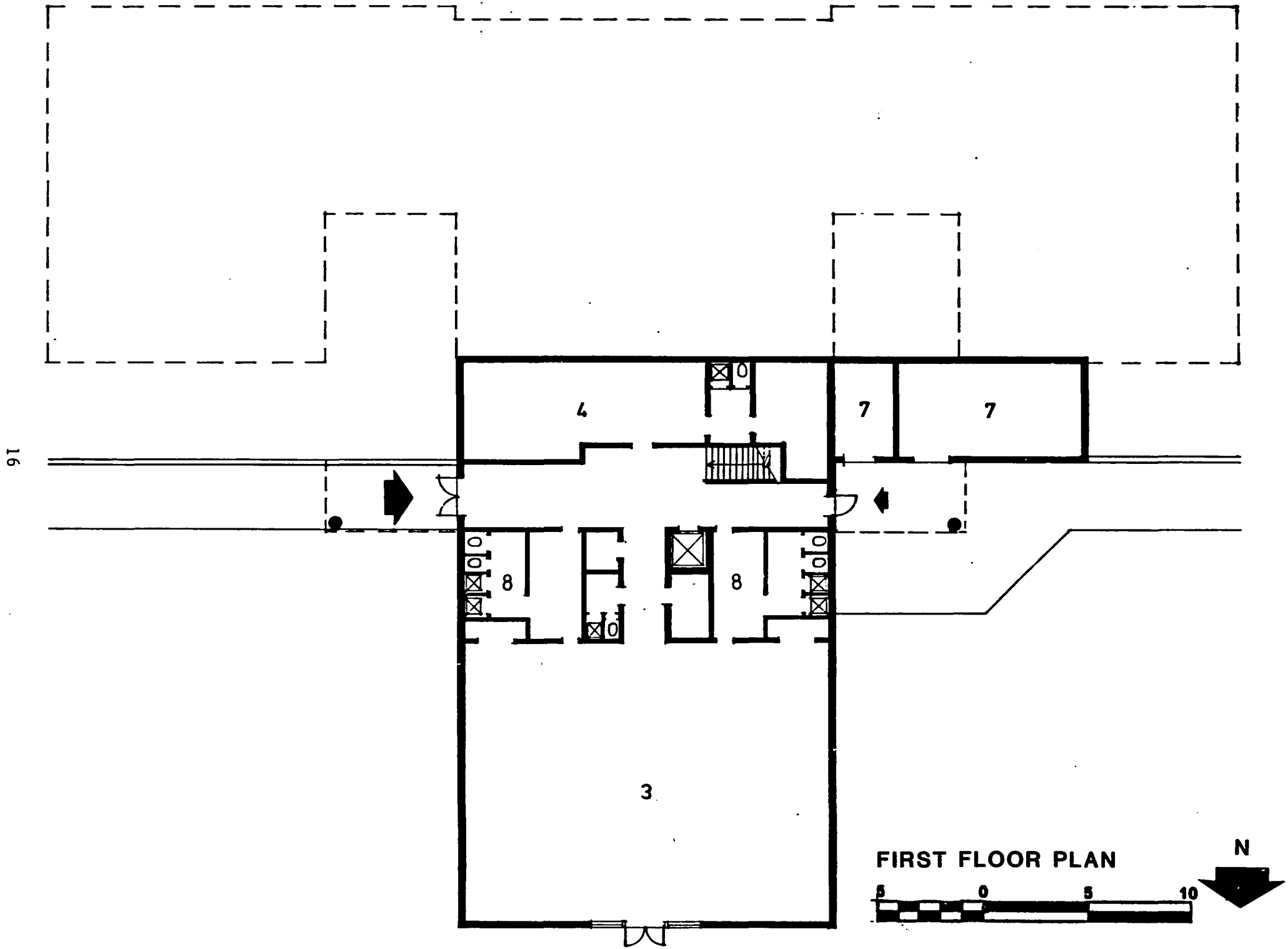
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FIRST FLOOR PLAN
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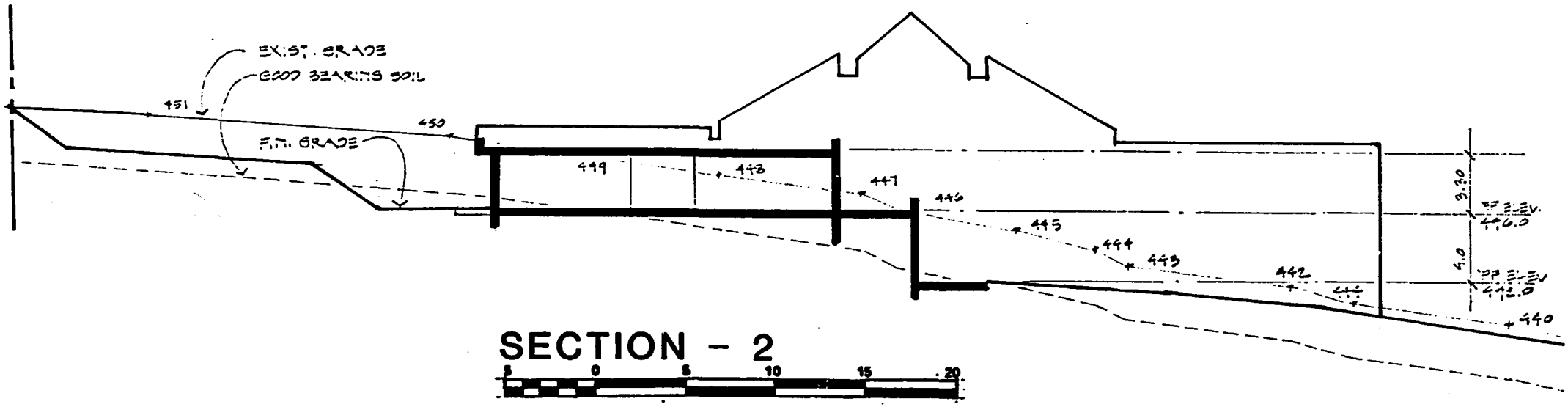

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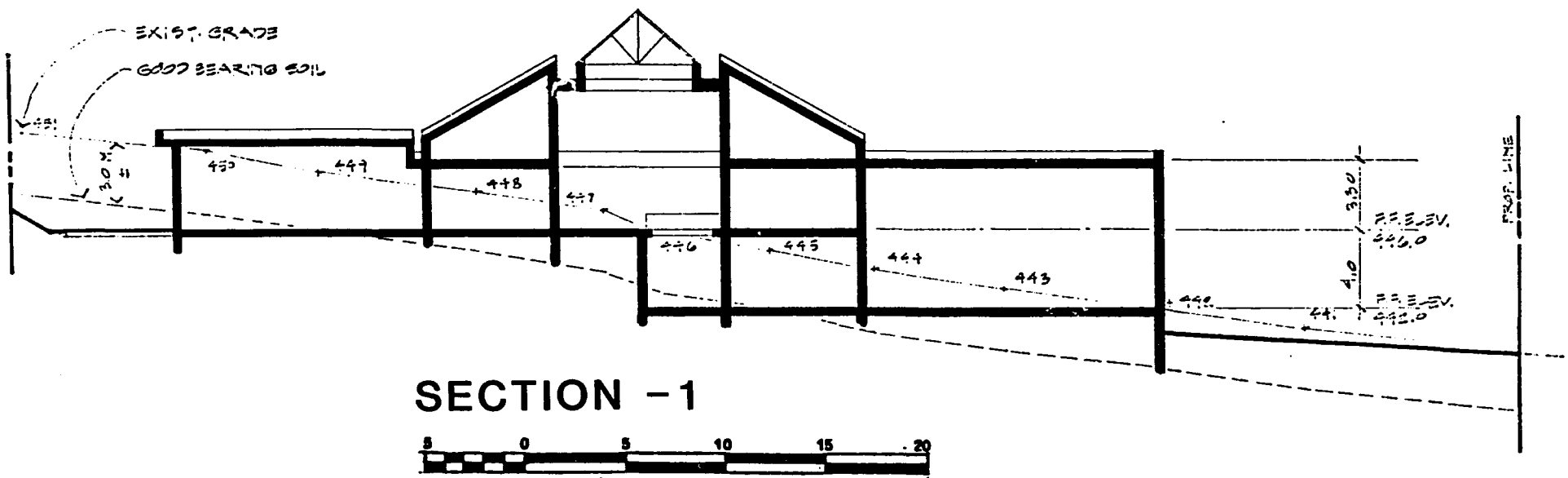

