

American Research Center in Egypt  
Egyptian Antiquities Project

**"Conservation and Display of Roman Mosaics  
Kom el-Dikka, Alexandria"**

**2nd Progress Report  
for Preparatory Work and  
Documentation**

submitted by Dr Wojciech Kołataj, the Project Director  
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**Dr. Wojciech Kołataj**

## **REPORT ON THE ARCHITECTURAL DESIGNING**

### **1. INTRODUCTORY REMARKS:**

Archaeological work aimed at excavating mosaics of the Early Roman House *alpha*, (*Cf. infra Report on the archaeological work*) revealed two important facts:

- Mosaic  $\alpha$ -3 extends well to the west for some 2,50 m more. The centrepiece of this mosaic was made in an *opus sectile* technique, featuring highly elaborate multicoloured geometric design. Preserved fragments make the theoretical reconstruction possible. (Phot.nos. 11, 12; draw.no 3)
- Mosaic  $\alpha$ -6, featuring black-and-white geometric design was re-buried under restored walls of the Byzantine building B, and therefore could not be displayed. (Draw. no. 2).

Both these facts had an essential impact on overall design of the planned shelter. The shelter initially designed to cover a square measuring 12 x 12 m (or 14 x 14 m) as suggested in the submitted Proposal, would not cover all the newly discovered mosaics. It had been decided therefore, to extend the shelter to the west to some 15 m, retaining the 12 m span of girders, although placed along the N-S axis. This new solution called for appropriate modification in the roof inclination. Moreover, eastern wall of the adjacent Byzantine building F, built over the western portion of mosaic  $\alpha$ -3, had to be dismantled. (Phot. Nos. 5, 6; Draw. No. 2).

As a result of this adjustment, structure of the roof is designed to rest from the south on modern revetment wall, and from the north on transverse steel beam supported by four steel pillars. The said alteration, albeit advantageous to the overall concept of the shelter, appeared to be rather difficult in execution. Firstly, the relation of supporting pillars to the existing walls of the Byzantine building is rather clumsy, and secondly, the necessity to construct panel-glass walls of the surface twice as large as initially planned will certainly cause substantial costs increase. Taking those two factors into account, we decided to apply more suitable variant of roofing: to reduce the number of girders but at the same time to retain more stabilising system of their setting in a 3 x 3 m grid. (Draw. no. 6).

The resulting economies could be used to cover increased costs of construction of the outer glass-walls.

## 2. SHELTER DESIGN:

The problem of adequate positioning of supporting pillars and walls of the shelter in relation to the existing walls of the Byzantine building was eventually solved by slight turning of the shelter and by lowering of its ceiling. Although extension of the shelter resulted in departure from the more regular form of the "square" plan, but in return made it possible to exhibit much larger fragment of the Early Roman house. (Draw. No. 3)

- Western elevation of the shelter will partially incorporate walls of the adjacent Byzantine building D. Southern part of this elevation will be structured as a panel-glass wall. This will certainly improve lightning conditions.(Draw. nos 3, 4). Entrance to the shelter will be preceded by a small courtyard garden embellished with palm-tree and endowed with park benches.
- Eastern wall of the shelter ( = partially reconstructed wall of the Byzantine building B) recalls in much smaller scale an arrangement applied at the Stazione Termini in Rome, combining fragments of ancient wall with modern construction. (Draw. No. 5)
- Northern wall combines two fragments of ancient walls with large (double-squared in proportion) glass panels in between. Glass wall (made of security glass) 3 m high, will be structured as frameless, abutting panels 2 x 1 m. They will be fixed to horizontal fittings set at the level of 2 and 3 m respectively. Sections above fittings could be partially opened to secure necessary ventilation, whenever needed. (Draw. No. 4)
- A wall of the Byzantine building, reconstructed very reliably in the 1970s to sustain adjacent escarpment makes southern wall of the shelter. Four reinforced concrete bays are to be built behind this wall and set at the level of mosaics. They will be joined by thin insulated stiffeners separating escarpment from the wall. Steel bars will be inserted on top of the wall to provide for anchoring the girders. (Draw. No.5)
- Roofing structure will be made of 6 girders, each one 12 m long. Girders will be made of L50 steel bars, doubled in upper and lower beam. Steel bars will be welded to sheet iron joints. Vertical and diagonal members will be made also of L50 steel bars. Girders' forefronts from the east and west will be cased with corrugated sheet iron. Gabled walls will be structured as panels-glass walls: lower sections made of clear transparent glass and upper parts (the gable itself) made of shaded opaque glass. Iron gutters will be shaped along the northern and southern eaves. (Draw. No. 6)
- White undersligned ceiling will be made either from prefabricated gypsum boards or plaster reinforced with wire netting. Roofing made of corrugated sheet iron (beige, in conformity with natural colour of weathered walls) fixed to steel channels C50 at the distance of 1 m will be thermally insulated with Styrofoam sheets 2 cm thick.

- Pillars and main transverse beam will be made of steel bars 2xC140 welded together to form square in section. Pillars will be fixed in concrete footings (ca 1 sq. m) made on spot, set at a depth of ca. 0,70 m. (Draw.No.5)

### 3. CONSERVATION WORK:

Lower courses of the Early Roman Villa walls will be restored using Helwan limestone blocks insulated with two-layered bitumen jute felt. Upper courses, reaching some 1,60 m over the level of the mosaics will be completed with ancient stones found in the debris during excavation. Since both northern and eastern walls seem to form the limit of the house they could be safely reconstructed. Blocks in these new walls will be joined with very thin layer of lime or clay mortar in a manner similar to original Roman technique.

Newly rebuilt fragments of walls will be clearly separated from the original ones. New plastering will be applied only in the mid-section of the northern wall. In the areas where walls of the Byzantine building B do not follow course of the earlier walls their foundations will be secured with stone casing. This new constructions will differ in their structuring in order to avoid any misinterpretation. *Lacunae* in mosaics and pavements will be completed with original elements found during excavations. (Cf. *Infra*: **Report on the Mosaics Conservation**).

It is still premature to tell, whether the transfer of mosaic discovered in yet another Early Roman house in the area of the Theatre will be possible.(Phot.no.15). This mosaic including Greek inscription: ΚΑΛΩΣ ΗΚΕΙΣ (Welcome!), might be displayed separately by the entrance to the shelter, close to the information board. In this very location, along the southern wall of the shelter a display of fragmentarily preserved courtyard pavement and some architectonic elements found during excavations is planned. Taking into account the new form of display and lower than expected level of the mosaics in relation to the Byzantine building, the walkway for visitors will be also lowered and its course simplified. (Draw. No. 3)

The planned exposition of mosaic might be in the future supplemented by an open-air exhibition of nearby Roman houses. The form and range of this exhibition is conditioned by the results of future excavations.

**Dr. Grzegorz Majcherek**

## **REPORT ON THE ARCHAEOLOGICAL WORK**

Archaeological work began on May 1, and continued to July 15, 1998. The area included in the Project program covers all of Late Roman House B with courtyard and the eastern wing of House F (loci F-1, F-4), altogether ca. 120 sq. m. The buildings constitute the frame for the projected display of mosaic floors from the Early Roman House *alpha* found underneath. (Cf. Draw. No. 2). The work was divided into a preliminary clearing stage and the actual archaeological explorations.

### **1. CLEARING AND PREPARATORY WORK:**

The first stage of the work was devoted to clearing the area of accumulated rubbish and weeds in preparation for the intended archaeological excavations. The open-air lapidary of pieces of marble architectural decoration from earlier excavations was relocated in a different part of the site. Superfluous modern deposits were also removed.

Using original documentation, the original trenches from the 1970s were retraced and re-excavated to reveal the mosaic floors. At the time, the conditions of the explorations had been quite different and much more formidable than at present. Most of the work was done in narrow trenches, reaching in places a precarious depth of 8 m below ground level. The trenches were located wherever the later architecture of the Late Roman period (houses B and F dated to the 5th-7th centuries AD) permitted it. These practical limitations had resulted in the mosaic floors from the Early Roman villa (*alpha*) being uncovered only fragmentarily in four separate trenches. (Cf. M. Rodziewicz, *Un quartier d'habitation gréco-romain à Kom el-Dikka. Etudes et Travaux IX*, 1976: 169-210; id., *Les habitations romaines tardives d'Alexandrie à la lumière des fouilles polonaises à Kôm el-Dikka*, Varsovie 1984: 43-53 )

It had been impossible at the time to follow the full extent of the floors; neither was the architectural context understood completely with no chance for preparing a plan of the layout or functional arrangement of the building. Following a provisional protection of the mosaics, the trenches were filled in 1974. One of the points of the programme under the Grant was the removal of this entire accumulation, a layer 1.80 m thick superimposed on the mosaic floors, putting the total of removed earth at ca. 125 cu. m. (Phot. No. 1, 2).

