SAFEGUARDING MY SON WORLD HERITAGE

- Demonstration and Training in the Application of International World Heritage Standards of Conservation at My Son Group G Monuments -

- 2005 –

Preliminary Technical Report
August 2005
## Contents

1. Introduction, *Mauro Cucarzi*  
   p. 3

2. Activity of Architectural Working Group, *Paola Condoleo*  
   p. 4

3. Activity of Architectural Working Group, *Danh Khanh Ngoc*  
   p. 62
1. Introduction

During the month of August the main activities have been:

- Continuation of restoration of G3 (see Condoleo Report)
- Continuation of restoration of G5 (see Condoleo Report)
- Consolidation and Restoration of enclosing laterite wall (see Dang Khanh Ngoc Report).

During this period has been prepared all the necessary equipment to install the drainage system in G3 and G5 (see Dang Khanh Ngoc Report).

During this month the characteristic of the new bricks has been decided and 6,000 of these bricks have been ordered to a brick factory close to My Son.
Preliminary Report on the Architecture Survey and Research carried out on G Group –August 2005

- 1st PART –

By Chief Architect P. Condoleo, Arch. F. Landoni and Arch. M. Landoni

SCIENTIFIC UNIVERSITY POLITECNICO DI MILANO, DIS, ITALY

1.1 G3: state of art

The disassembling and reassembling works on Mandapa have progressed in all sides and corners of the building (Fig. 1).

The project for draining rain water has been approved and the North and South side of the wall have been prepared for the beginning of the works.

Fig. 1- G3: general view during the consolidation works on August

1.2 Project for the drainage

The project for draining the rain water out of G3 was drown by Arch. P.Pichard (Fig.2).
The water is conveyed by a smooth slope to a central drain and than from here sent out the building by two plastic pipes passing under the foundations of the North and the South sides. (Fig.3)
1.3 North Side of G3

The last external courses of the upper part of the North side of the wall, close to North-West corner, have been fixed by natural resin till the final profile, as well as the internal layer has been fixed by mortar. (Figs.4,5)

Fig. 4 – North Side, external view
In order to investigate the state of the internal courses of laterite at the foundations level, a 50cm wide trench has been excavated along the internal façade of the wall. At the level of the first foundation course, a 10cm wide reddish filling has been found along the whole North side (Figs.6,7).

A small area of the wall in the middle of the North side has been dismantled in order to reach the layer under the foundations and place the draining pipe (Fig.8,9).
1.4 West side of G3

The last courses of the upper part of the wall have been fixed by natural resin till the final profile, as well as the internal layer has been fixed by mortar (Figs. 10, 11, 12).
The original threshold in sandstone (Figs.13,14) has been replaced in its position on a bed of mortar. The exact point for the threshold location has been chosen after the study of the building and following H.Parmentier indications (Figs.15-19).
Fig. 13 – West threshold before replacing

Fig. 14 – West threshold drawings: section and bottom

Fig. 15 – Profile of the threshold

Fig. 16 – Hollow carved to keep the threshold
1.5 South side of G3.

The dismantling phase of the internal and external layers of the walls of the South side of Mandapa have been proceeded. (Figs.20,21) The walls have been disassembled until the foundation level only in the parts where the original joint was lost and where the bricks were seriously damaged.
Fig. 20 – South side general view at present time
The reassembling of the external and internal layers of the wall proceeded from the second gradual connection left 3m from the South-West corner towards East (Figs.22,23).
Also in the East part of the South side the disassembled courses have been reassembled. This area of the external layer was particularly damaged even until the foundations by a bomb, so that a large amount of bricks had to be substituted (Fig.24). The internal side of the wall was in better conditions of preservation (Fig.25).
Fig. 24 - External South side: damages due to a bomb shell
In order to investigate the state of the internal courses of laterite at the foundations level a 50cm wide trench has been excavated along the internal façade of the wall (Fig.26). Laterite blocks were in quite good state of conservation; one thick brick took place of a block of stone (Fig.27).

A small area of the wall in the middle of the South side has been dismantled in order to reach the layer under the foundations and place the draining pipe (Fig.28).
Fig. 28 - Area before and after disassembling for drainage pipe

The three layers of the foundations (Figs. 29, 30) have been drawn by AUTOCAD.

