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*Image: Apollo France Diffusion and Apollo Benelux*

## Renovation continuous skylight in Commercial Centre Nantes

**C**entre Commercial Atlantis St Herblain is a mega mall, (hypermarket), in Nantes, France which has a very large skylight in the building that provides natural light into the multilayer shopping arcade. The original plastic glazing was approximately 15 years old and could no longer provide the desired luxurious feel nor meet today's high requirements of insulation and fire safety. Moreover,

the bottom layer of the two-layer glazing system was translucent, which obscured the view of the clear sky above. Enough reasons for a renovation of the glazing of the barrel vault.

The main contractor was Apollo France Diffusion, from Saint Sébastien-sur-Loire, which ordered the Dutch company Apollo Benelux, from Zevenbergschen Hoek, to perform the transformation. They worked in close co-operation with SRT Plastics in Bergen op Zoom (The Netherlands), who developed and delivered the polycarbonate sheets. The cassettes were pre-fabricated in the factory, and changed on site during the night with the original glazing panels.

### Cassettes

The old glazing consisted of a two-layer system of solid polycarbonate sheeting. The outer sheet was 8mm thick and the inner sheet 6mm. The cavity of 18mm between the two layers was achieved by using aluminum square profiles. The two sheets were clamped with rubber profiles and the whole was applied in a so-called lower traverse (95mm high, 70mm wide) and with a clamping strip (upper cross-beam, 10mm high and 70mm wide), screwed to the lower traverse, a construction principle as you also find in curtain wall construction. The new glass has again opted for polycarbonate instead of glass, but in completely assembled and

# Step by step nightshift produced daylight



The replacement of the polycarbonate glazing of the barrel vault was done mainly at night, since the shopping mall was open for public during daytime.



Strip by strip, the “old” polycarbonate sheeting is removed and replaced with the new prefabricated cassettes with triple layer glazing.

prefabricated cassettes. As a result, the load-bearing structure which was still in a good condition, in spite of the addition of an extra layer, didn't have to be replaced.

The new requirement that had to be complied with was clear: an insulation  $U_g$  of approximately  $1,7 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ , a ZTA value of approximately 34.5%, an LTA value of approximately 45% and fire resistance class C S3 D0 according

to EN 13501-1, which corresponds to an earlier class M2 (see box Fire). The cassettes are a three-layer system which were built (from inside to outside) as follows: a 5mm thick polycarbonate solid sheet (clear), 20 mm air cavity, a 3mm thick solid polycarbonate sheet (clear), 20mm air cavity and the outer sheet was a 8mm thick solid polycarbonate sheet with heat reducing properties and a green hue to match the look

of colour similar to the nearby glass dome. The layers are mutually spaced apart by circumferential plastic square profiles. Double-sided adhesive tape provides the connection between the sheets and profiles. The cassettes are installed upon rubber strips on the support structure. The same strip is present between the upper sheet and the clamping strips, which in the same way as the old system are screwed into the support structure.

### Gantry crane

The barrel vault is located in the middle of the mall. To carry out the work would require a fixed crane throughout the complete implementation phase, but that cost was not justified, therefore a different solution is selected, in which the roof (and especially the roofing material), which was not resistant against a roof load of more than 100 kilograms per square metre, was taken into account. A lightweight aluminum gantry crane, with a free span of 24 metres, was developed especially for this project, extending over the full width of the barrel vault. This crane was built of standard stage (truss) parts and had a weight of 1000kg. The total weight was distributed as much as

possible over as large a surface as possible by the special design. The gantry crane was able to move over pressure distribution plates on retractable tyres, to distribute the forces widely over the roof surface instead of point loading during actual loading / work of the crane. The loading on the roof was safe and not exceeding the calculated snow load on the roof construction. With this gantry crane the 'old' glass could be taken away, then lift the new cassettes from the transport racks and move them into place for installation. The transport racks, carrying the cassettes shipped from the Netherlands, were also rolling over plastic wheels on pressure distributing plates on the roof.