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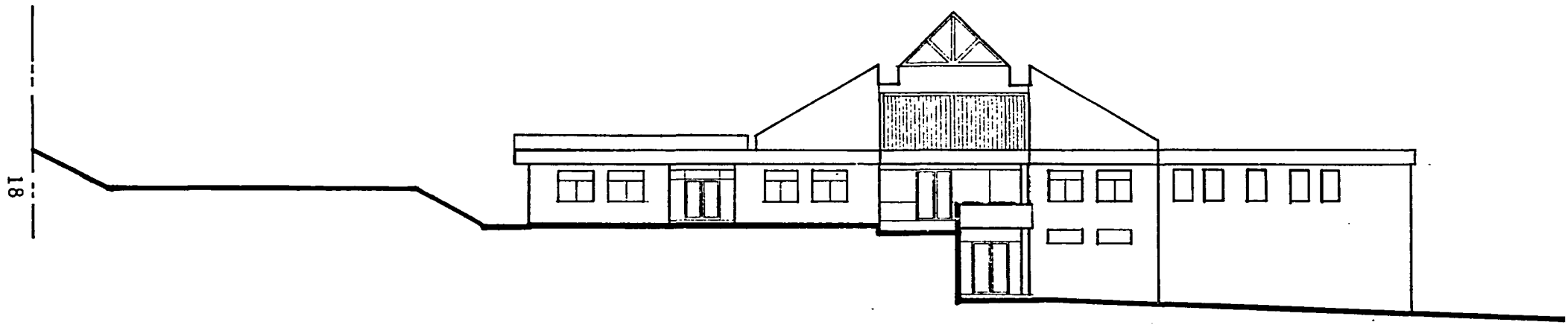

EAST ELEVATION

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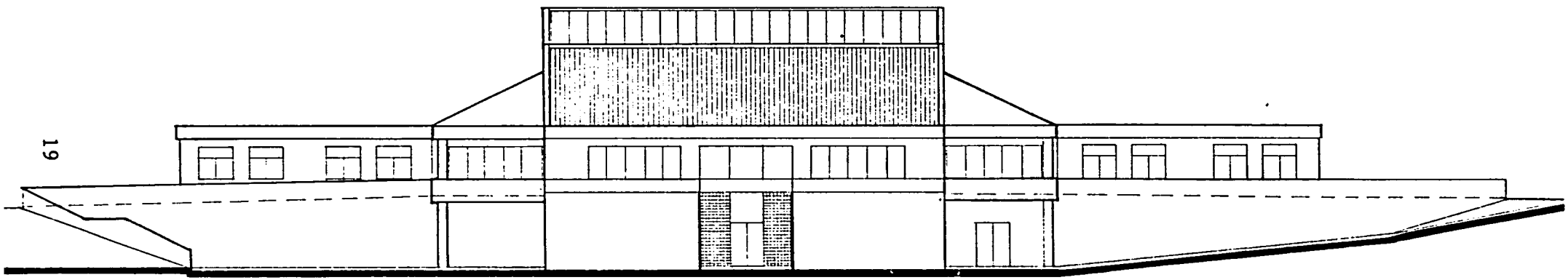

NORTH ELEVATION

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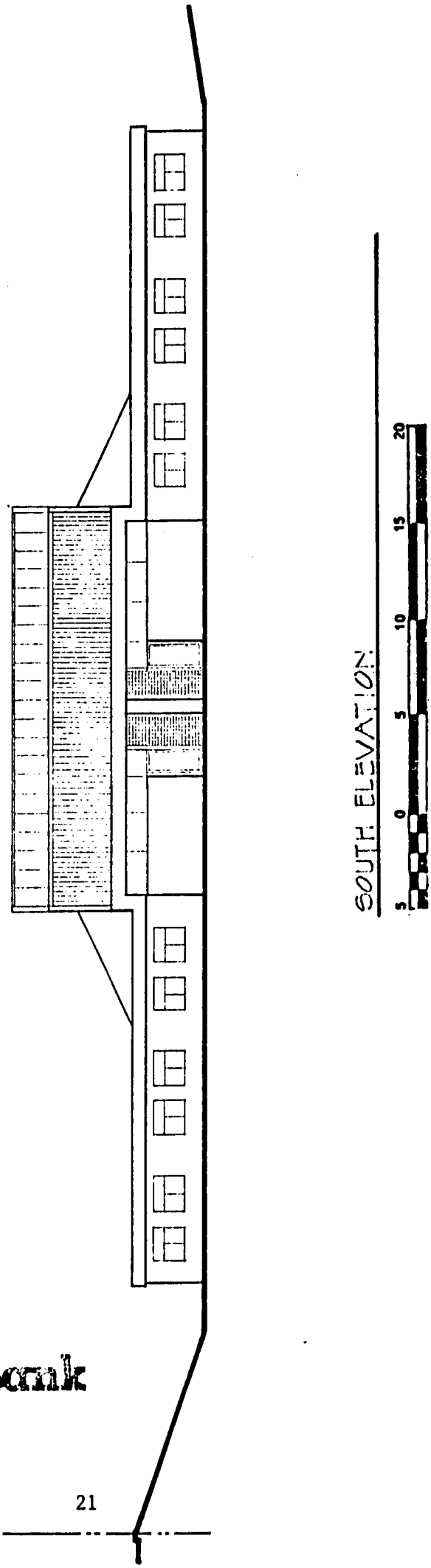


5. PRELIMINARY DESIGN PHASE

On June 17, 1983 P/JRB was notified of A.I.D.'s selection of Design Scheme B as prepared by P/JRB Architects and Martin Cagley & Middlebrook, Structural Engineers, and requested by letter authorization to proceed with preliminary and final construction documents. Work proceeded immediately with a team of American architects and structural engineers leaving for Italy on July 13, 1983.

A review meeting was conducted with A.I.D. representatives at the office of Studio Castore in Florence on July 15 to review the status of the project and determine the full preliminary requirements. Present at the meeting were:

Richard Dangler	C.O.T.R. AID/Naples
Tibor Nagy	A.I.D. Director of Project/Naples
Richard J. Passantino	Project Director P/JRB Architects
Italo Castore	Architect, Studio Castore
Miguel Aparicio	Project Manager P/JRB Architects
James R. Cagley	Martin Cagley & Middlebrook
Perry Mok	Martin Cagley & Middlebrook

Highlights of this meeting are as follows:

- Established design criteria, such as:

  a. Foundation to be of spread footing type with 90cm crawl space rather than slab-on-grade because of the poor soil conditions and steepness of site.

  b. Retaining walls to be minimized by sloping of grades.

  c. Entrance redirected to be from new proposed road.

  d. The small property configuration to be reaffirmed by the comune.

- September 23, 1983 was established as the completion date for the I.F.B. package.

- Greater coordination efforts between the architects and the City of Calabritto was requested, especially in connection with the new proposed road adjacent to the property.

The following Tuesday, July 19, 1983, a meeting was held with Calabritto city officials, A.I.D. representatives and the architects to resolve a series of important issues as follows:

1. The proposed road will be relocated as shown on the architects' submitted drawings.
2. The two eastern parcels to be formally returned to the Comune.
3. Service road east to the property will be improved by the Comune.
4. The 10 meter grading easement on the southern end of the property can be utilized for the A/E design.
5. The building designs were formally approved for educational conformance by the educational authorities.

At the completion of the preliminary phase, the drawings were approximately 25 percent complete. All of the major concerns for the civil, architectural, structural, mechanical, electrical and plumbing were resolved, and the final working drawings phase was authorized to proceed. For this phase, due to the Italian national holiday schedule during the month of August, all of the project activities and key personnel of Studio Castore were transferred to the Bethesda, Maryland office of P/JRB Architects.

6. CONSTRUCTION DOCUMENT PHASE

Work on the final working drawings commenced during the month of August at the office of P/JRB Architects in Bethesda, Maryland. A team of Italian architects spent the entire month coordinating and working closely with the American architects and structural engineers. During this period up to 75 percent of the working drawings were completed. On August 31, the team returned to Studio Castore's office in Florence to complete the final bid package.

A meeting with A.I.D. in Naples was conducted September 12, 1983 to review the 75 percent completion package. Present at the meeting were Richard Dangler, Tibor Nagy, Richard Passantino, Italo Castore, Miguel Aparicio and Stefano Merilli. A continuation of this meeting to review the remaining mechanical, electrical and plumbing drawings was held in Florence with A.I.D. Engineer Nagy on September 16, 1983. The following are the highlights of the comments and resolution made at these meetings:

- Provide more directional and informative notes to the construction details to better clarify and define the architects' intent, particularly to specialized items such as the skylight details and site details.

- Closer coordination should be conducted between the architect and the mechanical/electrical engineer.