In a number of places, especially behind the south wall of buildings B and F, deep trenches were also dug down to the foundations in order to examine the condition of the wall and to prepare it for additional structural reinforcement. The wall is planned as a carrying element on the south side of the shelter. (Draw. No. 5).

## 2. ARCHAEOLOGICAL RESEARCH

Actual archaeological work began once the old trenches had been cleared in their original extent. Excavations covered parts of the area as yet unexplored. Some dismantling of the Late Roman walls was found to be necessary, where the later structures collided with the projected viewing arrangement of the mosaic floors. In bearing with the terms of the Proposal, two sections of partition walls of the Byzantine building B, situated directly above mosaics  $\alpha$ -2 and  $\alpha$ -3, were recorded in full (photographic and drawing documentation) and subsequently removed. (Phot. nos. 3, 4). Both these walls, separating rooms B1/B2 and B2/B3 of the Late Roman structure, were originally very poorly preserved, as low as just two or three courses of blocks in places. The upper courses had been reconstructed in the 1970s, the new sections of the wall sometimes exceeding 1.20 m in height (5-6 courses of blocks).

The remains of the facade of House B and the Late Roman annexes in the courtyard (loci b2, b3 and b4) were dismantled for the same reasons. These walls were poorly preserved, too: barely one course of original blocks above the corresponding occupation level. In both cases, the wall foundation consisting of loose blocks and stone debris did not reach deeper than ca. 0.80-1.00 m below the Late Roman floors, that is, still some 0.60-0.80 m above the level of the mosaics.

### 2.1. Early Roman House *alpha* :

Once the later walls had been removed, the excavations centred upon the as yet unexplored original deposits accumulated on top of the mosaics. The primary objective was identifying the layout of the Early Roman structure: tracing the walls, determining functional divisions, and locating doorways wherever possible.

It was found that the majority of Early Roman walls had been destroyed already in Antiquity, either ruined or dismantled in search of building material once the structure had been abandoned.

Part of the original destruction layer of House *alpha* was investigated in the northern end of the current trench. Below the debris of shattered wall blocks and numerous fragments of coloured plaster, excavations revealed a segment of a wall dividing rooms designated as loci 2 and 3 of the Early Roman villa. (Phot. no. 10). This wall was 0.52-0.55 m wide and was found to run over a distance of 1.30 m. The blocks in it are partly cracked and dislocated, in a manner reminiscent of earthquake destruction. A similarly constructed segment of wall (only 1 m long) was discovered limiting room no. 2 on the north side. Both walls rise barely one course of blocks above the footing, that is, some 20-30 cm above the level of the mosaic floors. Easily discernible ghost walls permitted their course to be traced. In certain areas (north, west and east walls of loc. 2), some sections of the foundations, made of small blocks of varying size bonded in clay, were revealed. (Draw. no. 3). The north wall of rooms nos. 2 and 3 definitely constituted the outer perimeter of the building, as indicated by the presence of another structurally similar wall barely 0.40 m away from it. The course of this other wall leaves no doubt that it had belonged to a separate, architecturally independent structure, extending to the north, most probably another house.

In the southern part of the trench, remains of a floor pavement were discovered (loc. 4). The limestone slabs were barely 4-5 cm thick, and measured 0.40 x 0.80 m. To judge by this pavement, the locus must have served as a courtyard. Its size and architectural order

still remains to be identified. It might have been designed as a perystyled structure. A large and well preserved limestone cornice found directly on top of the pavement could provide a hint as to the architectural decoration of this space. It combines the Doric triglyph with elements of the Ionic cornice in a syncretic approach to architectural decoration that was rather common in Greco-Roman Alexandrian art. (Phot. No. 16).

A wide ghost wall (ca 0,80 - 1 m) was traced between the courtyard and rooms nos. 3 and 5; it is planned to explore its fill directly. Available data on the layout of mosaic  $\alpha$ -3 had suggested the possibility for it extending further to the west. A trench was dug in verification of this hypothesis and as a result another extensive section of the mosaic was discovered, together with the wall limiting room 3 on the west. (Phot. nos. 11, 12). In order to provide for the viewing of the fully uncovered mosaic floor  $\alpha$ -3, it was necessary to dismantle a segment of Late Roman wall constituting the eastern limit of loci 3 and 4 of Late Roman House F. (Phot. Nos. 5, 6; draw. no. 2). As in the case of the other dismantled walls, this segment, too, was mostly a modern reconstruction, the modern parts forming about four/fifths of the whole. In consequence of the discovery of new parts of mosaic  $\alpha$ -3, the extent of the projected display will have to be enlarged, gaining at the same time natural borders constituted by the walls of the villa.

## 2.2. The Mosaic Floors :

Assessment of the condition of particular mosaic floors, carried out upon clearing of their surfaces, reveals little changes for the worse compared to their state as recorded during the original excavations. In a few places on the edges of the mosaics, the cubes had come loose; in some other places, the mortar band protecting the edge of the floor had cracked.

The full extent of the mosaic floors in question was revealed in the course of extended excavations:

- Mosaic  $\alpha$ -2. In the north-western corner of room 2, an additional 1.4 sq. m. of mosaic  $\alpha$ -2 was cleared. The fragment, which abuts the newly uncovered wall segments, is in good condition and its conservation does not present any problems technically. Another previously unexplored fragment is a central piece of the rosette pattern decorating this floor. (Phot. 9).
- Mosaic  $\alpha$ -5 has now been uncovered in its full extent, the newly cleared sections constituting a narrow band on the eastern side and a part of the frame around the bird panels on the west. (Phot. No. 7, 8).
- The biggest changes as compared to the previous state of knowledge concern mosaic floor  $\alpha$ -3. The extension of the trench to the west revealed another 9 sq. m. of mosaic, including the original edge composed of a border frame of black rhomboids. (Phot. No. 11, 15). In the part to the south and west, two sizeable sections of very fine *opus sectile* floor were discovered. The pattern here was strictly geometrical, composed of combinations of circles, squares, rhomboids and triangles, made of pieces of multicoloured marble, aggregate and porphyry. (Phot. no. 12). Based on the preserved sections and the well-preserved impressions of tiles visible in the mortar bed in other parts of this floor, it can be said that this kind of decoration covered the



entire southern and central part of room 4 (measuring some 4 x 4,50 m). The decoration arrangement reconstructed as a result of the archaeological findings now includes an *opus sectile* floor, surrounded on three sides by a wide U-shaped *opus tessellatum* border. It is now obvious that the room had served as a *triclinium*, that is, the main reception room of the Early Roman villa. The said mosaic seems to be a rather later decorative arrangement introduced in this room, since it was laid directly upon the well preserved earlier lime floor, painted red.

### 2.3. Chronology and finds:

A destruction layer, varying in thickness from 0.40 to 0.60 m, was found directly overlying the mosaic floors in all of the newly explored areas. The layer consists of mainly stone debris, fragmentary coloured wall plaster, and a continuous layer of burning, including remains of burned beams, wooden door frames etc.

The layer has yielded mostly shards of pottery, a few fragments of lamps and coins (currently in the process of being cleaned). The repertoire of ceramic forms is quite extensive with Egyptian products constituting a major share. The forms identified include cooking pots, other vessels of everyday use and a substantial group of amphoras, the latter representing the typical Nile silt fabrics: forms Egloff 172 and Egloff 177-179. Imported pottery, although definitely less common, also covers a rather wide variety of types. Tableware is represented by mainly a few fragments of African Red Slip Ware. The imported amphoras include primarily body shards from vessels that had come from the Eastern Mediterranean: Kapitän II type, single-handed LRA 3 class amphoras (produced in western Asia Minor), Cretan vessels (CA1 and CA2 types) and a few examples of vessels from the Aegean. Amphoras from the Western Mediterranean, while definitely less numerous, are quite as varied: there are shards of African (Africana Piccolo), Tripolitanian (Tripolitana II) and Mauritanian types of containers.

The assemblage of finds as a whole can be dated to the late 3rd and beginnings of the 4th century AD, the period of the villa's destruction.

Three layers of painted plasters preserved in some wall sections point to rather prolonged occupation of the house as a whole, although the construction of the building is still far from being precisely dated. Stylistic analysis of the mosaics might at least provide some useful data. All of them seem to be made in the latter half of the 1st century AD or beginning of the 2nd century at the latest. This chronology is at least partially corroborated by archaeological evidence. A bronze coin dated to the reign of Domitian, found under the mosaic  $\alpha$ -2 provides a useful *terminus post quem*.

