Finalisation of the renovation works

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement no 680511. This document does not represent the opinion of the European Union, and the European Union is not responsible for any use that might be made of its content.

Deliverable number 3.7

PROJECT INFORMATION	
Project acronym	DREEAM
Grant agreement number	680511
Project title	Demonstration of an integrated Renovation approach for Energy Efficiency At the Multi building scale

DOCUMENT INFORMATION	
Title	Finalisation of the renovation works
Version	1.0
Release date	06.09.2019
Work package	WP 3
Dissemination level	P

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DOCUMENT HISTORY			
Version	Date	Modified contents	Implemented by
1.0	06.09.2019		Francesco Sacco

Executive summary

The DREEAM approach aims at delivering retrofits with energy savings of 75% of the baseline building energy consumption. To reach such an ambitious goal it is necessary that the renovation works are performed correctly, therefore there is a need for a quality assurance system. This work is part of WP3, the demonstration part of the project, and most specifically of Task 3.3 “Technical supervision”, where RISE performed monitoring through quality checks during the construction process for each demo site, based on the experience gained within the SQUARE project and on the own systems for moisture-proof, airtight and energy efficient building (ByggaL, ByggaF, ByggaE).

This report is about the last visit carried out by RISE to the demonstration sites in order to check how the work was done and perform quality checks. Both the outside and inside works have been checked and additional information about how the tenants perceived the renovation is provided. A chapter is dedicated to each of the three pilot sites.

This was the last of the three planned site visits: the other two were performed at the beginning of the projects and during the renovation works.

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1.1 Description of the site visit

The final site visit was performed at the end of June 2019. The renovation works were completed and only some final painting in the stairwells and some minor interventions were being finished at the time of the visit.

The roof is now finished and features the HVAC units and air ducting, together with the photovoltaic panels as shown in the figure below.

Figure 1. Renovated roof

The roof covering was installed correctly to provide adequate moisture protection, as it can be seen from the details shown in the figures below. The unfinished or (few) incorrectly sealed parts that were noticed in the previous visit had been fixed or finished.

Figure 2. Roof covering sealing details

Drainage wells are placed at lower points to ensure that water will not stagnate on the flat surface and create leakage problems.

Figure 3. Drainage well

Where the roof had to be perforated to install the air ducts and other components, the hole had been sealed correctly as shown below.

Figure 4. Sealings around perforations in the roof envelope

The photovoltaic panels were installed in a way that the metallic structure that holds them fastened to the roof does not impact negatively on the roof, as it can be shown in the figure below. The pressure from the metallic beams is distributed on a wider surface so that the risk for damage the roof covering is minimised.

Figure 5. Photovoltaic panels and details of installation structure

The inverter was also installed: there are still issues to be solved with the electricity provider to put the system into operation. The batteries are also ready to store the produced energy. It is still to be decided how to exploit the produced electricity (to be sold, used in the common areas and in the single apartments, or for a Tesla wall).

Figure 6. Inverter and batteries for the photovoltaic panels

The stairwells have been repainted, as well as the ducting that hosts the cabling, as shown in the figures below. LED lighting was also installed.

Figure 7. Detail of the cable duct and new led lighting

The new lifts were also operating and working.

Figure 8. New lift

The new windows were installed in a satisfactory way, with the correct sealing on the inside and outside, both on the sides and on the upper and lower part of the frame. The details are shown in the following figures. It can be noticed how the finishing silicone sealing was applied to provide for the double protection against moisture and to provide the desired air tightness.

Figure 9. Sealing details on the outside and inside of windows

Some slight imperfection in the stairwell windows was noticed, also due to the fact that the façade had not been renovated. The sealing was done correctly but the result does not look perfect due to the old façade panels. The façade with the new windows can be seen in the figure below.

Figure 10. Stairwell window outside sealing details

Where the terraces have been renovated, the result is very satisfactory, with an outside grate and water collector for additional drainage, as shown below. By doing so, the risk of leakage inside the apartments is almost eliminated since water cannot stagnate on the terrace and leak from below the door window (provided that the gutter is kept clean with periodical maintenance by the users, especially if there are many plants on the terrace that can clog it with their fallen leaves).