Fig. 29 – First foundation layer
Fig. 30 - third foundation layer

1.6 South-East corner.

The South-East corner was seriously damaged (Fig. 31) and in order to have a solid connection between the South and the East sides, the courses until the main mould had to be reconstructed (Figs. 31-34).
Fig. 31 - S-E corner before disassembling
Fig. 32 - Substitution of some laterite blocks in S-E corner

Fig. 33 - S-E corner after partial consolidation
1.7 East side of G3

The East side of G3 was in quite good state of conservation (Fig.35) and only few bricks in the wall texture and the upper course had to be substituted (Figs.36,37).
In order to investigate the state of the internal courses of laterite at the foundations level, a 50cm wide trench has been excavated along the internal façade of the wall. The first course of laterite was found not entirely under the wall: it’s not in fact placed parallelly with the surface of the wall and the last blocks of stone close to South-East corner just lean against the wall (Figs.38,39).
The original threshold in sandstone (Figs.40,41) has been put back in position on a bed of mortar. The exact point for the threshold location has been chosen after the study of the building and the H.Parmentier indications (Figs.42-44).
Fig. 40 – Original threshold

Fig. 41 – East threshold, drawings
Fig. 42 - Threshold before replacing

Fig. 43 - Threshold set in its original place
2 G5 building (posha): state of art

Conservation works on G5 proceeded in South-East corner, in South and East sides and they started in South-West and North-East corners and in West side.

2.1 South-East corner (East and South sides)

The reconstruction of South-East corner proceeds simultaneously with the disassembling of South and East sides. (Fig.45).
Fig. 45 - G5, general view during conservation works

2.2 Disassembling

The damaged parts of the walls are disassembled layer by layer; this phase allowed also to study the building techniques. (Fig.46).

Fig. 46 - Removing of the internal layer of the wall at four different levels
An archaeological cleaning of every course of bricks is carried out in order to highlight every single brick. (Fig.47)

*Fig. 47 - Archaeological cleaning of the courses*

The external layers of the wall are disassembled with the same procedure used in G3 and in the South-East corner of G5: temporary chalk numbering, photograph, permanent ink marking and removing of the bricks (Fig.48).
2.3 Reassembling

Walls are reassembled replacing well preserved bricks in their original position. Missings and damaged bricks are substituted with bricks coming from the archaeological excavations. These bricks are shaped in order to obtain the same size of the original ones (Fig.49).

*Fig. 48 - Permanent ink marking and removing of one brick*

*Fig. 49 - Three different phases during bricks shaping*

*Consolidation phase of the first course*

After the preparation of the course +1 of the external layers, (Fig.50), bricks were laid with fine mortar to substitute soil and to make thin joints.

*Fig. 50 - South side: replaced bricks*
The internal layer was made with half and complete bicks jointed with the same mortar used in G3 monument. (Figs.51,52).

**Consolidation of the subsequent courses**

The subsequent courses have been reassembled following the same procedure using in G3; bricks of the external layers have been glued with a thin film of natural resin. The normal procedure of the consolidation works consists in gluing three courses of the external layers with resin, let it dry for some days and then putting the internal layer with mortar making good connections between external and internal layers (Figs.53-57).
2.4 North-East corner

North-East corner had a considerable deformation towards North due to a tree grown in the middle of the wall and rooted until the foundations (Fig.58). The wall has been disassembled down until the course -2 because bricks were seriously damaged (Fig.59).
After consolidating the course -3 inserting mortar and bricks fragments inside the thick joints and after the substitution of few bricks of -2 and -1 courses, consolidation works proceeded with the normal procedure (Fig.60).
When the consolidation works in South and East side and in S-E and N-E corners were nearly to be concluded, works begun in West side following the same procedure (Figs.61,62).

**2.5 West side**

When the consolidation works in South and East side and in S-E and N-E corners were nearly to be concluded, works begun in West side following the same procedure (Figs.61,62).
In the external area of the West side a trench has been excavated along the profile of the wall in order to investigate the state of preservation of the foundations (Fig.63). The hill profile is sloping towards North-East corner, and the same situation is evident also in the internal part studying the two foundations pits excavated by the archaeological team (vedere la parte del report riguardante l’archeologia). Towards N-E corner the excavated material is made by pieces of original bedrock mixed with bricks fragments. 1m from S-W corner, in West side, the original bedrock emerges partially covering the course -2 (Figs.64-66).
Dopo un’analisi delle fondazioni, sono stati asportati puntualmente i mattoni con un degrado rilevante e quelli privi di connessione con il paramento interno(Fig.67,68).