Detailed stratigraphical and chronological analysis of all subsequent levels of occupation is still to be carried out.

**Ewa Parandowska**

## **REPORT ON THE MOSAICS CONSERVATION**

Conservation work was carried out from June 1st to July 15th 1998 on three floor mosaics decorating an Early Roman villa (house *alpha*).

The mosaics were partially discovered in 1970s during the systematic excavations at the site and provisionally protected. Because of lack of funds they had to be re-buried, and it is only now that the mosaics are fully excavated. It was determined that the mosaics had been secured with a thin layer of sand directly on their surface. The edges of the floors had been reinforced with a band made of lime mortar with some cement added. Mosaic  $\alpha$ -5, featuring the richest iconographical program (panels with bird motifs), was covered additionally with sheets of polyethylene protected against mechanical damage by a thin (ca. 4-5 cm) layer of lime mortar. The biodegradation was not observed. (Cf. *supra*, **The Archaeological Report**).

Work plan for included:

- rediscovery of two mosaics ( $\alpha$ -2 and  $\alpha$ -5) and full excavations of a third one ( $\alpha$ -3), under the guidance of an archaeologist.
- Mechanical and chemical cleaning of the uncovered surfaces.
- Localization of loose or crumbling tesserae and temporary protection of these areas.

### **1. Description of the mosaics:**

- Mosaic  $\alpha$ -2. Black and white geometric design. Black rosette surrounded by a circle and octagon framed within a square, on white background. This mosaic was made of rather big tesserae (2 x 1,5 cm) of irregular shape. (Phot. No. 9).

#### Stratigraphy:

1. Tesserae,
  2. Setting bed; layer of lime and marble powder some 0,5-1,0 cm thick.
  3. Nucleus; layer of grind stones, ashes mixed with lime and sand, some 3 -3,5 cm thick.
  4. Rudus; concrete, some 6,5 - 8 cm thick.
- Mosaic  $\alpha$ -5. Multicoloured mosaic with panels (originally 9) each representing different species of birds, some of the with additional decorative elements (cups, sun-discs, floral motifs) on white backgrounds. Each of the panels is framed with guilloche made of white, yellow, red, grey, blue and black tesserae. Figurative panels are framed with black and white geometric pattern. Tesserae are carefully cut to regular shape: (0,5 x 1, cm) for geometric design and very tiny (0,3 x 0,6 cm) of glass paste and soft stone for birds panels. Overall dimensions of mosaic: 2,90 x 3,70 m. (Phot. No. 7, 8).

Stratigraphy:

1. Tesserae.
  2. Setting bed; layer of lime and marble powder, ca. 0,5-0,7 cm thick.
  3. Nucleus; layer of lime mixed with sand, ashes and charcoal, ca. 5 - 6 cm thick.
  4. Statumen; stone blocks, ca 20-40 cm thick.
- Mosaic  $\alpha$ -3. U-shaped mosaic in *triclinium*. . On white backgrounds regular design arranged with tiny black crosses, edges of the mosaic underlined with black stripes. The mosaic made of very regular small tesserae (0,4 - 0,8 cm) surrounds a central pavement decorated in *opus sectile* technique. Multicoloured geometric design made of marble tiles of varied shape, width and thickness. Overall dimensions of mosaic: 7,30 x 5,50 m.(Phot. No. 11, 12).

Stratigraphy:

1. Tesserae or marble tiles.
2. Setting bed; layer of lime mortar ca. 0,5-1 cm thick.
3. Layer of cut pottery shards; ca 1 cm thick.
4. Rudus; lime and coarse sand mortar, ca. 3,5 cm thick.
5. Earlier floor; lime mixed with crushed brick powder, ca. 1 cm thick.
6. Floor bedding; lime mixed with ashes, ca. 2,5-3 cm thick.
7. Statumen; small stones set in clay mortar, ca 10 cm thick.

## 2. Condition of the mosaics:

The mosaics appear to be in a fairly good state of preservation, although some fragments are completely loose: one of the panels with birds and major part of the *opus sectile* pavement. There were further damages along the edges of the mosaics where the walls of the villa were robbed. In several zones a fire caused breaking of the tesserae and blackening of the surface. In those zones the bedding mortar lost its cohesion.

The firm support given by the earlier floor to the *opus sectile* mosaic left the surface flat and stable in major part. The underlying soil of other two mosaics sagged and shifted, causing cracks on the mosaic surface. Two kinds of old repairs are visible on the surface - ancient and modern ones (from 1970s). In the antiquity the *lacunae* of the *opus sectile* mosaic were filled with marble slabse chosen at random. In the 1970s - fragments of all three mosaics were temporarily reinforced with mortar.

Decision was made to leave the mosaics *in situ*, partially reconstructed and displayed in the shelter.

## 3. The conservation measures:

The following measures were undertaken to preserve the mosaics:

- removal of protecting layers put in 1974, (polyethylene sheets covered with lime and sand mortar) from the surface of mosaics with birds. (Phot. 14)
- preparation of canvas roofing upon the mosaic with birds (most fragile) to protect from the direct sunlight.

- Mechanical cleaning - gradual taking away of dust and soils with trowels and brushes. (Phot. No. 15)
- Chemical cleaning - washing the surface with clean water, zone by zone with soft brushes and sponges.
- Retrieval of the tesserae which had been detached was undertaken. All loose tesserae, marble tiles and mosaics fragments were collected, cleaned and grouped by category and origin.
- Protection of edges of all the three mosaics - the borders of the missing sections were protected provisionally against crumbling using Japanese paper facing and carboxymethylcellulose as a glue. (Phot. No. 13).
- The cement mortar put in 1972 on the edges of *lacunae* has been removed from the mosaics.
- Documentary measures were undertaken: detailed photographs before, during and after cleaning and protection were taken. 1:1 tracings were made of all *lacunae* and sensitive zones from mosaic  $\alpha$ -3.
- Lifting of a fragment of decoration in *opus sectile* (mosaic  $\alpha$ -3). This fragment has been detached from the bedding mortar. Before lifting, the fragment was cleaned and faced with Japanese paper and cotton fabric. (Phot. 13). This fragment is stored face down in the provisionally arranged field workshop laboratory beside excavated area. The back side of this fragment was cleaned from all remnants of original bedding, displaced fragments were stuck into their original position. Small *lacunae* were filled with original marble fragments collected from debris. After restoration, the said fragment will be placed in its original location on a new fixed support.



Phot. No. 1. Shelter area, beginning of excavations. Looking west.



Phot. No. 2. Shelter area, following the first phase of excavations. Looking west.



Phot. No. 3. Shelter area. Byzantine building B prior excavations. Looking north.



Phot. No. 4. Shelter area. General view of mosaics. Looking south.



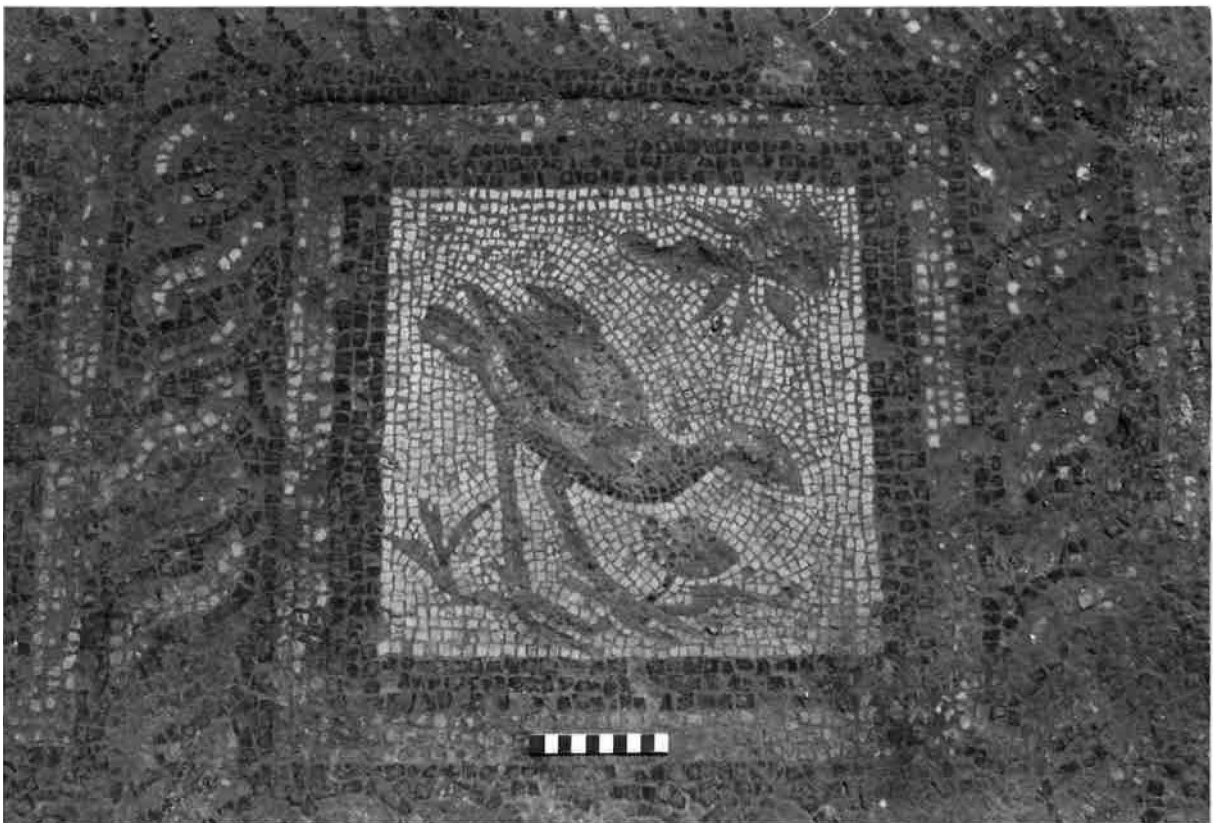
Phot. No. 5. Byzantine building F. Removed wall segment facing east.