Figure 11. Gutter detail in the door window

The sealing has also been done correctly here, even though at a first glance the result does not look very satisfactory, again due to the fact that the building envelope was not renovated.

Figure 12. Door window outside detail

The last work that was going on, together with some minor cosmetic interventions in the stairwell, was the installation of insulation (mineral wool) on the ground floor ceiling, which was the only part of the building envelope still uninsulated, as seen below (as it had been decided not to renovate the building envelope as it had a satisfactory level of insulation already). By completing the envelope, thermal bridges will be greatly reduced, with a positive influence on the energy performance of the building and on the overall moisture safety.

Figure 13. Ground floor ceiling insulation being applied

1.2 Control of the critical moments identified in the previous site visits

The critical moments that were identified during the previous site visits were as follows. For every point (in italic), feedback is given.

Windows replacement:

- *Make sure that the sill on the internal side does not obstacle the warm airflow from the underlying radiator (to prevent condensation and cold drafts)*

  Ok, even though radiators are quite recessed
- *Make sure that there is proper sealing between the window frame and sash*

  Ok, the window sealing looks much better now.
- *When installing the windows, apply a two-steps approach for waterproofing the joints, which means to separate the rain protection to the wind protection function: the first part of the seal has just the aim of preventing the raindrops for directly getting in)*

  Ok

Roof:

- *When renovating the waterproofing, avoid direct installation of the bitumen layer on cellular plastic, both due to the risk of burning when applying the bitumen and also because cellular plastic shrinks under the influence of the sun, which will turn into leaks between the insulation boards and therefore heat losses. It is recommended to place at least 20mm of mineral wool on top of the insulation to protect it.*

  Bitumen layer installed correctly, joints look ok and the parts that were sealed incompletely have been finished.

- *Moisture safety of the roof depends mostly on additional components such as gutters, vents, flashings and how the waterproofing is sealed around those components. Make sure that the perforations are sealed appropriately*

  The details that were identified to be improved (see D3.5) have been sealed correctly, as shown in the current report (see Figure 3 and Figure 4).

- *Solar panels installation to ensure that the fastenings are correctly dimensioned to withstand wind loads and that they will not impact on the weatherproofing of the roof*

  The panels were installed correctly, and the fastenings rest on a support so that their weight is distributed on the roof covering not to create tear, see Figure 5.

Terrace roof:

- *Make sure that any surface treatment on the other side of the slab is more permeable to vapour than the vapour barrier.*

  Not tested.

- *Bring the waterproofing layer high enough at the terrace borders and protect it from damage under construction.*

  Ok, the missing parts were finished

- *Check the effectiveness of the drainage system at the windows base: it is usually not optimal to have the terrace at the same level as the apartment floor or above as it will facilitate inwards leakage.*

  Not tested but it was clean from debris from a visual check.

1.3 Final remarks

The renovation works have been performed in a very satisfactory way, both from the energy and moisture point of view, with care in the details and quality in the materials and components used, and only some minor imperfections, that were fixed after feedback. It should be noted that most of the tenants that live in 1892's dwellings have been there since many years and have a deep connection with the neighbourhood and the cooperative: the renovation works improved the standard of the apartments and the sense of community. The addition of the student housing together with the dwellings for the elderly was also a brilliant idea which deserves to be followed and implemented in other housing complexes. We noticed an excellent communication as well between 1892 and the tenants; the latter were informed of the renovation at all stages which paved the way for a smooth work execution.

2 Padiham

2.1 Description of the site visit

The final site visit was performed at the beginning of July 2019, as the works had already been completed at the end of the previous year. The visit therefore had the additional benefit of gathering feedback from the tenants, who have been living in the renovated apartments for some months.

The figure below shows the difference between the renovated and unrenovated houses (some of those who owned the houses decided not to go for the renovation since they would have had to pay for the renovation themselves). Compared to the neighbouring districts, the overall impression is of much higher standard and quality. In the detail it can be seen the difference in wall thickness due to the external wall insulation (EWI) and the sealing in between.

Figure 14. Comparison between renovated (white) and unrenovated houses

The awnings above the entrance doors were also installed correctly, without interrupting the airtight external envelope, as shown below.