N-W corner of the building is seriously damaged by some roots grown inside the wall (Figs.69,70).
2.6 South-West corner

In S-W corner the brick and the original joints were well preserved but thick cracks gave instability to the corner (Fig.71). However it was possible to disassemble the corner in three big blocks of jointed bricks and reassemble it after cleaning the area (Figs.72,73).
Damaged bricks at foundations level were removed and substituted until course –2, and the foundations were consolidated with mortar and bricks fragments (Figs. 74, 75).
The three blocks of bricks were replaced following the alignments of South and West sides (not yet fixed for consolidation)

Some small inserts shaped from bricks were fitted in the missings due to the cracks in order to give continuity to the wall (Figs.76,77).

2.7 Comments

On July a foundation test has been opened in the S-E corner of G5 in order to investigate its state of conservation (Figs.78,79). After finding some pebbles and sand under the last foundations course, a further foundations test has been excavated in order to investigate the preparation layer. The study of the West section allowed to give a hypothesis how the foundations pit was made (Fig.80).
During the disassembling phase of the walls it was possible to study the ammorsamenti among the three layers: they are connected every three-four course. (Fig. 81).
The internal layer is usually constituted by complete bricks, but it’s not rare to find half bricks, bricks fragments and soil.

The bricks in of the three courses at the foundation level and the first course of elevation loose the regular trend of the rest of the wall (Figs.82-84).

As described in the previous report, bricks in the three layers at foundations level are not homogeneous in shape, dimension and colour. There are also some decorated bricks, probably belonging to other buildings.
3 G1 (kalan) building: state of art

Works on G1 started consolidating the North-West corner in order to avoid risks of collapse; this area is in fact particularly damaged with big missings (Fig.85).

![Fig. 85 - G1: North-West corner](image)

3.1 G1: consolidation of North-West corner

The technique and the procedure used to consolidate the North-West corner of G1 is the same used in G3 and G5 monuments. Bricks without original joint were numbered before dismantling in order be replaced in their original position, and the damaged bricks were substituted with bricks found during excavation.

Before numbering the bricks, the corner has been preliminarily clean from soil and vegetation (Fig.86).
Fig. 86 - Archaeological cleaning of N-W corner

The numbering with chalks have been done only in the area involved in this phase of the consolidation (Figs.87-89).

Fig. 87 - N-W corner after numbering
The numbered bricks have been photographed and only after that the disassembling phase started (Figs.90,91).

A partial disassembling of the corner and a deep cleaning from soil and damaged material allowed to see the internal layer of the wall and the particular shape of the bricks with oblique faces put one on top of the other (Fig.92).
In order to investigate the foundations of the building and to check their conditions, a small pit has been excavated around the corner (Fig.93). The foundations, still in good conditions, lay directly on the original bedrock and they are compound by a course of laterite blocks placed on a layer of thick bricks (Fig.94). The foundations and sections of the North-West corner of G1 have been drawn by the Vietnamese architect team (Fig.95).
The reassembling and consolidation works of the corner followed the same procedures of G3 and G5 monument (Figs.96-98).

**Fig. 96 - N-W corner during reassembling**  
**Fig. 97 - First layer after consolidation**
4 RESEARCH ON NEW COMPATIBLE MATERIALS

4.1 Production of new bricks in the traditional way

The 100 bricks made in the traditional way were fired after the a week of drying. The kiln (1x1m) was build with modern bricks and clay (Fig.99). Bricks were put in the kiln vertically in three layers and same carbon pieces were put among them (Fig.100). After covering and close the kiln with a top layer of modern bricks (Fig.101), the heating was produced by wood fire (Fig.102).
The bricks were fired for three days and after this period of time they were taken out the kiln (Figs. 103, 104).
The fired bricks were of quite good quality but the high percentage of cracked ones (50%) (Figs.105,106) and the slowness of the whole process forced to choose another method of productions.

The physical and mechanical characteristics of Cham bricks were given to a near brick factory in order to produce bricks of similar descriptions in big scale: the amount required to finish the works on 2005 is in fact of 6000 unities. The bricks factory made several samples (Fig.107) with different characteristics but only the one with compatible characteristics were chosen (Fig.108).