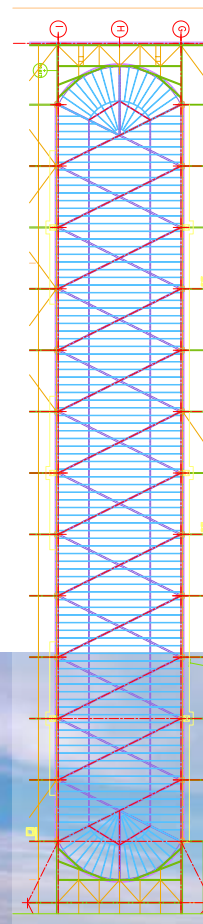


**Fire resistance**

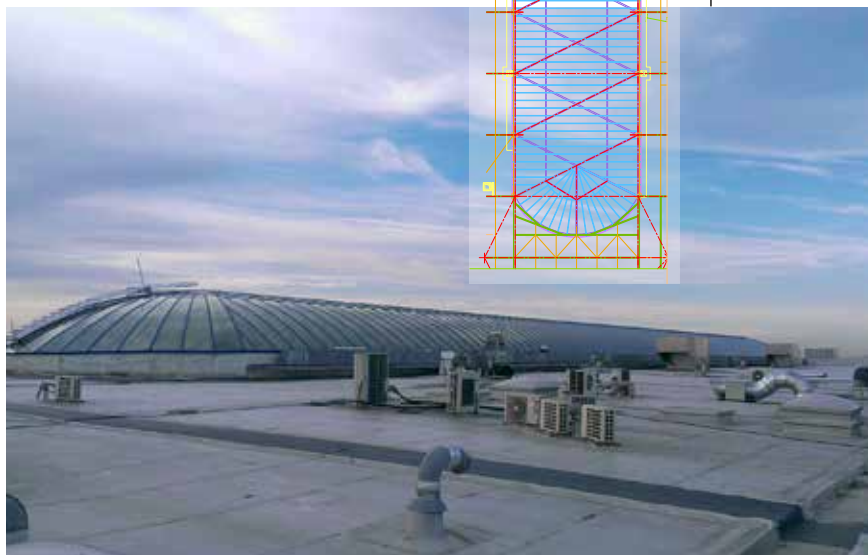
Meeting the requirement for fire resistancy was a 'difficult story', said Marc Koudenburg of SRT Plastics. "For the old glazing a certificate was available, because at that time it was still possible to obtain a certificate M2 in 8mm for polycarbonate solid sheet. Today, by tightening the rules around applications of requirements and tests, this is not so easy. Now no supplier could to be found anymore that could provide an M2 or equivalent on 8mm solid polycarbonate sheet. M2 is an outdated classification that refers to the old French standards NF.P92-501 and NF.P92-505. Europe is now working with EN 13501-1, in which C S3 D0 is equivalent to M2, but according to the new standard. However, the principal put a mandatory requirement on the table for fire resistance. The combination SRT Plastics - Digioplastics was challenged to find the solution for the fire resistancy requirement and succeeded amongst others, by working closely with the most advanced suppliers of raw materials and additives. Most of them were very sceptical about achieving a fire certificate for 8mm polycarbonate solid sheet. In reality it was very difficult but not impossible. We spent a lot of time and energy in testing and trial productions but through perseverance and continuous learning from the past results, we were able to meet the requirement for fire resistance".



Image over the heart of the lights of the inserted cassettes.



Map and outside image of the barrel vault. The circumferential steel purlin divides the building into three sections: a central section and two peripheral zones.



**old / new**  
The old windows had a translucent (opal) bottom sheet, which allowed no view of the outside world. The new glazing is completely transparent and offers visitors to the centre a beautiful view of blue skies of Nantes.