Phot. No. 6. Byzantine building F. Removed wall segment. Looking south-east.



Phot. No. 7. Mosaic  $\alpha$ -5. State prior to conservation. Looking north..



Phot. No. 8. Mosaic  $\alpha$ -5. Detail. Looking east.

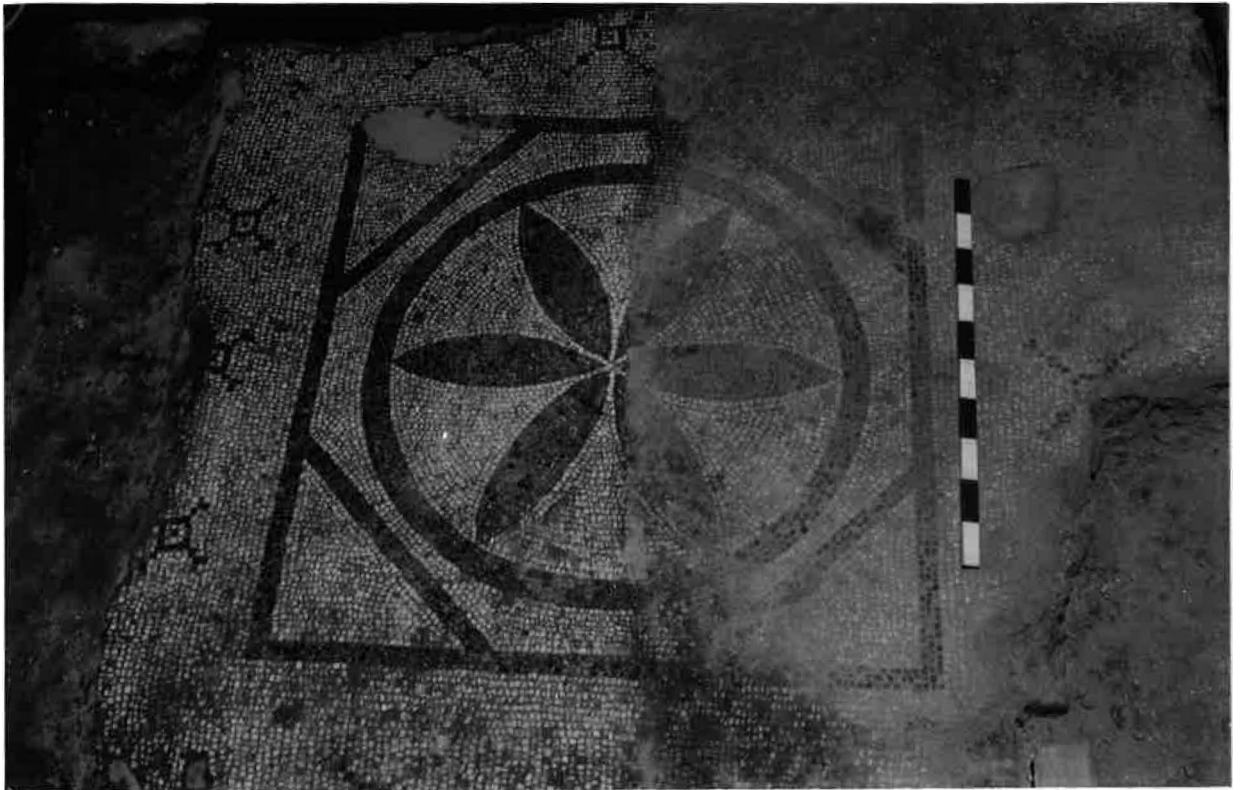




Phot. No 7a. Mosaic  $\alpha$ -5. General view during cleaning. (Colour print).



Phot. No. 8a. Mosaic  $\alpha$ -5. Detail. (Colour print).



Phot. No. 9. Mosaic  $\alpha$ -2 during cleaning. Looking west.



Phot. No. 10. Remnants of Early Roman wall between loci 2 and 3.



Phot. No. 11. Mosaic α-3. General view. Looking east.



Phot. No. 12. Mosaic α-3. Fragment of an *opus sectile* pavement. Looking south.



Phot. No. 13. Mosaic  $\alpha$ -3. Fragment of an *opus sectile* pavement. Cleaned and secured with Japanese paper. (Colour print).



Phot. No. 14. Mosaic  $\alpha$ -5. Cleaned and preliminary protected with Japanese paper. (Colour print).



Phot. No. 15. Mosaic  $\alpha$ -3. Cleaning the southern edge. (Colour print).



Phot. No. 16. Ionic cornice found in locus no. 4. (Colour print).

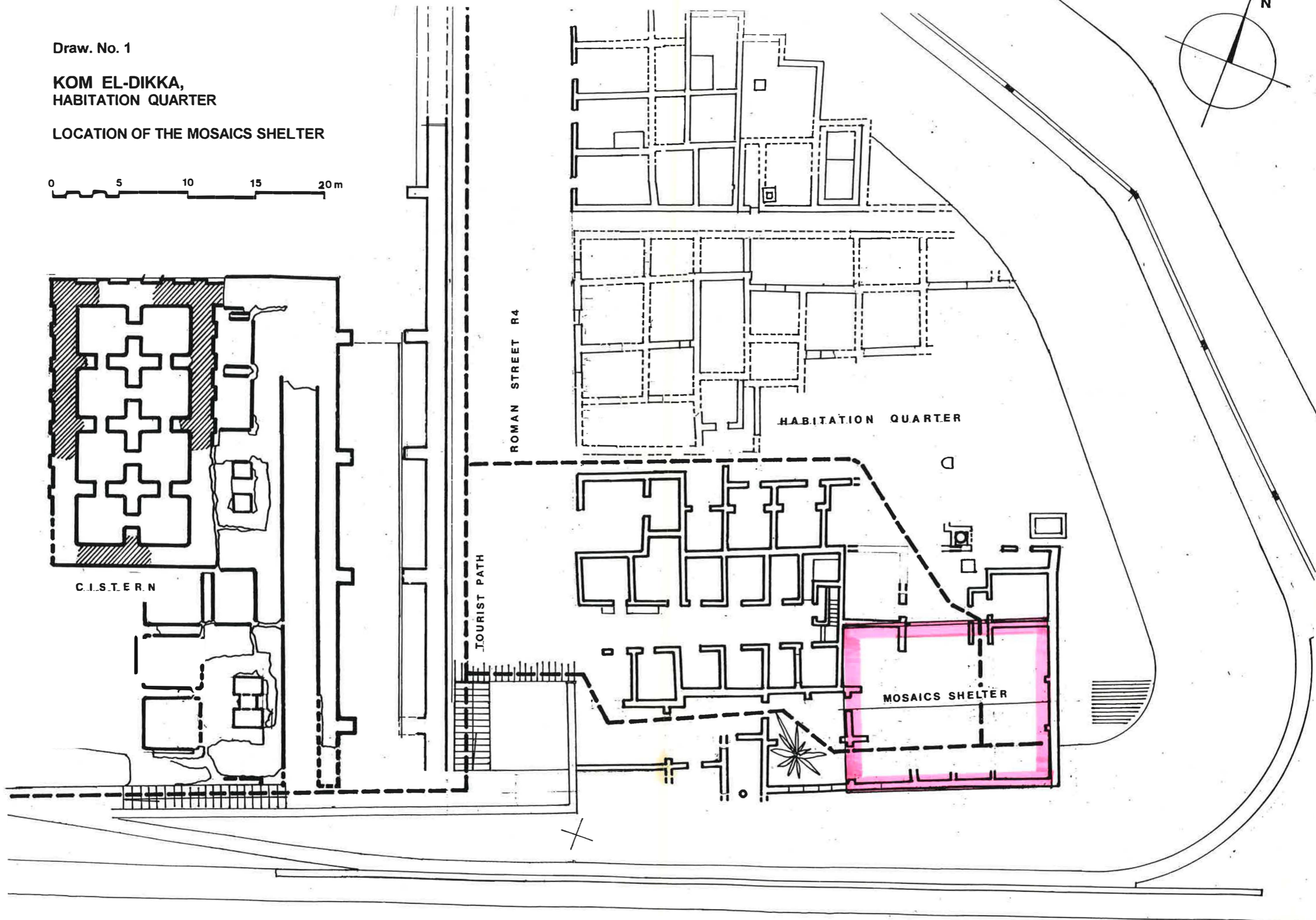
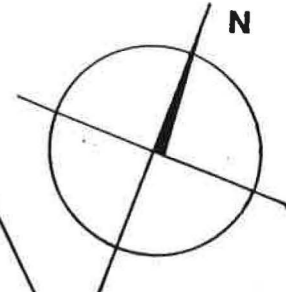