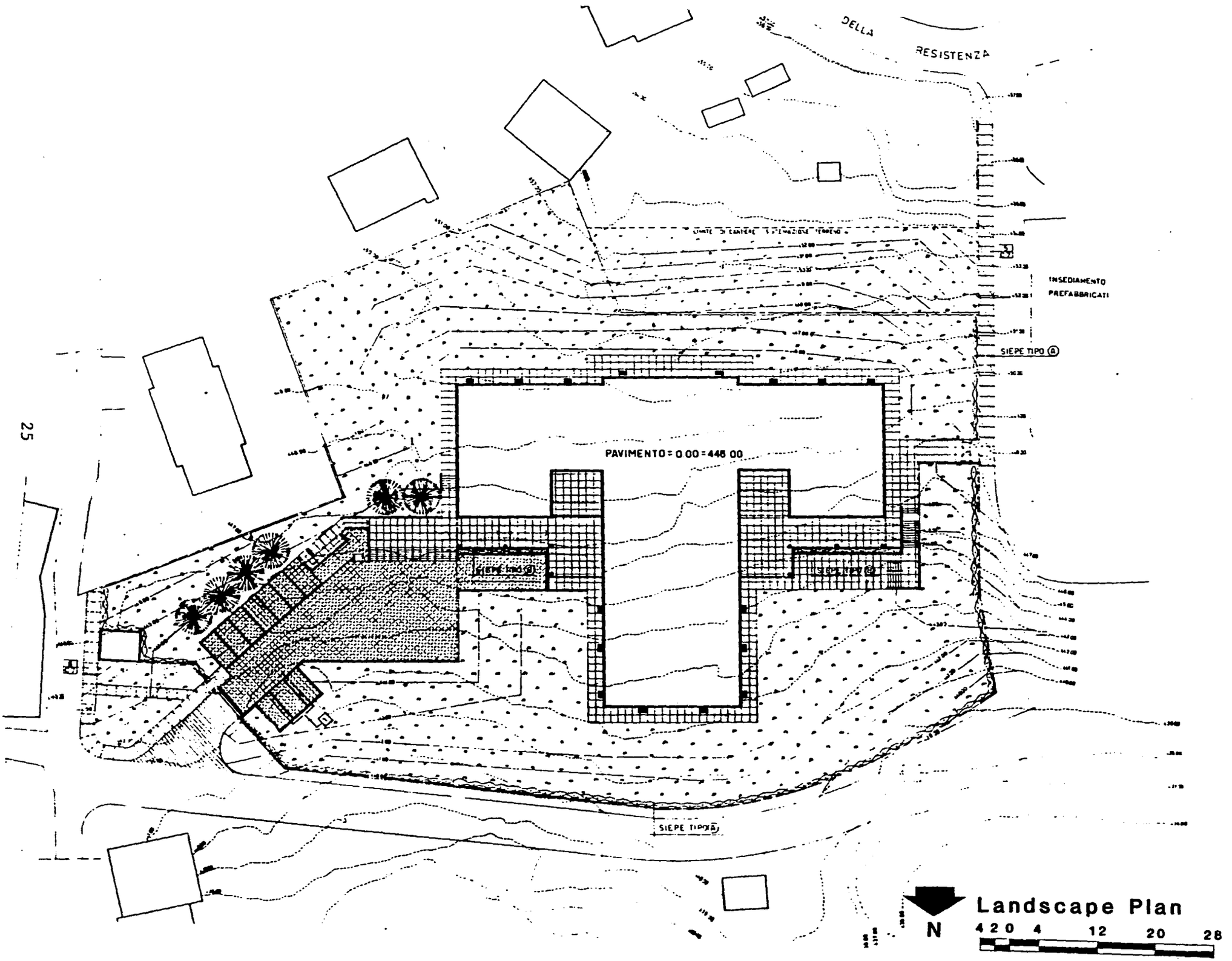
- Some modification to the I.F.B.

The architects incorporated the comments made by Engineer Nagy.

On September 23, 1983, the complete I.F.B. packages were available for contractor's review. The bid package consisted of:

- instructions to bidders
- specifications
- structural calculations
- working drawings of architectural, civil, mechanical, electrical, plumbing and civil works
- soil boring information
- geological report

Reference can be made to Section 7 of Final Report for information relating to the codes, regulations and standards governing the design of this school.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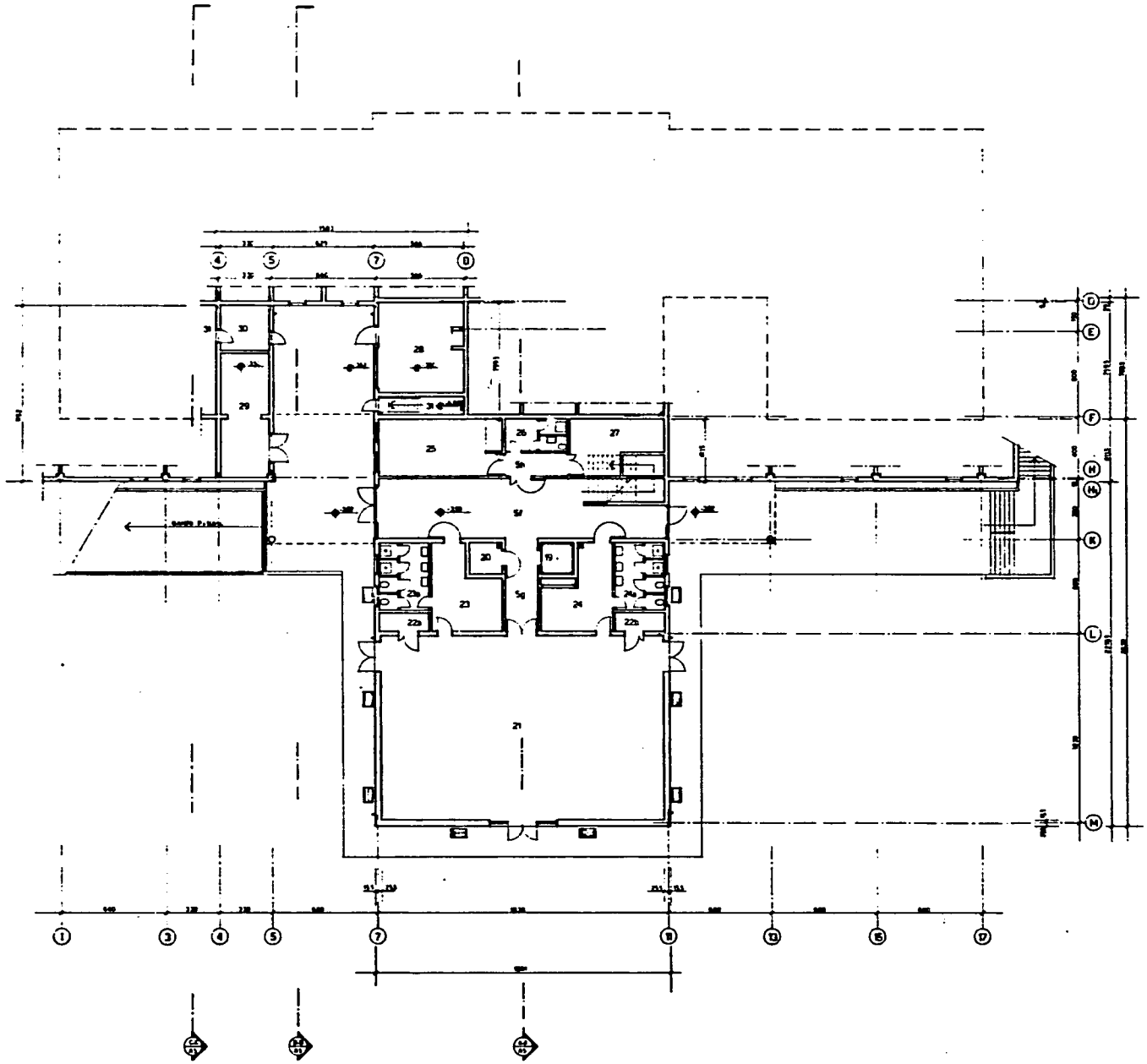

5 DISIMPEGNO
19 ASCENSORE
20 LOCALE MACCHINA ASCENSORE
21 PALESTRA
22 DEPOSITO PALESTRA
23 SPOGLIATOIO E SERVIZI MASCHI
24 SPOGLIATOIO E SERVIZI FEMMINE
25 CUCINA
26 SERVIZI CUCINA
27 DISPENSA
28 CENTRALE TERMICA
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30 DEPOSITO
31 ACCESSO SOTTOSOLAIO DI I-II LIVELLO

