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POSSIBLE LOW TECH NATURAL ILLUMINATION TECHNOLOGY ON-BOARD MARITIME VESSELS

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Abstract: *The paper treats a range of multiple solutions and possibilities of improving the ambient on board vessels by using Low tech technology*

Keywords*: Illumination solutions, deck lights, LOW TECH*

General aspects

The illumination problem on-board vessels may be considered to be as old as maritime transport.

Thus since the XVII century, seafarers were dealing with the problem of natural illumination of the interior part of vessels, "deck lights", because fires started due to utilizing lamps and candelas for illumination represented a major problem often encountered. So placing glass panels on the bridge of merchant vessels was adopted on a large scale, because it was useful in two cases: it let natural light pass through to the interior during daytime and during nighttime it signaled to the outside, any sign of fire from the inside.

In this sense, it seems the leap performed by science and technique in general, and transport techniques especially imposes a possible introspective search through the older and modern day examples and solutions, referring to classic low tech methods of permission of light within underground buildings with or without direct access to natural light. Besides the positive effects on a psychological level, physiologically related to the workplace surroundings of the crew members [2], from an economical standpoint, the effect can be very rewarding through increasing the efficiency and capabilities of the crew members.

On the other hand, when voyages take place during the summer near the equator or tropical areas, time intervals during the day, with natural light being very long power consumption demanded by artificial illumination can be considerably reduced. Being that artificial light on-board is produced using Diesel Generators, fuel consumption reduction can be significant. The paper at hand aims to refresh and update the solutions utilized in the construction field for solving similar problems. This approach proposes the analysis of these constructive solutions used by architects as possibilities of being adapted and taken into account benefiting from new materials and construction technologies on the market. Also, it can be a call to architects being introduced in naval architecture development staff for the architectural part of living and work spaces.

Different types of low tech natural illumination

Low tech natural illumination in spaces similar to the underground spaces, for daily activities of workers, are realized by means of simple procedures, be it direct, with the help of light shaft or atriums, or using light lamps. In addition, light can be introduced underground or on-board vessels in areas deprived of natural light**,** speculating its physical proprieties. Therefore, light can be redirected via mirrors using optimal routes in enclosed spaces where it is necessary.

Thus, profiting from lights propriety of being focused or dissipated with the aid of convergent or divergent lens, the intensity on its transfer route can be easily enhanced, diminishing the routes dimensions, and in the workspace using appropriate optical lens, a superior level of natural light intensity can be accomplished. In order to achieve this papers purpose of realizing a moment of reflection and analysis on the subject of interior illumination on-board vessels in which crew members go about their daily activities, according to the pre-established timetable, next are briefly described ways in which methods of introducing natural light in the underground or other similar spaces have evolved from a natural light exposure standpoint.

The case of horizontal plane intake

The most wide-spread method used for introducing light indoors by means of horizontal planes is the skylight, which can be placed in an open field (Fig.1.1 a), with one vertical obstacle (Fig. 1.1 b), or with two vertical obstacle (Fig.1.1 c), affecting the way in which light enters the spaces beneath.

Depending on the nature of the space and the desired effect, one of the solutions is chosen.

These skylights can occupy different positions on the deck above the engine room and can have different sizes and shapes according to the impact on the deck and other existing structures and also its purpose. These can have centrally positioned,

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placed circularly or rectangular, so that they assure total illumination of the peripheral space, or in order to steer the illumination one or two vertical walls can be used for a drastic image.
Skylight dimensions can vary starting from significant dimensions to small perforations or slats. Consequently, starting from the horizontal plane these can have small slopes or curvatures depending on the shape of the deck and also on the demanded quantity of light.