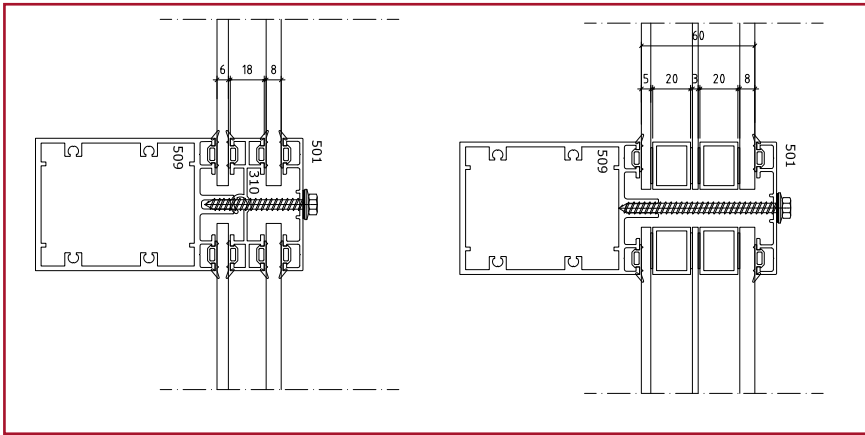
**Special features**

The pre-fabricated cassettes in the new composition have a number of advantages compared with the original glass. The insulation value of the three sheets together were much higher compared with the old system and the sheets are satisfying the high fire requirements (M2 & CS3D0). The outer sheet is a special polycarbonate, developed by SRT Plastics in co-operation with the company Digioplastics. Through the use of additives, the sheet has been given infra-red absorbing properties, which reduces the heat energy from the sun for the 3 layer system to less than 34.5%, absorbing more than 99% of the ultraviolet radiation. Through the transparency of this sheet a light transmission of 44.8% was achieved.

More than half more than the old translucent roofing. The green tint from the external sheet has no consequences for the transparency and only a slight influence on the light transmission. The cassettes are completely closed and through factory pre-fabrication the windows could be protected against the entry of dust during assembly. In order to be able to ventilate the spaces between the sheets, at the top and bottom of each cassette small openings with dust filters which were installed in the plastic profiles.

**Mounting**

In total there are 87 cassettes with dimensions of 5934mm x 980mm x 56mm in the middle, (see drawing) and 2 x 91 cassettes of 6046mm x 980mm x 56mm in the two zones



Vertical section of the old two-layered glazing. The lower traverse (carrying profile) and the upper cross member (clammings) are retained.

Vertical section of the new, three-layer polycarbonate glazing in the prefabricated cassette.



One of the semicircular head ends of the street light with the glass of the new bridge maintenance.



Production of the cassettes in the factory in Zevenbergschen Hoek NL. The lower polycarbonate sheet - with the plastic profiles ( spacers) - is placed on the padded bench.

**Project data**

Client:	Commercial Gallery Atlantis, Saint Herblain
Architect:	Cabinet D' architect Lameynardie, Nantes
Client:	SHD Real Estate, Saint Herblain
Fabricator:	Socotec France, Saint Herblain
Contractor:	Apollo France Diffusion, Saint-Sébastien-sur-Loire
Replacement / installation:	Apollo -Benelux BV, Zevenbergschen Hoek
Supplier glazing :	SRT Plastics, Bergen op Zoom
Start implementation :	May 2015
Completion:	August 2015



Transport Racks upon pressure distribution plates on the roof next to the skylight . The gantry crane lifted the cassettes from the rack and brought the installation site.

and both ends of the skylight. For the two semi-circular head ends of the barrel vault are 2 x 18 trapezoidal tapes and 2 x 9 triangular cassettes produced and installed. Because the continuous skylight is convex, all of the cassettes are not flat but curved. On average, each cassette weighs about 120 kilograms. Taking into account the thermal expansion of polycarbonate, the cassettes were installed on the lower traverse and fixed with strategically placed screws. The supporting structure of the skylight is composed of crosswise steel trusses covered with a circumferential steel purlin, which divides the roof surface in the above-mentioned middle segment and the two edge zones. On top of that that runs the aluminum

crossmember. All of this, including the upper crossmember (clammings), is maintained. The steel is coated again and the aluminum profiles are cleaned and provided with new rubbers. On the bottomside of the cassettes, at the base of the skylight, new folded sheet metal is applied as a finish. The replacement of the glass was carried out at night between 21.30 and 08.00. That was necessary because the centre had to remain open to the public during the renovation and no hindrance was allowed. So the glazing of the barrel vault was removed and installed strip by strip, three aligned with each other, so that always only one meter skylight was open. This is done to minimize the possible influence of bad weather conditions. Under the installation site fall protection nets

were suspended and the mechanics were leashed to the walkway of the crane.

**Sky visible again**

By the new, heat-resistant, transparent polycarbonate glazing the sky has become visible again for visitors to the mall, and the center has received an aesthetic boost.

The polycarbonate from the old glazing was recycled so that there has been thought for the environment. Besides new glazing, a new maintenance bridge for the barrel vault was also included in the job. This bridge runs over an additional rail mounted on top of the circular ridge beam of the support structure. Through this bridge every spot on the outside of the barrel vault is now reachable.