Ground Floor Plan

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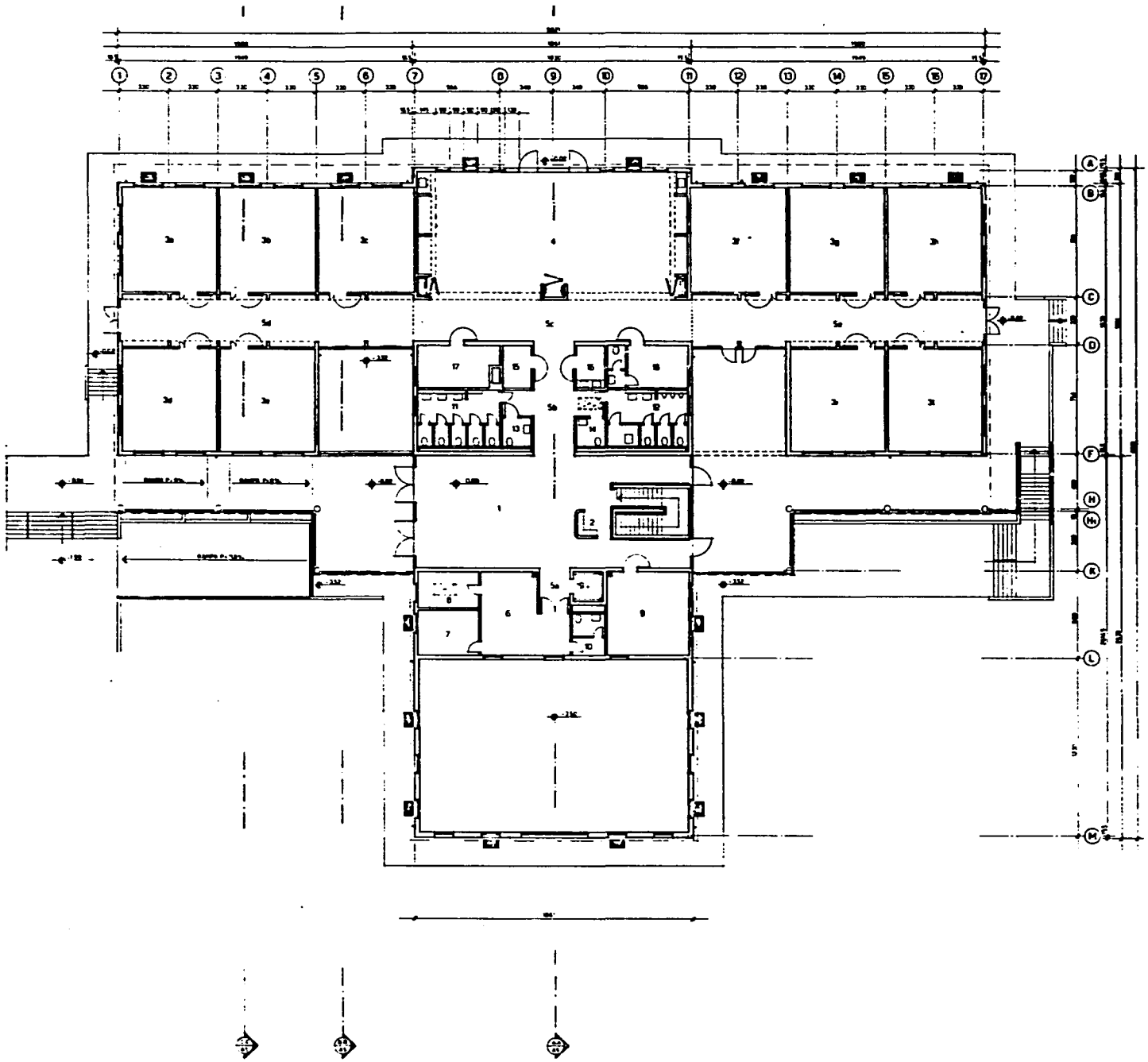

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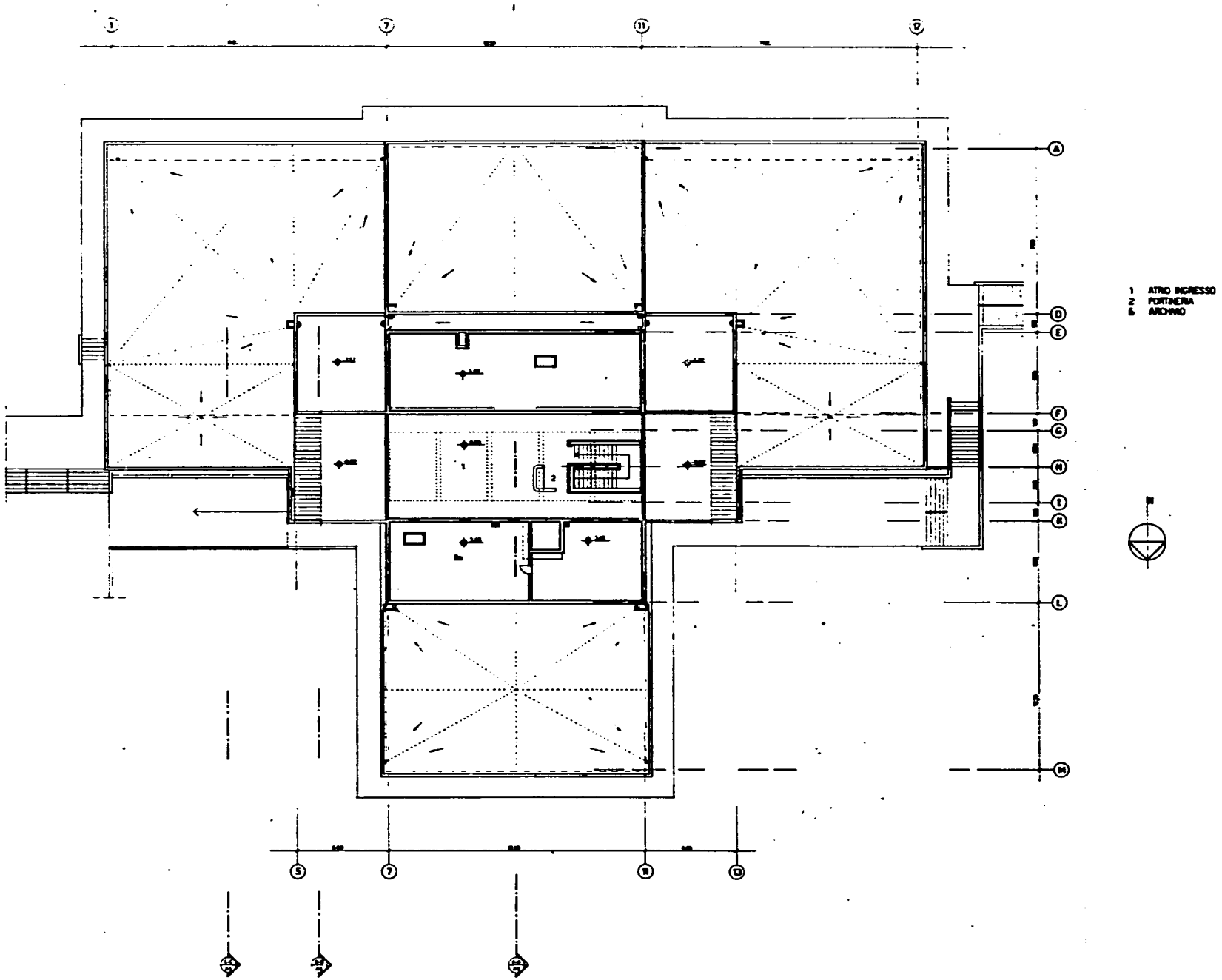
8 ARCHIVIO
9 SALA INSEGNANTI
10 SERVIZIO SEGRETERIA
11 SERVIZI FEMMINE
12 SERVIZI MASCHI
13 SERVIZIO INSEGNANTI
14 SERVIZIO ANDICAPPATO
15 SPOGLIATOIO BIDELLI
16 CAMERA OSCURA
17 DEPOSITO MATERIALE DIDATTICO
18 VISITA MEDICA
19 ASCENSORE

ATTIVITA' DIDATTICHE	mq 615
ATTIVITA' COMPLEMENTARI	mq 47
CUCINA E SERVIZI	mq 55
PALESTRA	mq 285
AMMINISTRAZIONE	mq 49
SERVIZI E CONNETTIVI	mq 572
CENTRALI TECNOLOGICHE	mq 63
TOTALE AREA NETTA	mq 1686
TOTALE AREA LORDA	mq 1953