Figure 15. Awning detail and view

Where the wall had to be perforated to allocate ducting, air intakes or the gas system (only for the houses with gas heating), the holes have been sealed correctly, as it is shown in the figures below.

Figure 16. Detail of perforations in the EWI

The new gutters are working correctly, conveying the runoff water into the collection wells on the ground. Special care was taken to make sure that the fastenings did not cause tear in the wall insulation, as shown in figure below.

Figure 17. New gutter and fastening detail

It should be noted that the render of the EWI can be washed so that it will maintain its appearance with minimal maintenance, ensuring a good result throughout the years. In the figure below it can be seen how the wall, dirty as some mud splashed on it, will be washed with water to regain its original colour: this is an interesting solution that is worth being picked up for other renovation works. Also, some parts were not renovated since they were deemed to be in good conditions and with a good U-value, something we could confirm during the visit.

Figure 18. EWI to be washed (left) and part where additional insulation was not installed (right)

The new windows, which had been installed correctly as already shown in the previous report, with good sealing to protect from external moisture and driving rain, have proven to be a source of improved comfort as the tenants remarked during the inspection on the inside of the dwellings. The better glazing and air tightness avoid cold draughts and give a higher surface temperature on the inside, which results in an improved indoor operative temperature. The pictures below show some detailing on both sides.

Figure 19. Window details, inside

Figure 20. Window details, outside

The mechanical ventilation system installed in the cold attic was working properly and as far as we could see the ducting was installed correctly so that the loose insulation is not blocking the air intake and the sealing was done correctly. In the same cold attic, the inverter for the photovoltaic panels was installed, as shown in the figures below.

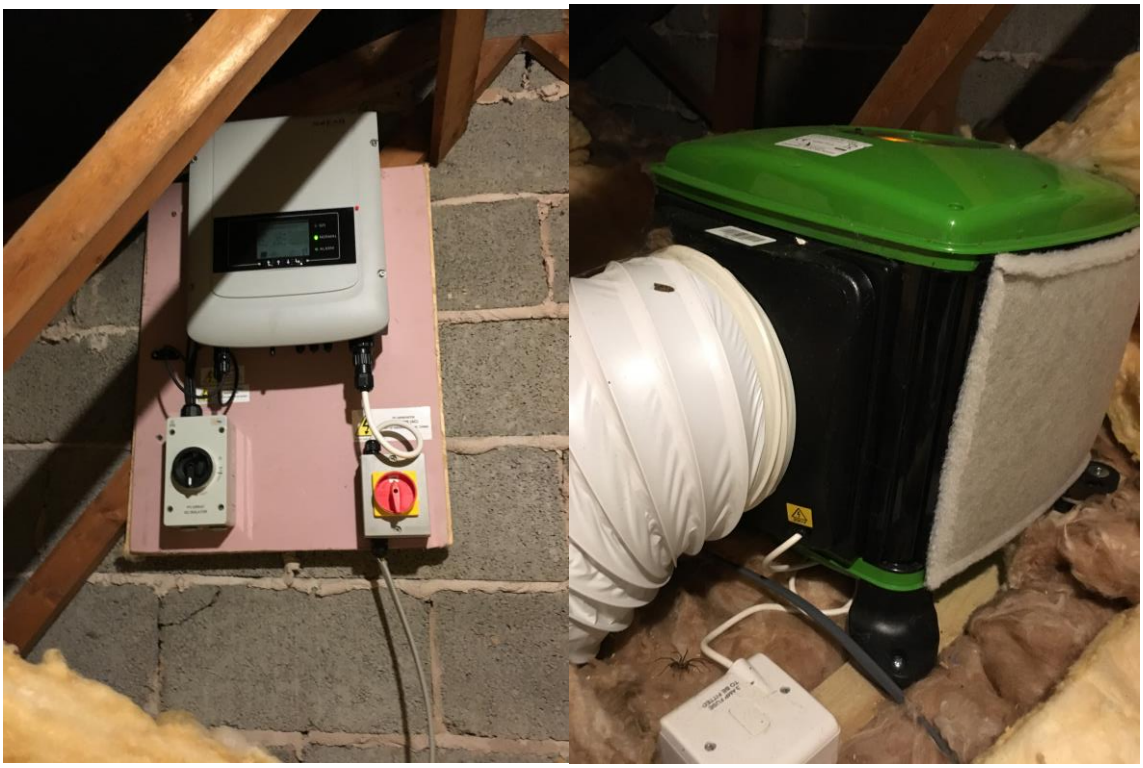

Figure 21. Inverter for the PV panels (left) and ventilation unit (right)