5 PROVISIONAL MEASURE ON G1 - KALAN
Following Prof. Binda's suggestion, all the main missing parts of G1 and G2 monuments have been temporarily filled with bricks without joints, in order to avoid risks of collapse or further water erosion of the damaged areas. (Figs. 109, 110)

**APPENDIX**

**REPORT ON THE VISIT TO MYSON – AUGUST 6TH TO 11TH**

*By Prof. L. Binda and Architect P. Condoleo*

1. **G3: Mandapa**

On August 7th, L. Binda, P. Pichard, M. Cucarzi together with the architects P. Condoleo, M. and F. Landoni, visited the MySon site in order to observe the state of the works and take care of some unsolved problems. At first the situation of G3 was taken into account. The works are in an advanced state on all the four sides of the building. Nevertheless some decisions remain to be taken.
The first and most important one concerns the finishing of the North side. Here in one position in the middle of the side, half of the wall together with some parts of the base are missing (Fig.1). Following the assumed principle for the intervention, a complete reconstruction of the wall should be avoided.

Three possible solutions were proposed by L. Binda, P. Pichard and P. Condoleo; they are presented in Fig.2a,b,c. All three solutions propose to construct the missing part of the wall with new bricks in order to show very clearly the difference between the original and the new part. Finally solution b) was chosen. In Fig.3 a 3D reconstruction of the solution is shown. During these work the drainage of G3 will be realised by opening small parts of the walls.
As a second subject how to finish the entrance to the West side was discussed. The stone doorstep has already been set (Fig. 4). The vertical frame of the entrance will be
made in brickwork and positioned as the original were; nevertheless this parts will be built with new bricks in such a way as to show that it is a new part.

Also some steps are needed in order to allow to reach the doorstep. They can be made in new bricks with distinction from the old ones or in reinforced concrete.

Finally the finishing of the walls of G3 horizontally and vertically was discussed. Horizontally the wall should be finish with two courses of new bricks, the first one positioned on top of the original wall covering the three leaves of it, the second one on top of it, made all in brick only glued together very tightly in order to protect the underneath part. Vertically the wall will again be finished with new bricks, but leaving in view the side the original profile also by realising a small recession (Fig.5)

Fig.4 Positioning of the doorstep on the West side
2. **G5: posha**

The works on G5 are progressing rather rapidly and very well (Fig.6). During the excavation to reach the foundation in laterite, it was noted that the geometry of the walls was not very regular in the corners (they did not follow the laterite geometry) (Fig.7). Since the lower part of the corner was already positioned it was decided to avoid further changes.

Also for G5 the finishing will be made as for G3.
Fig. 6 Progression of the works on G5
Furthermore, since the level of the remaining of the walls are in some parts lower than the original internal level of the floor, the finished floor will be kept lower then that original level (Fig.8).

**3. Laterite wall**

The laterite wall surrounding G2 and G1 and separating them from the other buildings, is being cleaned and the internal part will be repaired after cleaning by adding pieces of bricks recovered on site (Fig.9). The mortar used will be the same as the one made for the other buildings, eventually with some larger grain size of the brick pebbles.
Nevertheless it is recommended to avoid very thick mortar joint and rather to fill with pieces of bricks the large gaps.

![Fig.9 The internal part of the wall after cleaning](image)

### 4. Repair and provisional measure on G1 - Kalan

The state of G1 in some parts is rather worrying. Some partial collapses can be expected in the future and the provisional support in wood might be destroyed by the termites. Therefore some measures have to be taken. Following the suggestion of P. Pichard the decision is taken of repairing the North-West corner which is in bad conditions (Fig.10). After cleaning the corner will be
rebuilt by anastylosis by using the collapses bricks and the corner sculpture (Fig.12) set on place. Above the corner sculpture level other four or five courses of bricks will be placed in order to realise a support for the above part of the building, which are in dangerous position (Fig.11)
Furthermore, concerning the risking parts of the building which seem to be rather unstable, L. Binda suggests to fill all the gaps where bricks are missing (Fig.12 a,b) with dry bricks, slightly forcing them inside the holes, in order to support all the upper parts.

Some small parts of the walls which appear very unstable on side North, East and South (Fig. 12 a,b) can be dismantled after been carefully marked in order to set the bricks back during the intervention, and stored away.