First Floor Plan

4 2 0 4 12 20 28



Mezzanine Floor Plan

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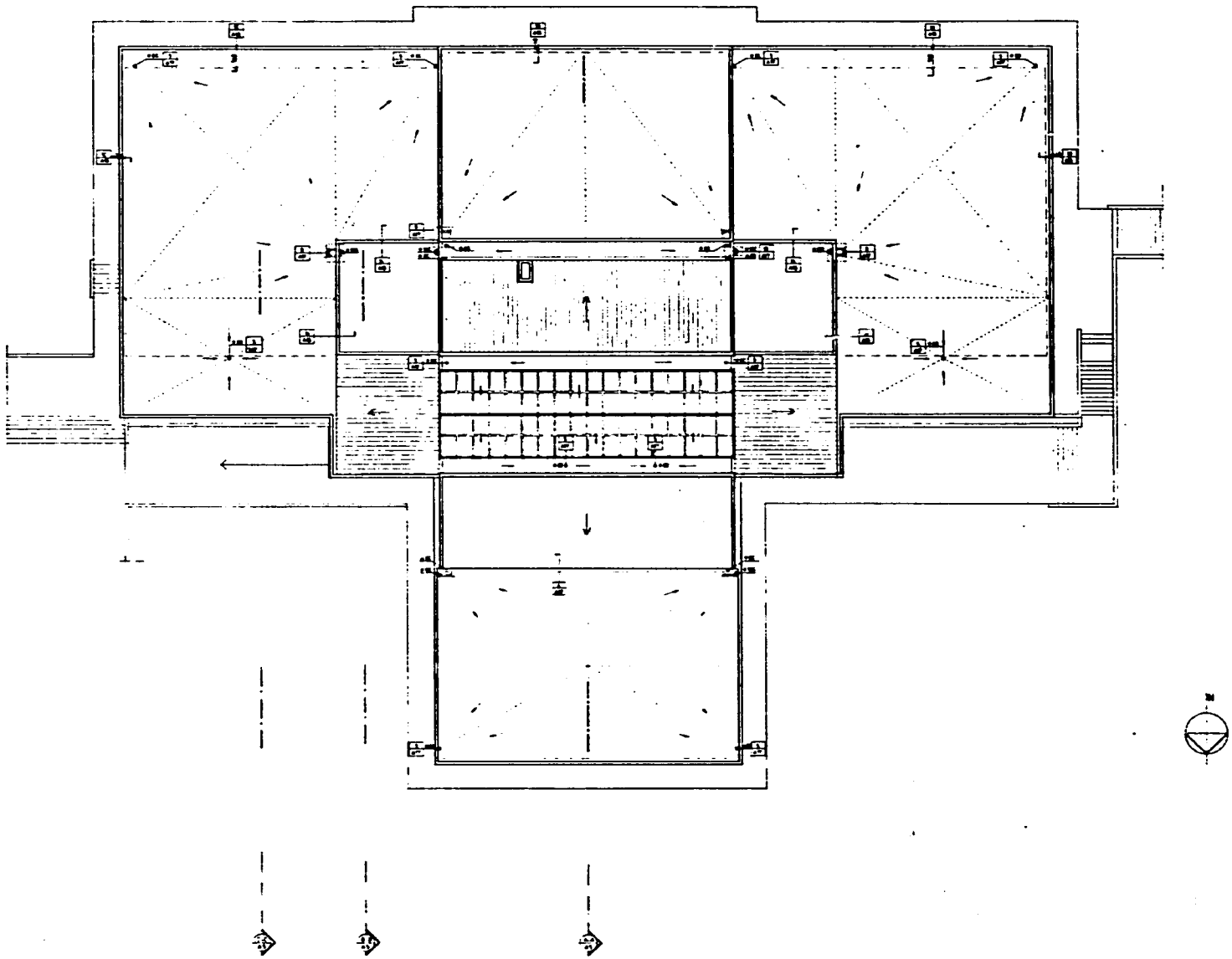

Roof Plan

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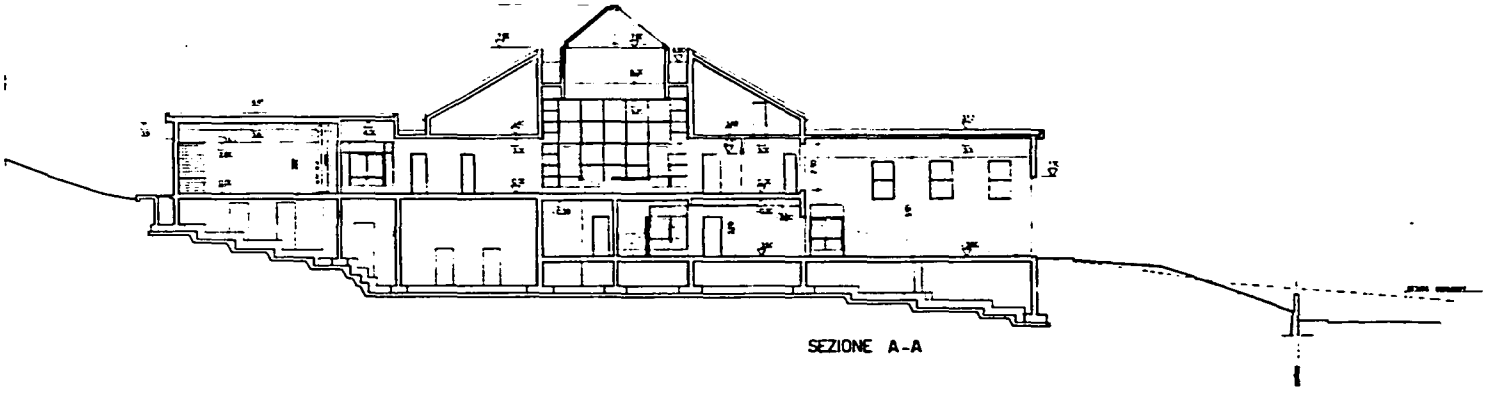
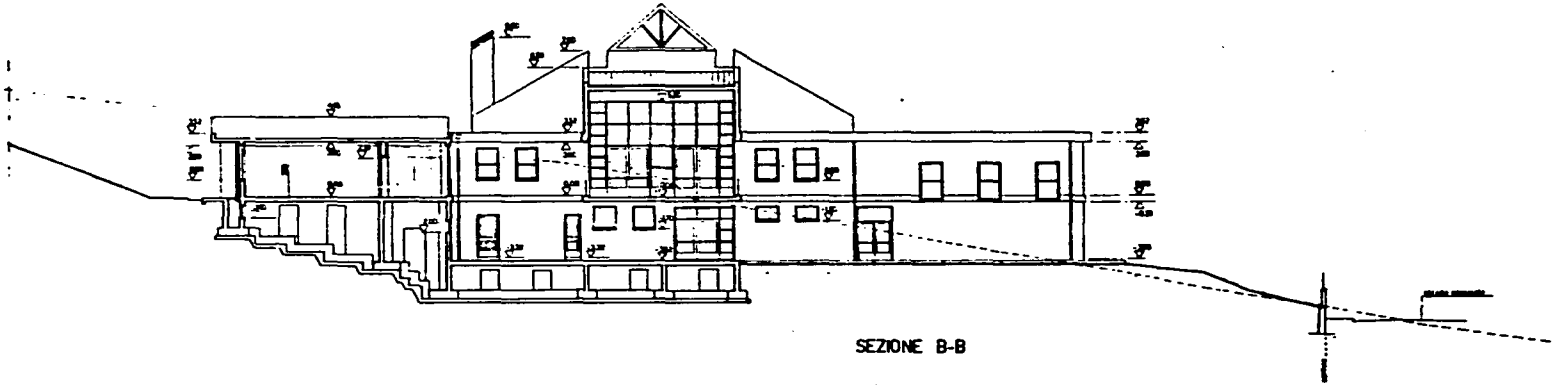
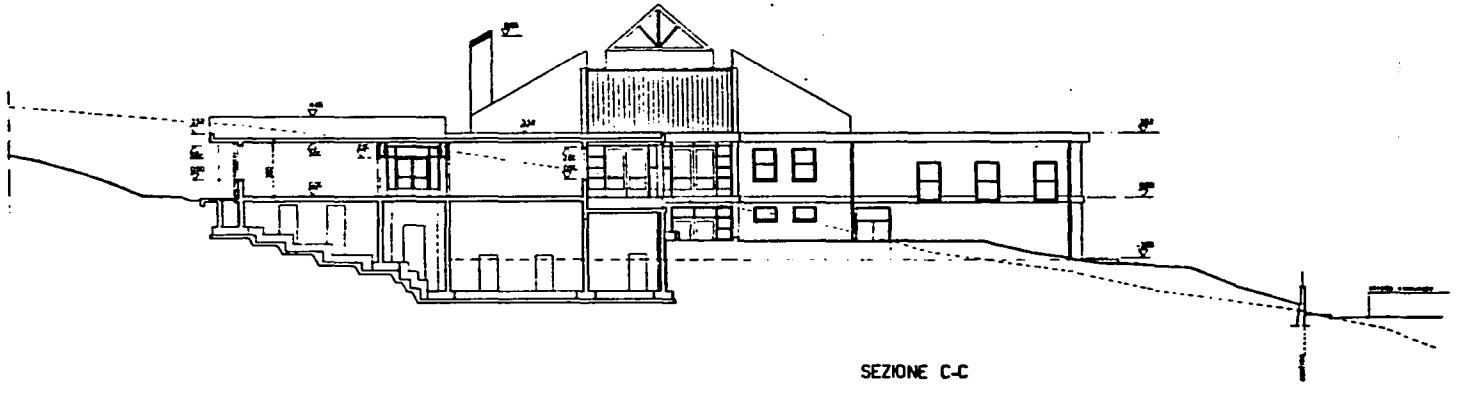