Figure 22. Loose insulation detail (left) and ducting for the gas boiler exhaust (right)

The new combination boiler that was installed in place of the previous boiler is working correctly and, being much smaller than the previous boiler, as shown in the figure below, it was possible to install in the same room the gel unit that works as a battery for the photovoltaic panels, storing the excess electricity as heat in the gel inside the box, to be used when the heat demand requires it. This technology is becoming getting popular in Scotland but there are still very few applications in England.

Figure 23. Combination boiler and gel heat storage (the box on the ground)

Where the household has electric heating, the tenants talked enthusiastically about the new "quantum" units and the ease with which it was possible to set the desired temperature, in addition to the concrete savings they were able to make every week and the feeling of having central heating. The units, as it was stated in the last report, were installed correctly and are working properly.

2.2 Control of the critical moments identified in the previous site visits

The critical moments that were identified during the previous site visits were as follows. For every point (in italic), feedback is given.

External wall insulation:

- *Every perforation through the insulation layer has to be sealed correctly to avoid thermal bridging and moisture penetration (condensate pipe, overflow outlet, waste water outlet, ventilation ducts, gas meter box and so on)*

  Sealings made correctly, as reported. The final installations were also sealed correctly.
- *Provide adequate protection to the external insulation where the roof overhang is not sufficient to cover the new insulation layer, as indicated in the specs*

  Metal protections to flush rainwater could not be inspected closely but they looked well-installed as shown in the report. The gutters proved to work correctly.

Roof/attic insulation

- *Check with calculations the relative humidity values that might occur at the joists and make sure that they will not exceed the critical threshold of 75% (or less if a safety factor is desired)*

  No calculations were done.
- *Make the attic slab as airtight as possible when insulating it to prevent warm moist air from the lower floors to get into the cold attic and condensate.*

  Ventilation system working correctly.

2.3 Final remarks

The renovation works were performed according to the state-of-the-art and we could detect only some negligible imperfections. The most interesting part was once again not just the strictly technical one (the solution with the gel heat storage for the photovoltaic panels is worth further investigation to study its feasibility in broader applications) but the social one. Renovating the houses really changed the lives of the tenants, many of whom are poor, for the better; the first tangible impact was the one on energy poverty, since the new heating systems are more efficient and cost less, also due to the decreased heating need now that the building envelope has lower U-values. A tenant, for instance, could only afford to heat one room before the renovation, and keep the children in there. Now that the whole house is warm, the whole family can use the whole house and have a more relaxed and better life.

Once again, the successful communication between Places for People and the tenants was the key to a successful renovation. The site manager, Mr. Patel, is well-known in the area and people turn directly to him

in case they have any complaints or remark, without going through the call centre: this is a strategy that worked especially with “difficult” tenants that prefer to rely on a personal relationship with the housing association. Mr. Patel told us that the contractors agreed to put some in-kind input to perform some little additional works on the tenants’ request, a sign that now tenants are caring more for their renovated houses and take pride in making it look good. One example is that people are now doing more gardening, as shown in the picture below (taken with the tenants’ permission). Improving the housing conditions is therefore an excellent way to tackle social isolation and the starting point to begin solving some of the problems that nowadays affect troubled suburbs.