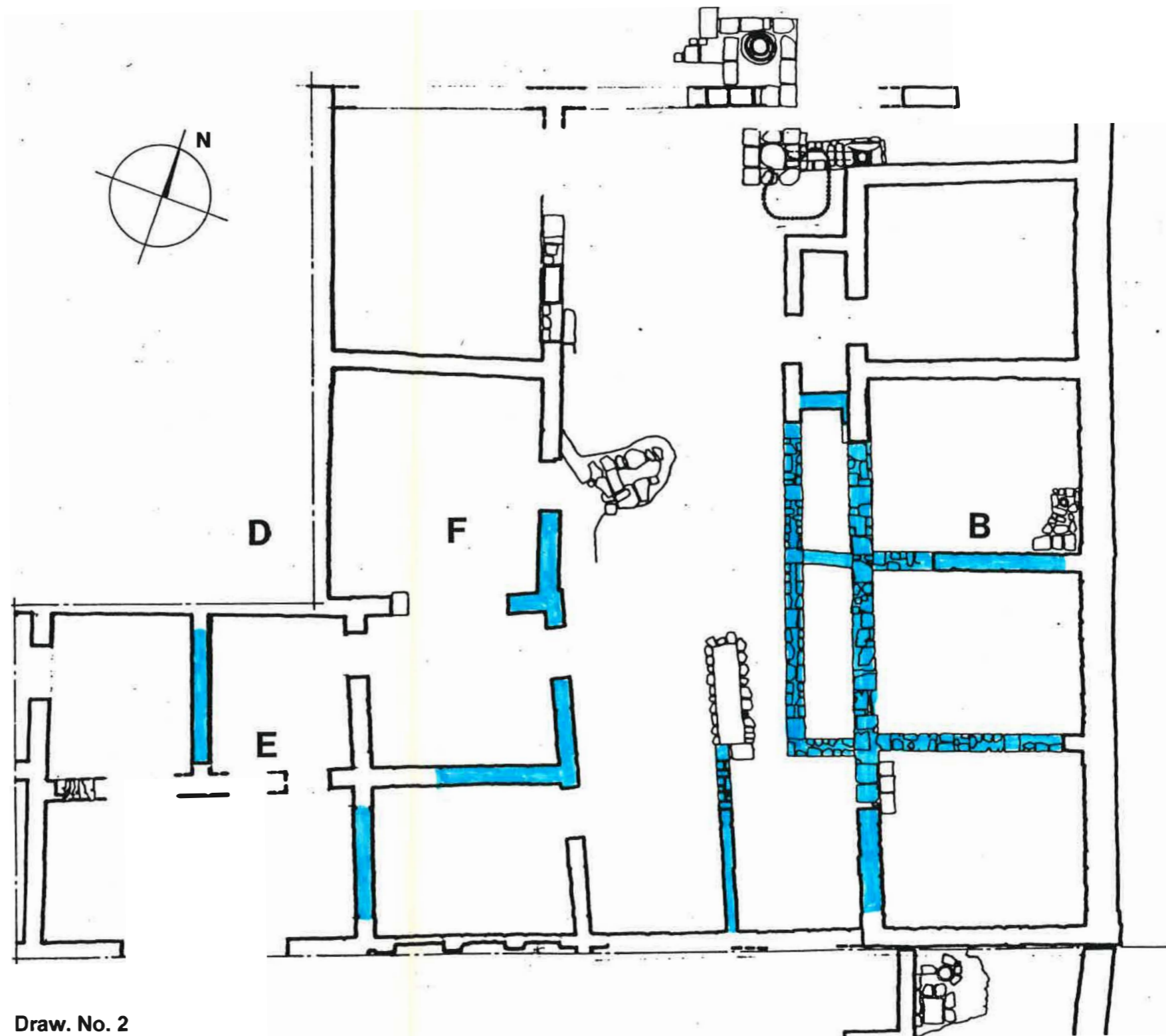
Phot. No. 17. Early Roman mosaic found in the theatre area.