**Fig.11** The corner after the first cleaning and the unstable parts above it
Before leaving the site unbalanced parts and top of G1 should be protected as the last year with a net fixed to the top of the building (Fig.14).
5. G2 - Gopura

Also G2 has parts in a rather unstable state. Also these parts have to be supported in order to avoid collapses during the hard season.
P. Pichard suggests to support corner which is in difficult condition with a pile of sand bags (Fig. 15). All the small missing parts will be fixed with dry bricks as for G1.
6. Production of new bricks

On August 8\textsuperscript{th} some new bricks came from the local producer in…. The bricks were made from three different parts of the quarry. They look different in colour from red to light yellow and perhaps have different characteristics. The bricks were weighed and then put into the oven at 100\textdegree where they will be kept until they reach constant weight, in order to calculate the bulk density and proceed to some physical tests as capillary rise, IRS, total absorption. The values will be compared with the ones of the original brick’s and of other new bricks in order to understand eventual incompatibility. Since it appears that the producer will not be able to make the requested number of bricks in due time, it was decided to have bricks produced also by another factory nearby MySon. To this factory P. Condoleo will send the physical and mechanical characteristics of the original bricks.
1. GEOMETRICAL SURVEY

1.1 Geometrical survey of the laterite enclosing wall

In order to take in account complete data and the real situation of the wall before start the conservation phase, the geometrical survey has been carefully carried out since July 11th. Participated to this work is a Vietnamese team composed by architect Nguyen Anh Tuan and draftsman Pham Le Trung (Institute for conservation of monument, Hanoi); architect Nguyen Anh Dung (staff of Bureau of Cultural Heritage, Ministry of Culture); and architect Tran Toan Sy (Quang Nam’s Center for Conservation of monuments and culture heritages). The onsite survey phase was finished in the end of July.

The second phase of the survey has been the drawings processing with Auto CAD right after the onsite survey has been completed. This phase was carried by draftsman Pham Le Trung and arch. Tran Toan Sy and has been just finished in September 20th.
1.1. Situation of the wall

After archaeological excavation phase the wall has been completely exposed in the sides East, North, and northern half of the West side. Before cleaning phase all of the wall surfaces were covered by a mixture of soil and debris of laterite, it was unable to distinguish the joint between laterite bricks.

In the west side the wall has quite uniform in height with 3 courses of brick in average. In the North side it was shown in different situations, some parts with 6 courses high and some others with 2 courses remain only. Especially the south-east corner was in an extremely damaged situation; the corner was completely collapsed and deformed due to slide of the ground.
1.3 Building technique

The wall was built with three different layers: foundation by two rows of brick, the base is 80cm in width and the body is 60cm in width. Following the same technical principle the wall was built with two external leaves by laterite and the core inside was filled by reused brick pieces and mortar. There are two (inside surface) and three (outside surface) transition moulds between the base and the body of the wall.

The survey drawings show clearly the principle of building technique. Two leaves of laterite were built with one in longitudinal direction and the adjoining one in cross direction. The laterite has average size is 35 x 20 x 8cm, in particular the longest one is 60cm and the shortest is 25cm.

2. CONSERVATION THE LATERITE ENCLOSING WALL
2.1. Cleaning of the wall surfaces

A decision to clean the wall surfaces has been taken in order to take in account general situation of the wall, and then it was able to set up the principle for preserve the wall.

During cleaning process the deeper survey also was taken. The condition of the internal filling also checked, it seemed to be very fragile, all of brick fragments are loosen and all of the brick joints were deteriorated and remain like soil. All the internal filling parts have been removed as far as it get so that the remains should be only the ones with strong bond.

2.2. Tree roots removal
Some positions of the wall were suffered extremely damage by tree roots. In some cases there were big roots crossed throughout the wall section and all the laterite blocks around were broken. In this case the wall has to be opened in order to completely remove the entire root and clean all laterite debris inside.

In the other cases it was unable to completely remove the root in order to keep the entire structure the decision has been taken is to cut off the root as much as possible and then kill the remains by herbicide injection.

2.3. Washing by water and soft bruscher
After cleaned the wall’s structure was shown in very bad conditions either internal or external surfaces. The laterite brick surfaces are loose like soil, in many positions the grains of laterite were mixed with soil. So that the wall was decided to be washed with water by soft brusher in order to remove the mixture of the laterite grain and soil.