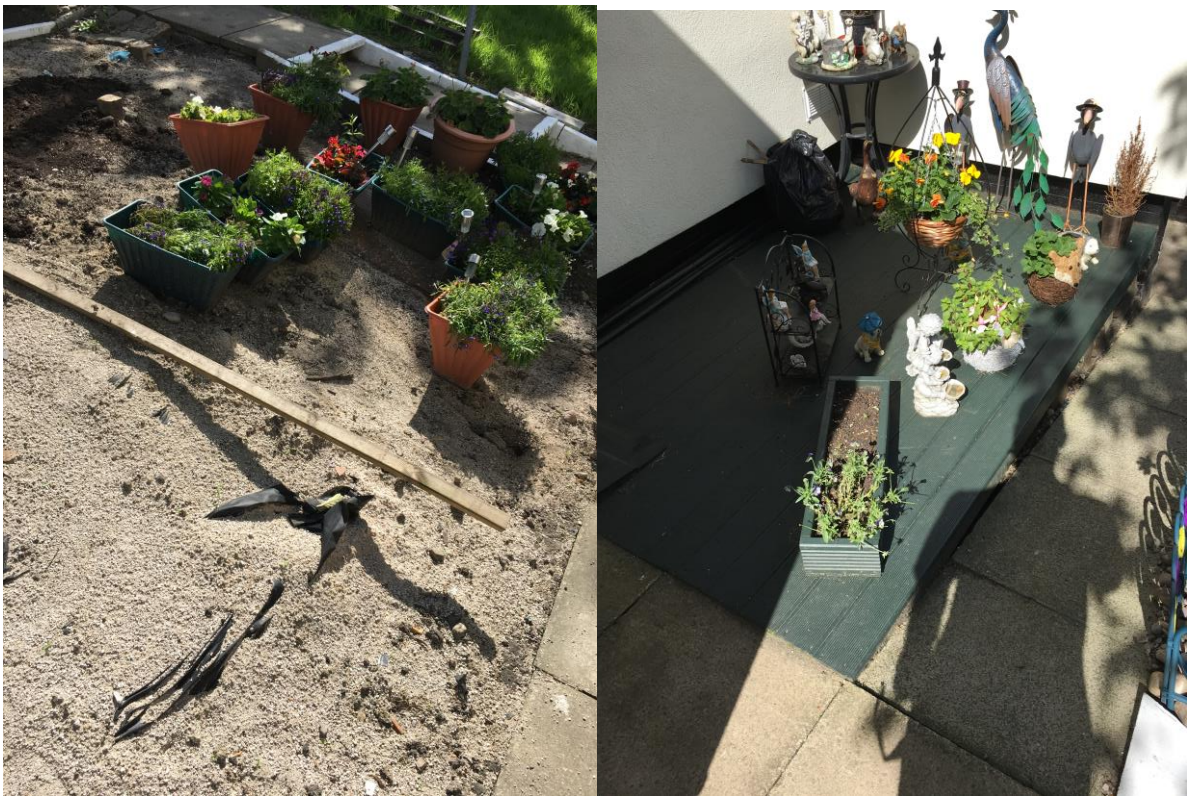

Figure 24. Some neighbours have rediscovered the pleasure of keeping a blooming garden. The flooring in the right picture was done as in-kind contribution by the contractor, under request from the tenant.

3 Treviso

3.1 Description of the site visit

The site visit was performed at the beginning of July 2019, as the works have been completed save for the activation of the photovoltaic and solar thermal system, as there are some issues with the certification of the installations and with the connection with the electric grid, and some minor works in a couple of apartments and stairwells. Even though some of the contractor companies went bankrupt, ATER Treviso was able to work on a solution to replace them and ensure that the works could be completed before the end of the DREEAM project.

Now that the scaffolding has been removed, it is possible to see how the towers look with the new EWI, as shown below.

Figure 25. View of the renovated towers

Most of the detailing has been already reported in the previous deliverable, here a few details of the EWI are shown below, as the addition of the room that houses the thermal storage of the solar thermal, and how it was joined with the tower and its EWI.

Figure 26. Thermal storage for the solar collectors and joining to the building detail

Where the piping of the gas system goes through the EWI, as it can be seen from the grate in the figure below, an aerogel layer was applied to counter the reduced thickness in insulation and prevent thermal bridging. The grate is required by the law, so that the piping will run externally to the wall.

Figure 27. Gas system piping detail

The new PVC front door was installed correctly and the sealings are good, as shown below. Some issues have been reported though about difficult opening, probably due to the thermal expansion of some joints.

Figure 28. PVC front door details

The EWI has been installed properly also at the terrace level, even though some tenants have been complaining about the reduced space that the additional insulation implies on already small terraces.

Figure 29. EWI on terraces. Note the reduced space and the toilet window detail.

Now that the works are finished it is possible to see the quality of the sealings and detailing that we could see being done in the previous visit, where workers were still installing the ducting and the EWI.