Draw. No. 1

KOM EL-DIKKA,  
HABITATION QUARTER

LOCATION OF THE MOSAICS SHELTER





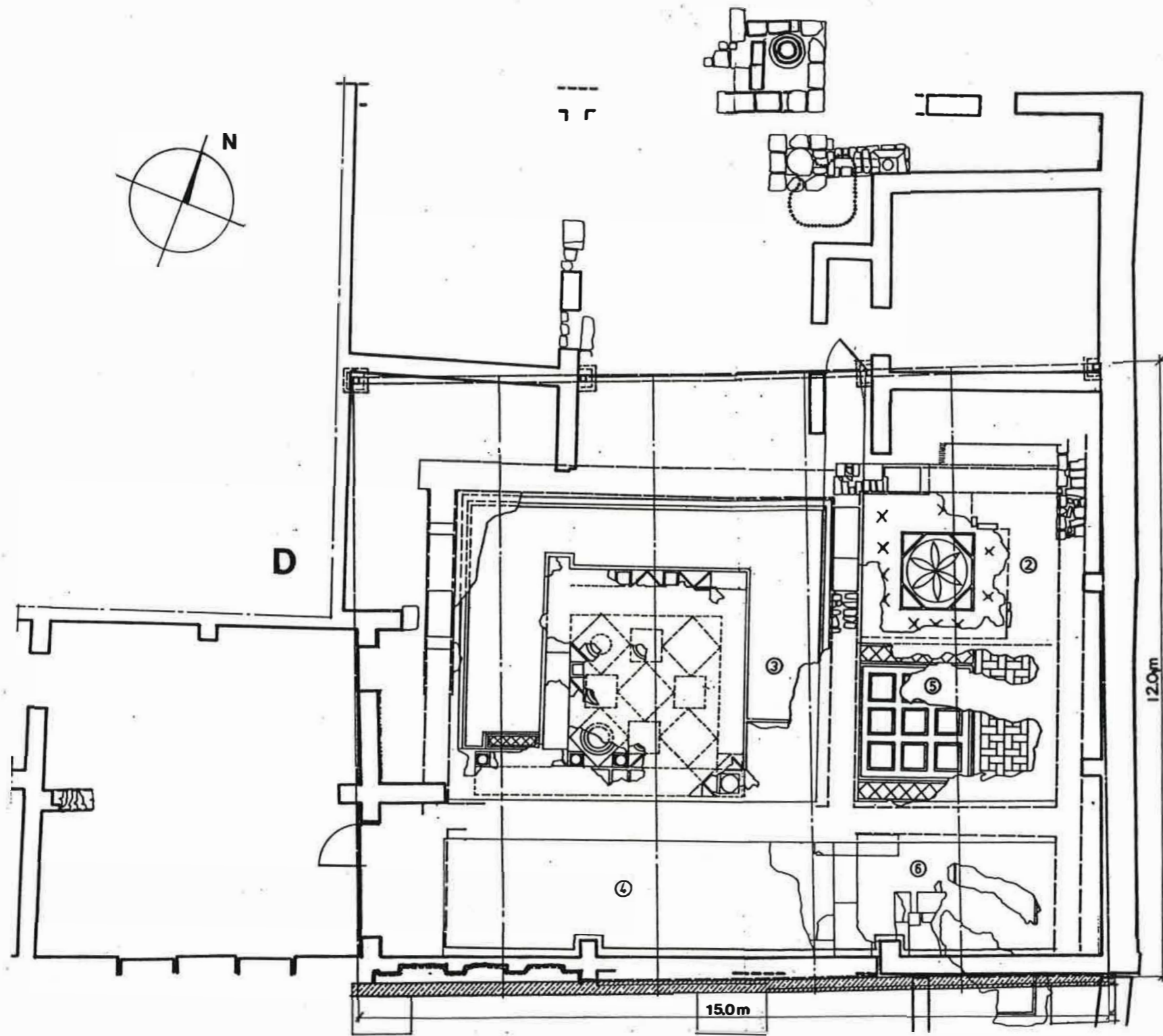
Draw. No. 2

KOM EL-DIKKA,  
BYZANTINE BUILDINGS B and F

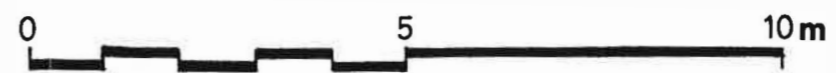
 removed segments of walls

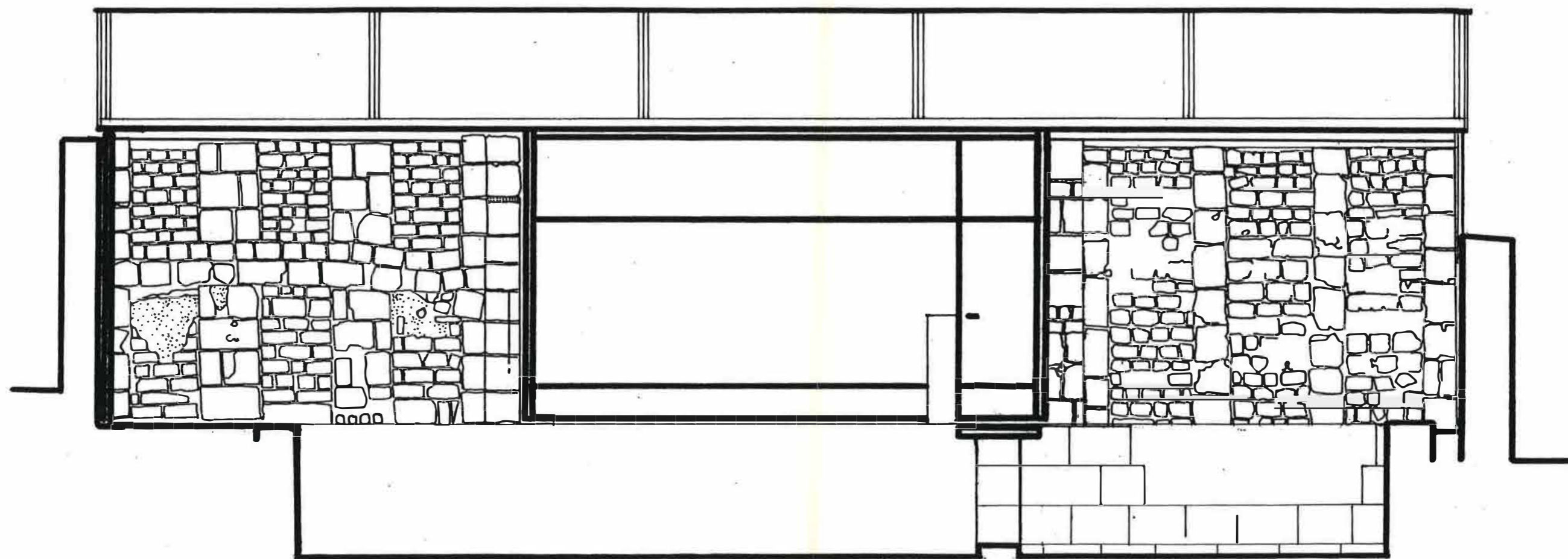
0 5 10 m



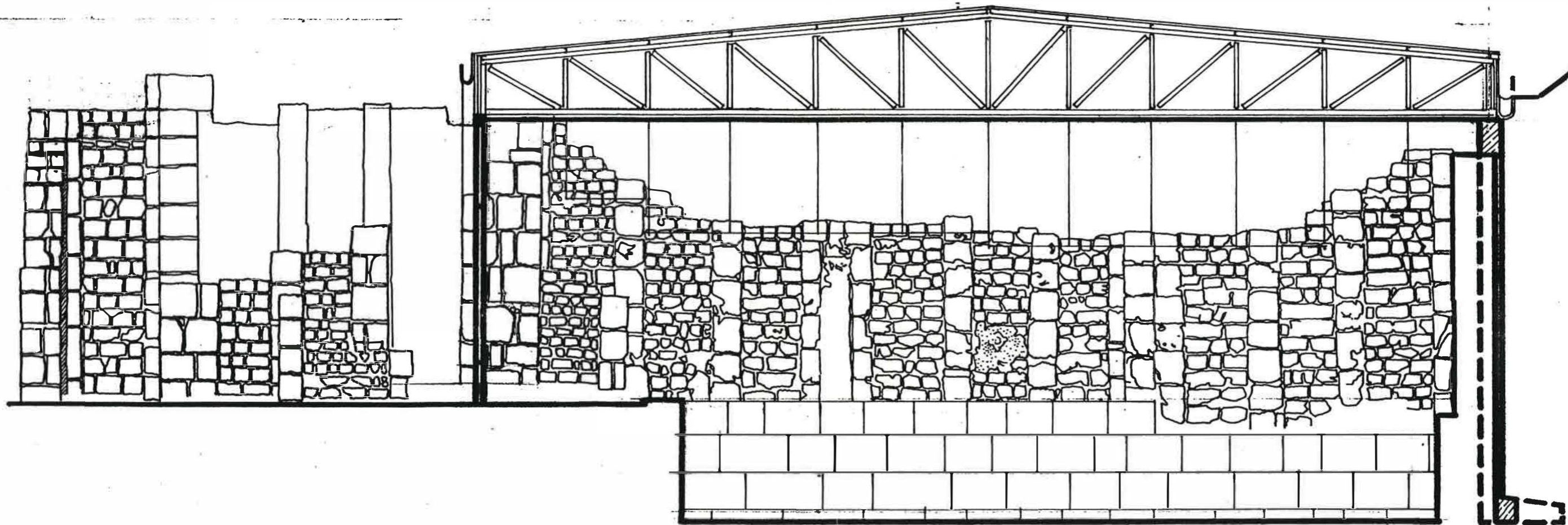


Draw. No. 3  
**MOSAICS SHELTER**  
 PLAN OF THE EARLY ROMAN RELICS





Draw. No. 4  
MOSAICS SHELTER  
CROSS-SECTION E-W



Draw. No. 5  
MOSAICS SHELTER  
CROSS-SECTION N-S

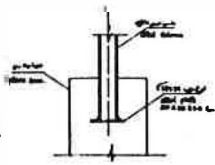
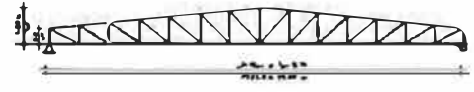
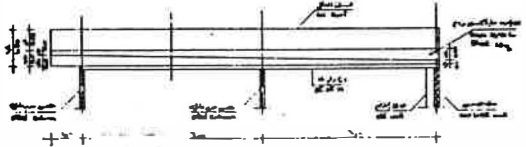
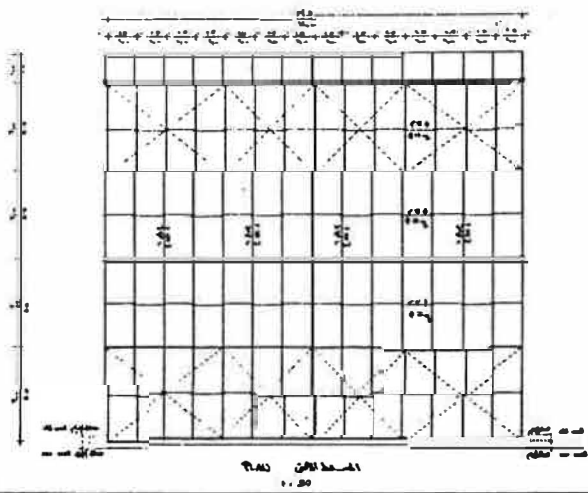
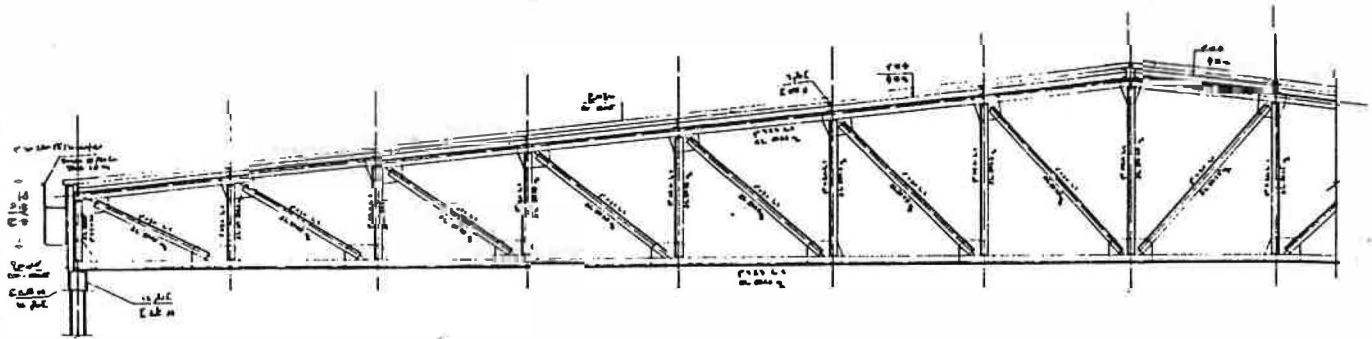
ATTACHMENT 1.