2.4. Foundation test and reconstruction of foundation
One particular position of the wall, where is suffered strong damaged, has been opened until the ground layer in order to study the foundation technique and to stabilize the wall’s structure as well.

3. PREPARATION OF MATERIAL AND MORTAR

3.1. Laterite
New laterite brick was delivered to the site in sizes of 35 x 20 x 9 (cm) with quantity is 250 pieces. The new laterite has been washed with water by brusher in order to remove clay and soil was contained on its surfaces. After washing the real sizes of laterite brick is a little reduced and the brick’s edges are not very sharp. Actually when they were used they have to be cut depending on the size of original ones, which usually have been reduced due to the erosion.

Fig. 23 – Laterite bricks being washed with water  Fig. 24– Ready to use

3.2. Mortar
Mortar used was made by lime and brick powder in the following quantity:

1 part of shell lime
2 part of brick’s powder very fine (less than 1.6 mm)
1 part of brick’s powder made by 1,6 to 2 mm

4. CONSERVATION OF THE WALL
Considering that the laterite enclosing wall is an important element which is characterized of the G group, the conservation of the wall has been put in activity plan as a priority action of the year 2005’s mission.

Being the strongly damage situation of the wall the first task has to be done is consolidation of the wall’s structure. After all the loose material of the internal part of the wall had been removed and it was necessary to rebuild with stable materials. The chosen materials are good reused bricks and the mortar with composition shown above.

4.1. Consolidation of the wall

In order to rebuild the wall’s internal part the reused brick has been selected with suitable sizes and in good conditions.

Before to be laid with mortar the brick had been immersed in water in order to avoid occurred cracks and detachment between brick and mortar due to the strong water absorb action of bricks.

The process has to be done with single or couple of brick course depends in order to have strong bond with laterite promptly.
4.2. Fixing of original laterite bricks

There are cases in which original courses or single laterite blocks are staying freely. The situation of those bricks is very fragile and in high risk of collapsing, so it is necessary to fix them in their original position without removal in order to preserve the original figure of the wall. New laterite bricks were inserted into the missing positions with mortar connecting the entire course. In the other cases of single brick it has been fixed in position by adjoining new bricks. The laterite masonry then has to be consolidating with the filling bricks inside.

4.3. Repairing and replacing of new block
When the internal part was hardened the inserting of the new block of laterite has been taken in order to repair the damaged masonry or replace the missing laterite bricks. In this case we have not only to cut the new laterite brick in order to fit with the missing part but also the new core of the wall has to be carved out to be met the new brick sizes. Finally the new brick was inserted with mortar compacting the masonry.

In some cases when the wall is extremely damaged, in one external part such in the east side, it has been necessary to rebuild three or four entire courses in order to support the opposite part.

4.4. Repairing of original drainages

There are two original drainages found located in two half of the north wall. In the ancient time they were taken responsibility of discharging raining water of sacred space around the main temple G1. The situation of two drainages is different but both were broken. A decision was taken to repair two drainages for reuse as their original function.

At first the drainage in the east half was opened. In this location the wall high only 3 brick courses upper the drain bricks. The broken drain brick has been removed and stored as an artefact object; it was then substituted by a reproduced one made from an entire brick. The damaged laterite bricks were replaced with the new ones.
The situation of the drainage located in the west half of the wall was more complicating, it covered by at least six courses of laterite above. One of drain bricks was broken and it sloped toward inside in stead of outside so drain water could not be discharged properly. In this case the decision was taken to be very carefully opening the south leave which was in worse conditions in order to avoid enlarging dismantling. The same work has been taken as had done with the first drainage; the original broken drain brick has been removed and substituted by a reproduced one with right sloping.
5. PROJECT FOR DRAINAGE IN G3 AND G5

5.1 Project for drainage in G5

In order to discharging the big quantity of raining water inside G3 during rainy season it is necessary to install a system which should be enough ability. Based on the suggestion of architect Pierre Pichard one project has been proposed.
5.2 Project for drainage in G5

The quantity of raining water in this monument is surely smaller than in G3 so that one project with same technique but simpler also proposed.
5.3 Installing of drainage system inside G3

Following the project, the system is now starting to be installed.
Fig. 35 – Reproducing of the substituted water trough

Fig. 36 – Dating of new water trough after placed