Figure 30. Sealings where the EWI was perforated (fastening and ducting)

Figure 31. Integrated ducting in the EWI (gas unit exhaust)

Wherever tenants wanted to install external curtains on the balconies, a smart solution was adopted, as shown below: the structure rests on the concrete balconies above and below, and not on the walls (where the EWI was installed), therefore not affecting the moisture performance of the building.

Figure 32. Curtain structure details

The windows have been installed correctly with adequate sealing ensuring air tightness (now paramount since the mechanical ventilation was installed) and moisture safety, as shown below:

Figure 33. Window installation details: apartment door window (left) and stairwell (right)

Concerning the mechanical ventilation, the decentralised units were installed in the apartments and are working as they should. The air handling units have been installed in the hall ceiling of every apartment, now only the outlets are visible, as shown in figure below. The air intake is in the terrace, the filter being protected by a grate.

Figure 34. Ventilation system outlet (corridor, one in every room)

Both the photovoltaic panels and solar collectors have been installed on the roof, which was not possible to inspect due to safety reasons. The picture below was taken from the top floor and shows how the installation looks. There are still some issues with the connection with the grid therefore the PV panels have not been put to work yet, but everything (inverter and thermal collector) is installed and ready to go.

Figure 35. Solar collectors (left) and photovoltaic panels (right)

The cold attic has been insulated with mattresses of mineral wool, as shown below, to guarantee continuity in the U-value of the building envelope.

Figure 36. Cold attic insulation with mineral wool mattresses

The floor of the warm attic (the room where clothes are hung to dry) was insulated as well with a layer of polystyrene, as the small step reveals the now slightly raised floor, shown in the figure below.

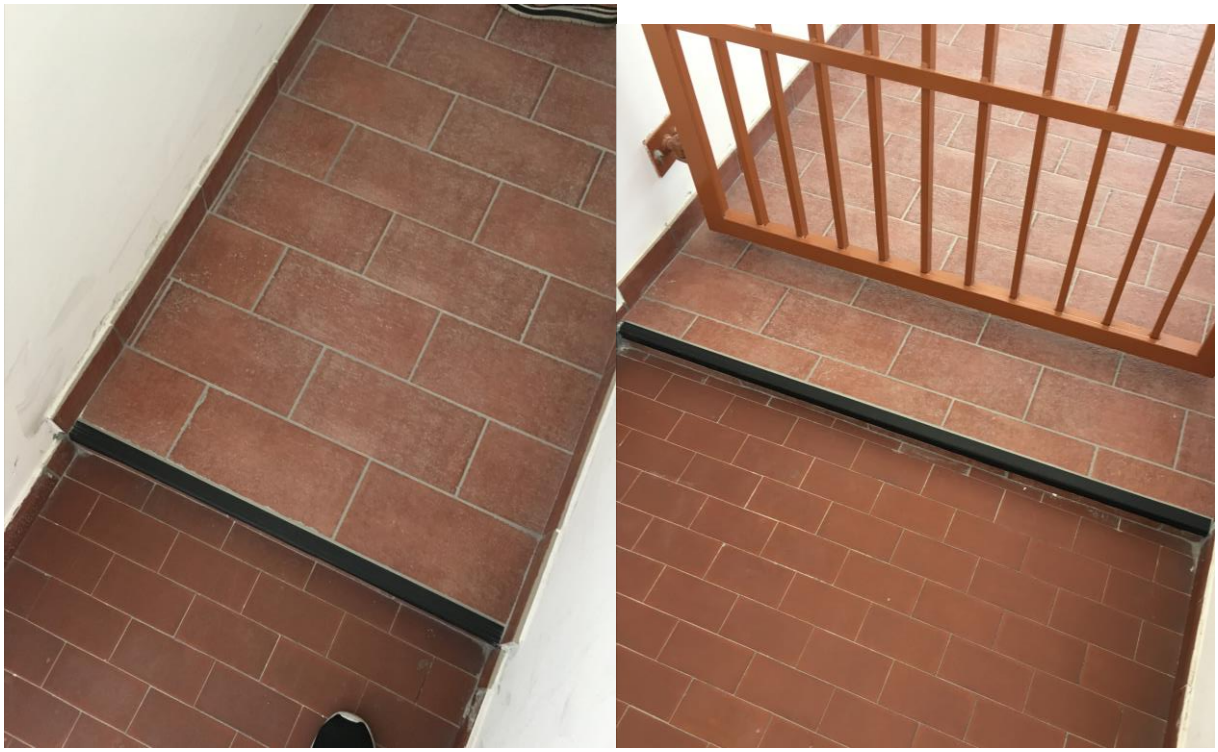

Figure 37. Raised floor after polystyrene insulation

The stairwell windows and armoured apartment doors have been replaced as well.