SEZIONE A-A



SEZIONE B-B



SEZIONE C-C

Building Sections

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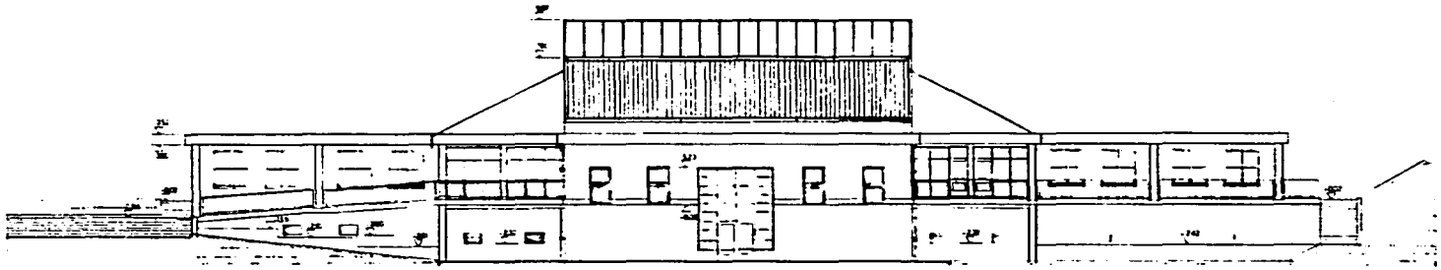
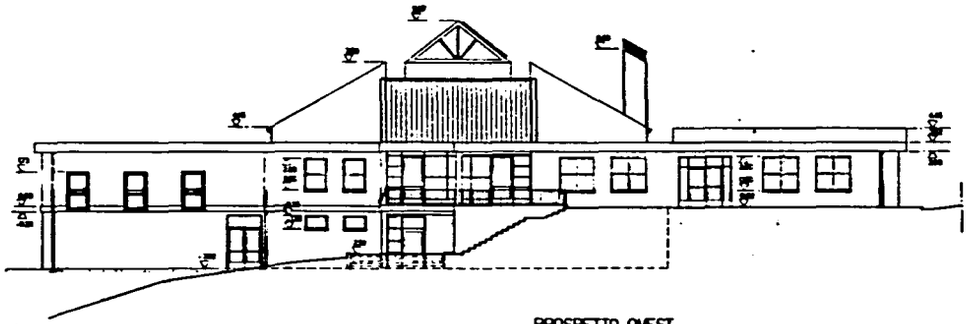
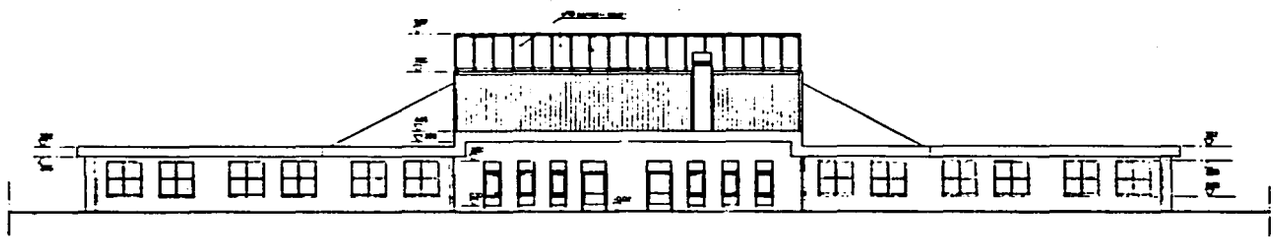


PROSPETTO NORD



PROSPETTO OVEST

PROSPETTO EST



PROSPETTO SUD

Building Elevations

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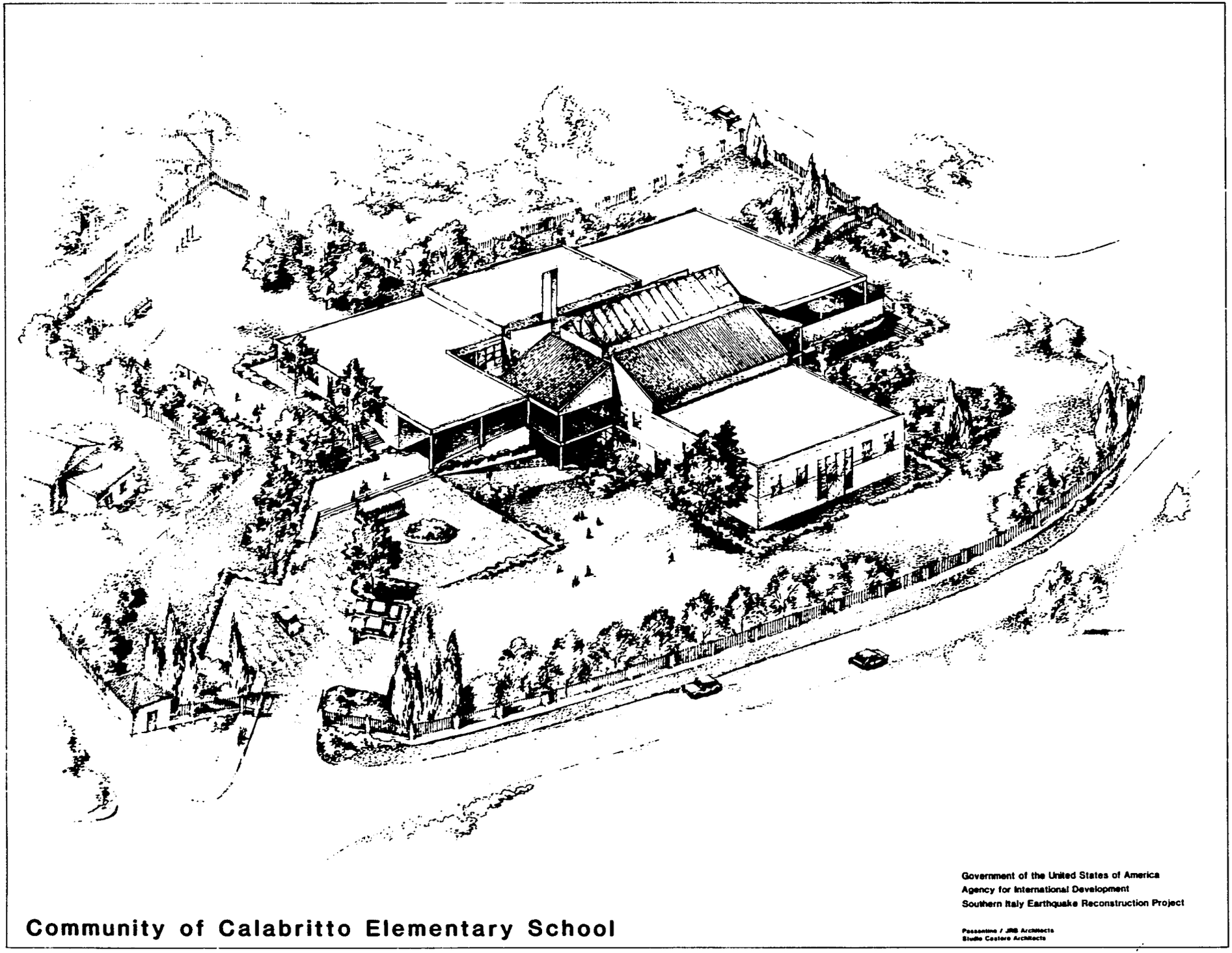
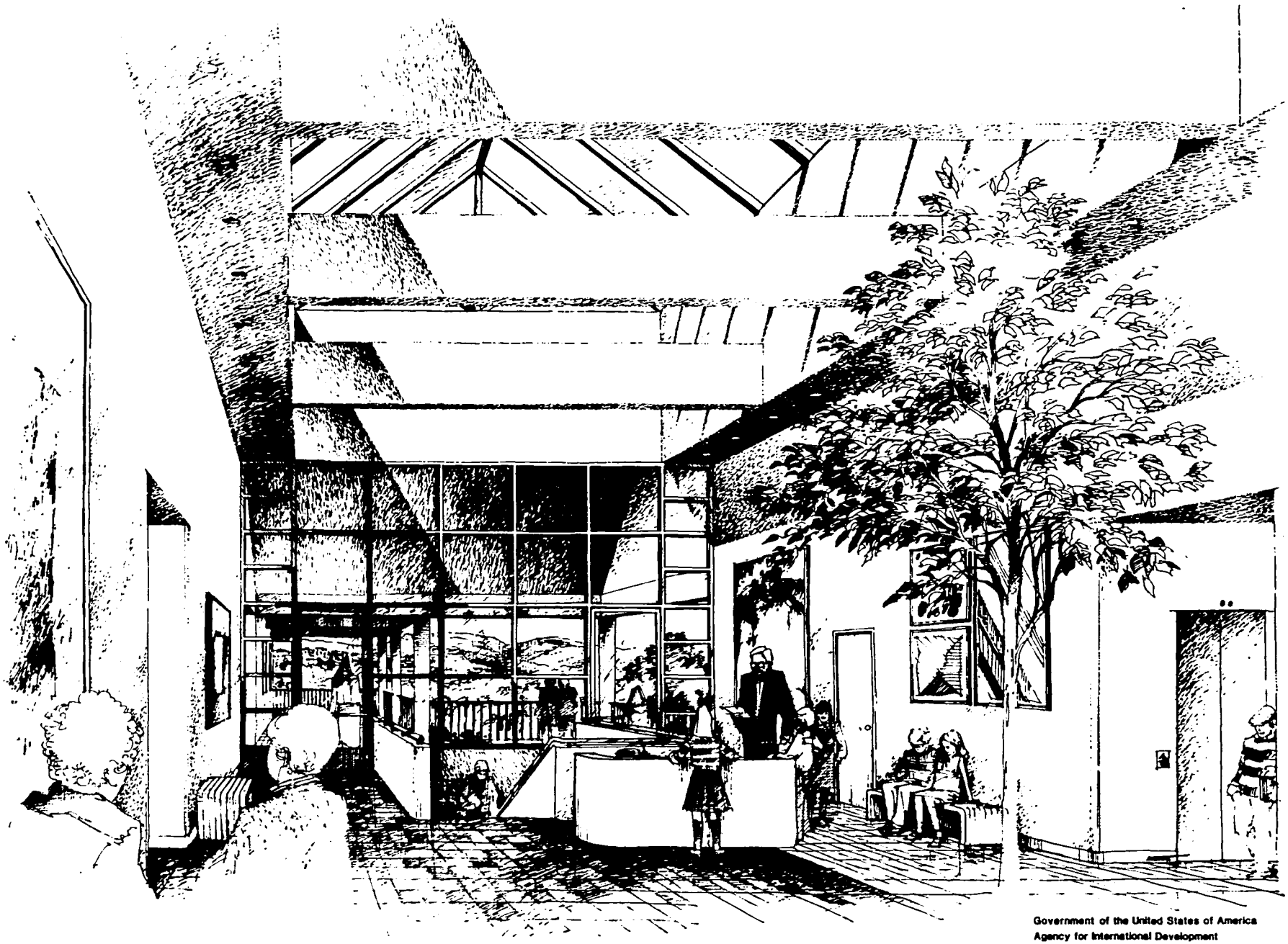