**MOSAICS SHELTER**  
**ROOF STRUCTURE CALCULATION SHEETS**

by. Eng. El-Mradny Essam

Draw. No. 6

# MOSAICS SHELTER ROOFING CONSTRUCTION



Use Rivets with  
a plate by riveting

Use Rivets with  
a plate by riveting

PLANS OF MOSAICS SHELTER  
1. 20

Loading :

$$\text{Cover} = 10 \times 3 = 30 \text{ Kg./m'}$$

$$\text{Purlins} = 5 \times 3 = 15 \text{ Kg./m'}$$

$$\text{Bracing} = 5 \times 3 = 15 \text{ Kg./m'}$$

$$\text{O.W.} = 75 \text{ Kg./m'}$$

$$\text{Plaster \& Stell net} = 50 \text{ Kg./m'}$$

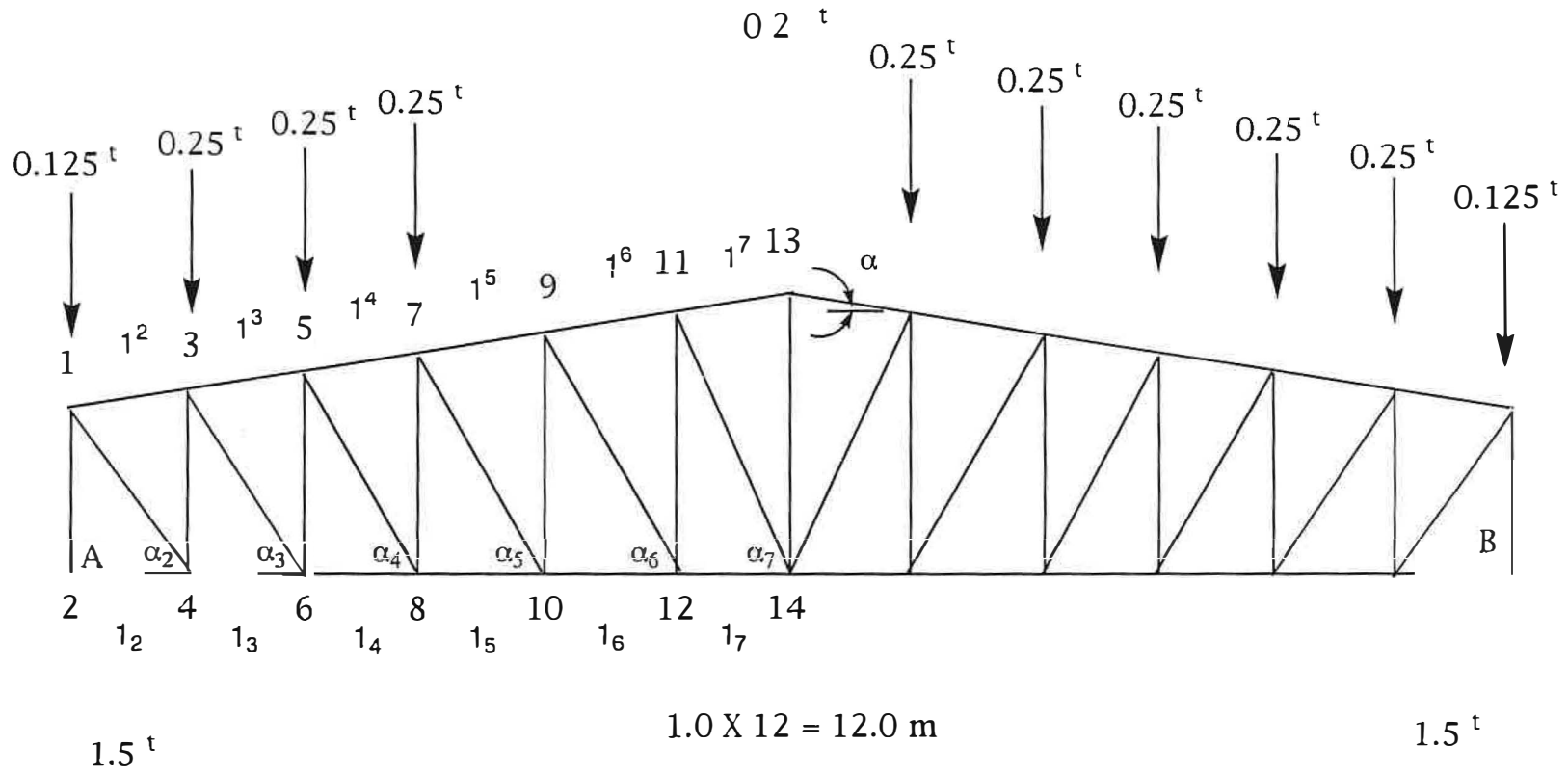
$$\text{L.L.} = 50 \text{ Kg./m'}$$

$$W = 30 + 15 + 15 + 75 + 50 + 50 = 235 \text{ Kg./m'}$$

$$\text{for weld} = 0.25 \text{ t./m'}$$

Max. height = 1.20 m

Min. height = 0.6 m



Heights

1-2	0.6 m	7-8	0.9 m	$\alpha_2 = 30.96$	$\alpha_5 = 41.99$	$\alpha = 5.71$
3-4	0.7 m	9-10	1.0 m	$\alpha_3 = 34.99$	$\alpha_6 = 45$	
5-6	0.8 m	11-12	1.1 m	$\alpha_4 = 38.66$	$\alpha_7 = 47.73$	
		13-14	1.2 m			

## For Uppers

### Sec. 2-2

$$M @_4 = 0$$

$$1.5 (1.0) - 0.125 (1) - r_2 \cdot F_{1-3} = 0$$

$$r_2 = 0.697 \text{ m.} \qquad F_{1-3} = 1.97 \text{ t.} \quad (\text{Comp.})$$

### Sec. 3-3

$$M @_6 = 0$$

$$1.5 (2.0) - 0.125 (2) - 0.25 (1.0) - r_3 \cdot F_{3-5} = 0$$

$$r_3 = 0.796 \text{ m.} \qquad F_{3-5} = 3.14 \text{ t.} \quad (\text{Comp.})$$

### Sec. 4-4

$$M @_8 = 0$$

$$1.5 (3) - 0.125 (3) - 0.25 (2) - 0.25 (1) - r_4 \cdot F_{5-7} = 0$$

$$r_4 = 0.896 \text{ m.} \qquad F_{5-7} = 3.77 \text{ t.} \quad (\text{Comp.})$$

### Sec. 5-5

$$M @_{10} = 0$$

$$1.5 (4) - 0.125 (4) - 0.25 (3) - 0.25 (2) - 0.25 (1) - r_5 \cdot F_{7-9} = 0$$

$$r_5 = 0.995 \text{ m.} \qquad F_{7-9} = 4.02 \text{ t.} \quad (\text{Comp.})$$

### Sec. 6-6

$$M @_{12} = 0$$

$$1.5 (5) - 0.125 (5) - 0.25 (4) - 0.25 (3) - 0.25 (2) - 0.25 (1) - r_6 \cdot$$

$$F_{9-11} = 0$$

$$r_6 = 1.09 \text{ m.} \qquad F_{9-11} = 4.01 \text{ t.} \quad (\text{Comp.})$$



Sec. 7-7

$$M @_{14} = 0$$

$$1.5 (6) - 0.125 (6) - 0.25 (15) - r_7 \cdot F_{11-13} = 0$$

$$r_7 = 1.194 \text{ m.} \qquad F_{11-13} = 3.76 \text{ t.} \quad (\text{Comp.})$$