3.2 Control of the critical points identified in the second site visit

The control points that were already checked and deemed OK in the second site visit are not reported here for brevity.

The critical moments that were identified during the first and second site visit were as follows. For every point (in italic), feedback is given.

External wall insulation:

- *Restore accurately the plaster of the external wall where damaged, to allow for correct installation of the external insulation.*

  We noticed that repairing works were done correctly, and that measures were taken to prevent thermal bridging from the piping installed in the external envelope, such as with the aerogel behind the external gas piping.
- *When the finish is applied directly on the insulation (on mortar), then it has to give adequate protection against driving rain. It has been proved that building a completely rainproof rendered façade it is almost impossible: some water during hard rainfall could get in through possible cracks or connections. Since there is no ventilated air gap behind the render, it will take some time for the water to dry. It should be verified through calculations that the critical values of relative humidity for the wall materials are not exceeded.*

  No calculations were performed but the dry weather allowed for a safe installation, and the building was sufficiently protected by the scaffolding anyway.
- *Every perforation through the insulation layer has to be sealed correctly to avoid thermal bridging and moisture penetration (condensate pipe, overflow outlet, waste water outlet, ventilation ducts)*

  Ok, see report. The apartments that were checked show excellent sealing.
- *Install the aerogel panels in the window reveals by paying attention to the joining and sealing to avoid thermal bridging*

  Ok, see report.

Windows replacement:

- *Make sure that there is proper sealing between the window frame and sash*

  Ok, see report. The sealing looks good after a few months as well.
- *When installing the windows, apply a two-steps approach for waterproofing the joints, which means to separate the rain protection to the wind protection function: the first part* of the seal has just the aim of preventing the raindrops for directly getting in)

  Could not check this directly but the result looks good.
- *When installing the new insulated aluminium window sill, pay attention to correct sealing to ensure water- and airtightness.*

Ok, see report. The sealing looks good after a few months as well.

Roof/attic insulation

- *Avoid thermal bridging when insulating the cold roof slab, adjust insulation thickness to provide uniform U-value*

  Insulation was installed correctly.

- *Make the attic slab as airtight as possible when insulating it to prevent warm moist air from the lower floors from getting into the common room*

  The mineral wool mattresses were rolled out so that they cover all of the cold attic. The sealing around the polystyrene insulation on the floor of the warm attic is airtight. No airtightness tests were performed, only visual checks.

The "additional" critical factor, namely the delay in the works due to the bankruptcy of a contractor, was managed and solved by ATER by finding new contractors. This did not affect the technical quality of the works.

3.3 Final remarks

It is not easy to do renovation works in Italy in the public sector, due to the very strict laws on tendering and to the fact that it is impossible to make even small changes to the workplan once that the tender has been submitted. On top of that, the precarious economic situation of many contractors and subcontractors makes often the renovation process a difficult journey, full of unexpected twists and problems. The work was executed technically in a very satisfactory way, even though some tenants are not happy and have been hostile to ATER, despite a clear communication from their side. This is also due to the fact that most tenants are not aware of the privileged situation they live in, by renting apartments at bargain prices now with a standard that is higher than most of Treviso. It was very interesting to see the difference between Padiham, where tenants were very grateful, and Treviso, where there was a general sense of hostility even though the renovation works have been executed really well and the delay in the work completion was of a few months (not in any way attributable to ATER, which had actually found a solution), during which they had to live with the scaffolding still around the building.

In this way, the focus is shifted from the technical and quality aspects of the renovation to the ones connected to the acceptance of the works in such a difficult environment, particularly with unreliable contractors and potentially hostile tenants.