Community of Calabritto Elementary School

Government of the United States of America
Agency for International Development
Southern Italy Earthquake Reconstruction Project

Passantino / JRB Architects
Studio Costero Architects



Government of the United States of America
Agency for International Development
Southern Italy Earthquake Reconstruction Project

Passanisi / JRB Architects
Studio Castoro Architects

Community of Calabritto Elementary School

7. I.F.B., BID ANALYSIS AND AWARD RECOMMENDATION

With the submission of the construction documents to AID/Naples, P/JRB and Studio Castore proceeded with the next contract phase - bid preparation and review. As per contractual agreement with A.I.D., P/JRB responsibility for Calabritto was the same as for the first six schools. The same list of pre-qualified contractors was used for this project. (Refer to Section 8 of Final Report.)

Bidding and Construction Award Recommendations

A. Bids were received from eight pre-qualified contractors on 29 October 1983. The lowest bid received was by Consorzio fra Cooperative di Produzione e Laboro (CONSCOOP) with a bid of 1,814,310,972 Lire, (U.S. $1,133,944) which was slightly below the second and third bidders, Coop Mucafer and S.I.A., respectively.

   This bid represented approximately one percent above the architects' estimate of 1,792,862,000 Lire (U.S. $1,120,539).

B. It was recommended that the bid offered by Consorzio fra Cooperative di Produzione e Laboro be accepted by A.I.D. since it was offered by a known, reliable bidder currently under contract with A.I.D. for the Calitri school, and their performance on that project to date was excellent.

   It was further recommended that, prior to executing the construction agreement with CONSCOOP, the following provisions be established:

   - The sport facilities work be included in the base bid since a line item amount was not entered into the itemized bid (2.1).
   - The solar hot water system (2.2) and the landscaping (2.3) items remain part of the construction scope-of-work since they were included in the base bid price.
   - The contractor should again look at the breakout itemization in this bid for each trade, since many were in substantial variance with the Architects' estimate. Adjustment should be made in this itemization where appropriate.

C. Project Summary:

Student capacity:	250 students
Classrooms:	10 regular classrooms, 1 special classroom
Bid Cost:	$1,133,944
Gross Area:	19,995 sq. ft.
Contractor:	CONSCOOP
Construction start:	Spring 1984
Expected occupancy:	September 1985

TABULATION OF BIDS

CALABRITTO SCHOOL

A. Name of Bidder (In Order of Bidding)	B. Part III Sect. B Italian Lire	C. Amend No. 1 Rec'd	Bid Bond
1. Coop. Mucafer s.r.l.	1,880,000,000	yes	yes
2. S.I.A.	2,618,000,000	yes	yes
3. FEAL	1,962,000,000	yes	yes
4. I.M.C.A.	2,549,000,000	yes	yes
5. Diego/Nervi-Bartoli	2,150,000,000	yes	yes
6. T.R.N. Costruzioni	1,980,000,000	yes	yes
7. GECOFER	2,592,000,000	yes	yes
8. CONSCOOP	1,814,310,972	yes	yes

Architects' Estimate: 1,797,862,000 Lire
Date Received: 29 October 1983

Reference Table of Previously Submitted Documents

1. Geological Report for the Comune Di Calabritto "Rapporto Geologico - Tecnico" Dr. Geol. Luigi De Iasi, December 30, 1982

2. Three Schematic Design Solutions, June 9, 1983

3. Construction Documents:
   - Specifications
   - Civil, architectural, structural, mechanical, electrical and plumbing construction drawings
   - Cost estimate
   - Structural calculation

4. Invitation for Bid Contract

5. Final Report for A.I.D. Project No. 145-81-01 dated 30 December 1983 for Calitri, Avellino, Solofra, Grottaminarda, Sant'Angelo Dei Lombardi, and Vallata

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CALABRITTO SCHOOL

INTRODUCTION

On November 23, 1980 at 19.34 local time the Southern Italian provinces of Basilicata and Campania were shaken by a strong earthquake of magnitude 6.8 on the Richter scale. The epicenter of the quake, located by the Instituto Nazionale di Geofisica in Rome, had the coordinates 40.81 N and 15.38 E and a focal depth of 15-20 km. A series of after shocks followed the main shock, whereby the twelve strongest in the 7 days afterwards reached magnitudes between 4.0 and 5.0 and gave rise to further damage. A preliminary investigation of the recorded seismograms showed that the earthquake was caused by a normal fault movement. The main (tensile) stress was in a SW-NE direction. The epicenter was situated in a seismically very active zone of Southern Italy, which follows the strike of the Appenines and bends in the region of the epicenter towards the south to the Tyrehenic Sea, where the focal depths of earthquakes may be as great as 400 km.

The two regions with the highest observed intensities (IX on the MSK-scale) are in the area of normal faulting. The location of the normal fault was defined by the large number of measured after shocks and by analyzing the data from the surrounding seismograph stations. The worst hit areas in the epicentral regions are, amongst others, S. Angelo dei Lombardi, Conza di Compania, Lioni and Laviano. The epicenter is about 5-7 km north of Laviano. The area with the greatest amount of damage stretches from Avellino to Potenza in the E-W direction and from Grottamindarda to Salerno in the N-S direction, covering an area of approximately 3000 km^2. Within this area average intensities of VII or more were encountered. However, tremors were felt as far away as Northern Italy, some 700-800 km from the epicenter. (Reference: "Southern Italy Earthquake", November 23, 1980, E. Berger and J. Studer.)

The U.S. Agency for International Development (AID) is administering a grant aimed at providing relief to the victims of the earthquake. Part of the relief program is the construction of a number of schools in the Avellino region.

The design Team of JRB/Passantino, Studio Castore, along with Engineering Consultants has been selected by AID to provide redesign of the new earthquake resistive school for Calabritto. Martin, Cagley & Middlebrook along with Gianfranco Pareti are the Consulting Structural Engineers for this redesigned project.

The school building is approximately 20,000 square feet (1900 square meters) in size and is located in the Avellino District in the town of Calabritto.

The AID program requires the new schools to be constructed in a style and character that is indigenous to the region, utilizing local materials and labor. The school building will also serve as a community center and will demonstrate design and construction practices that have superior earthquake resistant characteristics.

It is quite evident from the observations made during visits to the school sites in the region that earthquake effects were evident over a wide region. The magnitude of the earthquake's force could be identified to be between 6 and 7 on the Richter Scale. Such earthquake magnitudes occur around the world fairly frequently in seismically active areas and can be expected to occur again in the region. Design and construction practices that are not cognizant of the forces, and detailing requirements necessary to resist earthquakes will continue to be inadequate. Future earthquakes of magnitudes similar to the November 23, 1980, earthquake will extract heavy tolls in the region.

It is imperative that all new construction in the region be designed with earthquake forces and detailing requirements in mind and proper supervision of construction be exercised to ensure that correct concepts of design are actually implemented during construction. While no single factor can answer all aspects of earthquakes, there is no question that rational design and detailing practices developed with earthquakes in mind can help to minimize losses and reduce hazards, thereby assuring performance levels far superior to those observed in the Avellino district.