## For Lower

### Sec. 2-2

$$M @_1 = 0$$

$$1.5 (12) - 0.125 (12) - 0.25 (66) - 0.6 F_{2-4} = 0$$

$$F_{2-4} = 0 \text{ t} \quad (\text{tension})$$

### Sec. 3-3

$$M @_3 = 0$$

$$1.5 (11) - 0.125 (11) - 0.25 (55) - 0.7 F_{4-6} = 0$$

$$F_{4-6} = 1.96 \text{ t} \quad (\text{tension})$$

### Sec. 4-4

$$M @_5 = 0$$

$$1.5 (10) - 0.125 (10) - 0.25 (45) - 0.8 F_{6-8} = 0$$

$$F_{6-8} = 3.125 \text{ t} \quad (\text{tension})$$

### Sec. 5-5

$$M @_7 = 0$$

$$1.5 (9) - 0.125 (9) - 0.25 (36) - 0.9 F_{8-10} = 0$$

$$F_{8-10} = 3.75 \text{ t} \quad (\text{tension})$$

### Sec. 6-6

$$M @_9 = 0$$

$$1.5 (8) - 0.125 (8) - 0.25 (28) - 1.0 F_{10-12} = 0$$

$$F_{10-12} = 4.0 \text{ t} \quad (\text{tension})$$

Sec. 7-7

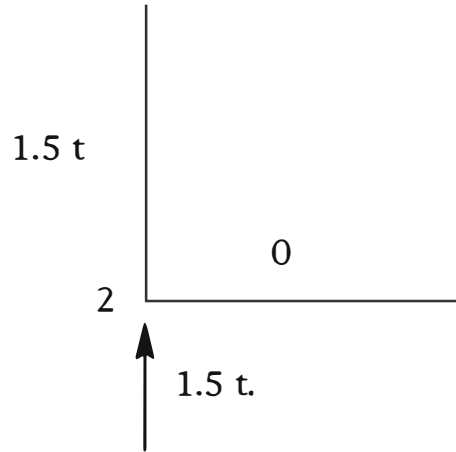
$$M @_{11} = 0$$

$$1.5 (7) - 0.125 (7) - 0.25 (21) - 1.1 F_{12-14} = 0$$

$$F_{12-14} = 3.98 \text{ t} \quad (\text{tension})$$

Joint 2

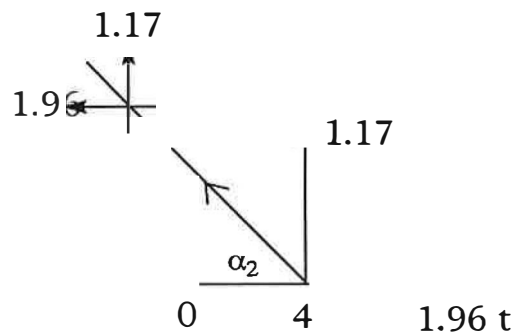
$F_{2-1} = 1.5 \text{ t (Comp.)}$



Joint 4

$F_{4-1} = 2.28 \text{ t (tension)}$

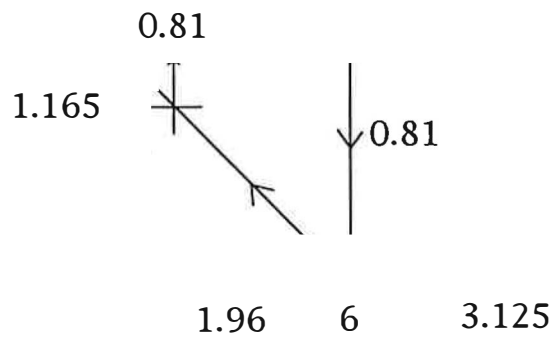
$F_{4-3} = 1.17 \text{ t (Comp.)}$



Joint 6

$F_{6-3} = 1.42 \text{ t (tension)}$

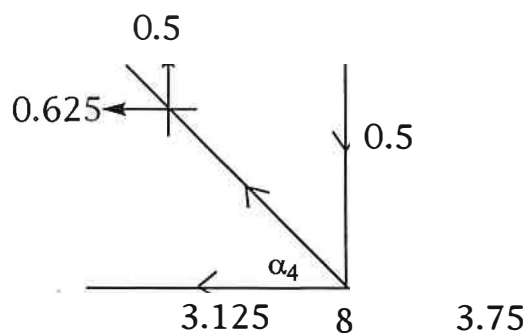
$F_{6-5} = 0.81 \text{ t (Comp.)}$



Joint 8

$F_{8-5} = 0.8 \text{ t (tension)}$

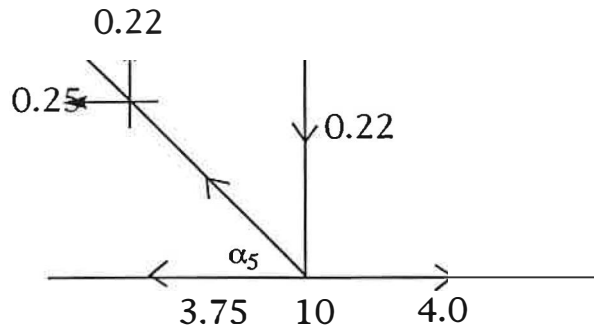
$F_{8-7} = 0.5 \text{ t (Comp.)}$



Joint 10

$F_{10-7} = 0.34 \text{ t (tension)}$

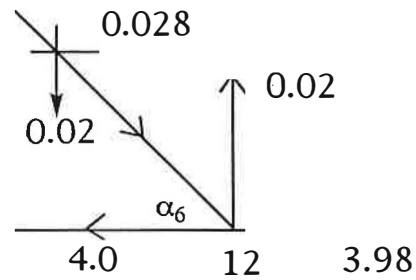
$F_{10-9} = 0.22 \text{ t (Comp.)}$



Joint 12

$F_{12-9} = 0.028 \text{ t (Comp.)}$

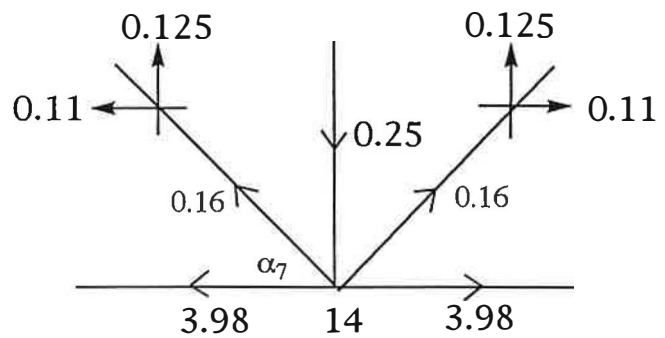
$F_{12-11} = 0.02 \text{ t (tension)}$



Joint 14

$F_{14-11} = 0.16 \text{ t (tension)}$

$F_{14-13} = 0.25 \text{ t (Comp.)}$



$$C = 4.02 \text{ t}$$

$$l_{bx} = 0.8 (1.0) = 0.8 \text{ m.}$$

$$l_{bx} = 1.0 \text{ m.}$$

$$\text{Let } l/i = 100$$

$$f_{pb} = 0.7 \text{ t./Cm}^2$$

$$A_{\text{req.}} = 4.0/0.7 = 5.71 \text{ Cm}^2 \quad (2.85 \text{ Cm}^2 \text{ for one angle}) \quad 50 \times 5 \text{ mm}$$

$$A_{\text{req.}} = 4.8 \text{ Cm}^2$$

$$a_1 = 5.0 \text{ Cm.}$$

$$l_{bx} / i_x = 100 = 80/0.3 \quad a_2$$

$$a_2 = 2.67 \text{ Cm.}$$

$$l_{by} / i_x = 100 = 100/0.45 \quad a_3$$

$$a_3 = 2.22 \text{ Cm.}$$

$$a = 5.0 + 2.67 + 2.22 / 3 = 3.29 \text{ Cm.}$$

choose  $50 \times 5 \text{ Cm.}$

$$\lambda_x = 80/1.5 = 53.33$$

$$i_x = 0.3 \times 5 = 1.5$$

$$\lambda_y = 100/2.25 = 44.44$$

$$i_y = 0.45 \times 5 = 2.25$$

$$f_{pb} = 7 (1000/53.33)^2 = 2461.24 \text{ Kg/Cm}^2.$$

$$f_{\text{act}} = 4020/2 \times 4.8 = 418.75 \text{ Kg/Cm}^2 < f_{pb} \quad (\text{O.K.})$$

$$T = 4.0 \text{ t}$$

$$A = 4000/1400 = 2.85 \text{ Cm}^2$$

$$\text{For one angle} = 1.425 \text{ Cm}^2$$

$$50 \times 5 \text{ mm}$$