DESIGN CRITERIA

The project Statement-of-Work defines the following:

"Design criteria", were specified in the contract and developed in coordination with AID, will take into account the traditional design concepts applied in Southern Italy, as well as the varied aspects of its landscape. While giving due consideration to Italian architectural characteristics, particular emphasis have been placed on the functionality of designs in order to produce, with the dominant use of building materials available locally, a standard of building design that is compatible with its surroundings, and which is at a level substantially above that commonly displayed by recently constructed schools and public buildings. Proposed designs also incorporate energy conservation features that have proven beneficial and cost effective in current building technology and development.

Specifics and details of the architectural and detailed engineering design requirements, plans, bid documents and other services required are discussed below and elsewhere in the contract. The design and ultimate construction of the project shall conform to Italian building standards and codes except as otherwise provided herein.

PERFORMANCE STANDARDS

1. Drawings and specifications are written in Italian and follow Italian unification norms (UNI) rules, codes and all other applicable regulatory legislation. In particular, technical criteria for school designs take into account the following norms.

   a. "Decreto ministeriale" dated December 18, 1975, and published on February 2, 1976, in the "Gazzetta Ufficiale" No. 29, and/or as subsequently revised.

   b. Italian Law Number 373 dated April 30, 1976, and published on June 7, 1976, in the "Gazzetta Ufficiale" No. 148, and/or as subsequently revised. The Code regulates energy consumption and utilization.

2. In general, the Italian Building Code Seismic provisions have been applied in the process of structural design. Regardless of the level of intensity of the seismic zone, all school buildings have been designed in accordance with the norms relative to the highest intensity provided by the Italian Seismic Code, or equivalent to "first category" zone (Seismic coefficient S-12) or higher if so required for structural integrity in the judgment of the Contractor. Where the Contractor considers it necessary to provide a greater factor of safety in the structural design of the school, the norms of the Uniform Building Code, 1979 edition, have been applied.

3. All work has been performed consistent with standards commensurate with professional competence for work of a similar nature.

A comparative study between the Italian Seismic Code for the first category zone with the maximum earthquake forces (Seismic coefficient S-12) and the 1979 Uniform Building Code reveals the following: The Italian Code forces are similar to the earlier 1973 Uniform Building Code forces and considerably less than the 1979 Uniform Building Code forces.

FOR A SHEAR WALL STRUCTURE

Italian Code Forces = 0.16 Wd

1979 UBC Code Forces = 0.23 Wd

where Wd is the total dead weight of the structure.

In conformance with the AID requirements of designing for the most stringent of the two, the forces defined in the 1979 UBC have been used as a basis of design.

LOADS

A. VERTICAL

All building elements are designed for the following uniform loads with provisions for any special conditions such as elevators, tanks, etc.

--for unused attics and roofs

150 Kg/m^2

--for laboratories with heavy equipment and boiler rooms

1000 Kg/m^2

--For gymnasiums

600 Kg/m^2

--for used stairways, terraces and supported floors

400 Kg/m^2

--for attic areas used for storage

300 Kg/m^2

LOADS

B. SEISMIC

All structural elements have been designed to conform with the 1979 UBC forces computed as follows:

V = ZIKCSW where:

V = lateral load due to earthquake forces

Z = zone factor = 1.0 maximum

I = importance factor = 1.25

K = 1.33 for shear wall buildings

CS = 0.14 maximum specified by Code

W = weight of structure and all permanent elements

MATERIALS

The structural system utilizes the following materials:

i) Reinforced Concrete

Columns	290 Kg/cm (4000 Psi)
Beams	290 Kg/cm (4000 Psi)
Supported Slabs	290 Kg/cm (4000 Psi)
Walls Above Grade	210 Kg/cm (3000 Psi)
Foundations	210 Kg/cm (3000 Psi)

ii) All Reinforcing Steel

Yield strength: 4400 Kg/cm^2 = 60,000 Psi

STRUCTURAL SYSTEM

The structural system utilizes shear walls on the perimeter and on certain building interior locations. These walls support the vertical loads and resist the horizontal loads as caused by earthquakes and wind.

Construction of the roofs consists of cast-in-place reinforced concrete slabs generally varying between 6'-150mm to 8"-200mm in thickness supported on beams 16"-400mm to 24"-600mm deep located at 10 ft - 12 ft, 3m-4m on centers. Roofs are designed to support the weight of tiles and snow loads.

General floor construction consists of joists 2-3/4"-70mm wide by 6"-150mm deep located at 16"-400mm on center and covered with a slab onto which a tile floor is applied. Floor system is reinforced concrete designed to support the Code specified live loads.

Foundations are continuous along the perimeters and main joint lines and will tie together column footings. Design of the foundations is in conformance with the recommendations of the Geotechnical report. The general construction system is as follows:

Insulated panels approximately 18"-50cm wide and 3'-1m to 6'-2m long are used to form both sides of walls, beams, columns, etc. Reinforcing steel is placed in between and filled with concrete. The forms are permanent insulation over which plaster and/or stucco is applied, thus forming a continuous, rigid and monolithic structure. Where large spans occur or other special requirements are present steel trusses constructed of welded angles and metal decks are used.

Interior partitions and exterior infill walls must be designed, detailed and constructed to remain intact after an earthquake as stated in "Statement of Work" Page 1, Section A, paragraph 2, where it states:

> "a standard of building design that is compatible with its surroundings and which is at a level substantially above that commonly displayed by recently constructed schools and public buildings."

The school contains significant lengths of interior partition walls and infill exterior walls. The following options are considered:

1. Metal Studs and Drywall or Stucco is preferred from a structural point of view as it is very light, flexible and can be satisfactorily anchored at the tops and bottoms of walls by means of power fasteners.

2. Concrete Block Masonry Walls may be used in seismic areas provided that vertical and horizontal reinforcing is placed at certain intervals in the cores and joints and that such cores be grouted solid. The weight of such walls impact the lateral design considerably.

3. Precast Concrete or Prefabricated Panels can be constructed with interior stiffeners and properly anchored to the supporting structure.

4. Unreinforced Brick or Hollow Clay Tile cannot be satisfactorily anchored or reinforced and should not be used.

Due to the findings contained in the geological report whereby portions of the new school site could be subjected to land slides in the event of a major earthquake, it was determined that (a) certain portion of the existing burdon would be removed (b) the school building will be supported on deep walls extending below the critical slip planes (c) tie together below grade the entire structure (d) reduce the natural slope on the hill to increase slope stability (e) set site grades and elevations so as to minimize detrimental effects where possible.

The above provisions were incorporated into the structural design of the school.

The selection of all systems including foundations was discussed with AID personnel prior to the preparation of the working drawings. The project has now been successfully bid and will be constructed in Calabritto.

SUMMARY TABULATION CHART

Name/Type	Area(Meter/Ft)	Cost (Lire/Dollar)*	Cost Per (Lire/M^2 Dollars/Ft2)	Date Bid
1. School of Calitri Senior High School	5,750 sq. m. 61,900 sq. ft.	L 3,494,998,800 $ 2,588,888	L 607,825.00/M^2 $ 41.82/ft^2	8 October 1982
2. School of Avellino Music Conservatory	6,002 sq. m. 64,615 sq. ft.	L 5,054,400,000 $ 3,744,000	L 842,119.00/M^2 $ 57.94/ft^2	15 October 1982
3. Sant' Angelo dei Lombardi Junior High School	3,216 sq. m. 34,625 sq. ft.	L 2,161,350,000 $ 1,601,000	L 671,969.00/M^2 $ 46.23/ft^2	8 October 1982
4. School of Grottaminarda Industrial Electronics	6,088 sq. m. 65,542 sq. ft.	L 3,750,000,000 $ 2,778,000	L 613,547.00/M^2 $ 40.00/ft^2	2 December 1982
5. School of Solofra Technical High School	5,440 sq. m. 58,557 sq. ft.	L 3,450,000,000 $ 2,556,000	L 633,260.00/M^2 $ 41.45/ft^2	2 December 1982
6. School of Vallata Senior High School	5,139 sq. m. 55,323 sq. ft.	L 3,450,000,000 $ 2,555,556	L 689,035.00/M^2 $ 45.09/ft^2	2 December 1982
7. School of Calabritto Elementary School	1,860 sq. m. 19,995 sq. ft.	L 1,814,310,972 $ 1,133,944	L 975,436.00/M^2 $ 56.71/ft2	29 October 1983
SEVEN SCHOOLS TOTAL:	33,485 sq. m. 360,557 sq. ft.	L 23,175,059,772 $ 16,957,388	L 5,033,191.00/M^2 $ 329.24/ft^2	

The average cost per lire/M^2 for the seven schools equals L719,027.28 per square meter.
The average cost per dollar/ft^2 for the seven schools equals $47.03 per square foot.

*Exchange Rate @ 1350 lire/U.S. dollar.