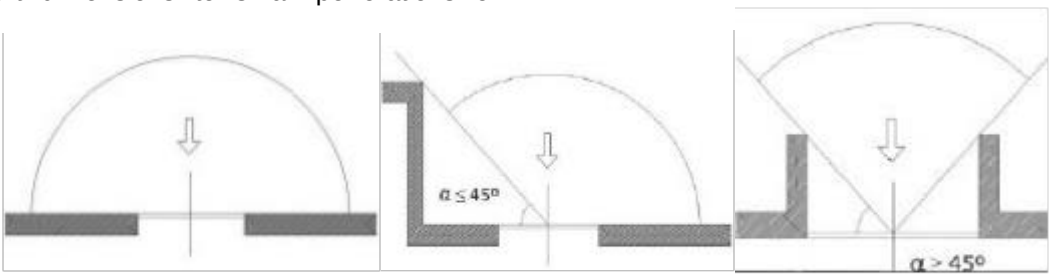

Fig. 1.1. a | Fig. 1.1 b | Fig. 1.1 c

2.2 The case of inclined plane intake

Fig.1.2 a Captator vertical si reflector puțin inclinat

Situated in this category are shed type catchers, which were initially spread widely among factories and halls, subsequently, being adopted for buildings of public interest like museums, schools, etc. Obviously that through assimilation this solution can be extended not only to the illumination of the engine room but also for other spaces designed for daily human activities in which the ceiling can be divided with the catchers described in this paragraph.

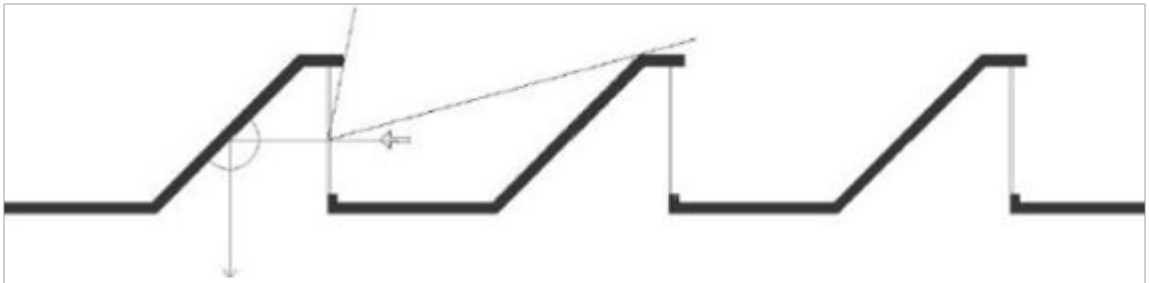

Fig. 1.2 b Captator vertical și reflector la 45 grade

Unlike the luminary solution, this solution has a greater impact on structures image or exterior building, whereas the reflector item is depicted with respect to its volume, fact that affects the entire design.

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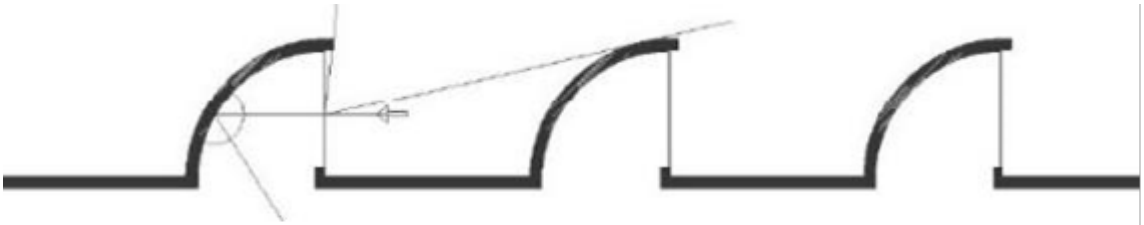

Fig. 1.2 c Captator vertical şi reflector cilindric

Constructive options that may be used in this branch are represented lower in page:

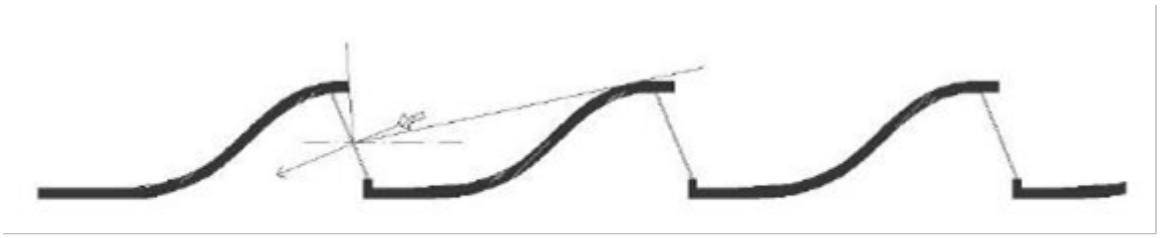

Fig. 1.2 d Captator înclinat şi reflector curbat

The verticality or tilt of the catcher which can consist of glass or another transparent or partially transparent material letting the light pass through, influence the way light enters inside, and also plane or curved geometry of the reflector further determines the way light spreads in whole space that is to be illuminated.

Fig.1.2 e Captator înclinat şi reflector puţin înclinat

Knowing the basic principles of light passing through different mediums, catchers and reflectors can be designed to answer to any demands. So, a relatively total illumination or a local one, focused on the points of interest can be obtained. This solution has been frequently used for museums, the coverage becoming an attractive element from an aesthetic point of view in the case of metro station illumination.

2.3 The case of vertical plane intake

The Vertical intake can be mainly useful if we take into account the fact that the direct sun light as well as light reflected by the water surface can be captured. Currently the solution is possible due to materials with special qualities and proprieties which permit the mounting of such systems at reasonable prices. When the volume permits an opening of small dimensions to the outside, implying that it is not fully covered, using this opening is preferred for introducing light, thus obtaining a light-flushed ceiling effect. A very efficient way is the french system used to illuminate the parts farthest from the windows in an ample room, which implies the placement of an exterior concave curved reflector, to which on the upper part the inclined catcher is placed. A control of the mode in which the light passes through to the interior is thusly obtained.

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2.4 Atriums and light-shafts

This is a solution which not only has a light gain but a visual gain as well, being often utilized in public structures. These not only permit the passing of light at great depths but they can also direct it through the geometry of its lining, or through the materials being used (which, for increased efficiency must be reflective or have bright colors). Atriums with dark color wooden walls absorb light, and another effect is obtained by finishing the walls with white porcelain ceramic which reflects it. This solution is useful for illuminating enclosed spaces on-board ships if the castle, machinery and the surface usage permit the placement of these systems. Where it is possible, sufficiently large openings can be proposed, so that light that gets into the atrium is sufficient for creating an optimal visual comfort.

2.5 Vault lights

Vault lights are a great solution which would revolutionize the atmosphere and lifestyle on-board. A outstanding example of building using vault light principle is the Penn metro station of New York (fig 2.5 a). In this case, the glazing ceiling light all the ground floor of the metro station, while floor mounted systems of prisms at first storey, steer the light to metro platforms.

Fig. 2.5 a Statia Penn New York

If we make an effort and extrapolate the image from fig.2.5 a, of the metro station over the image of the engine room on-board the ship, obviously smaller but with large height placement, we can be sure that the crew would be delighted by such work conditions.

Also, if we take into consideration the current timetable from 8-17, the rest of free hours being substitute by automated surveillance and functioning systems, then we can consider that we entered a new era of maritime transport.

At the base of the vault light solution are glass prisms which are being used for introducing natural light in enclosed spaces by reflection and refraction. The brightness is impressive, visible in other

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Fig. 2.5 b Stația de metrou „18th Street", New York, construită în 1905

New York as well a station (Fig.1.5 b). This method has suffered changes both in functional performance evolution and also in the realization one. Initially, glass parts were mounted in metal framings to which conformation has been modified to reduce the slipping risk for moving workers and also the breaking risk. So, the first method consisted of a metal frame that covered the perimeter of glass, and subsequently the metal piece totally covering the glass but having small ports for letting the light pass and protecting the glass from the men who walks on it. Nowadays technology and materials in market offers us greater mounting possibilities.

Prismatic tiles

How we can observe from fig.2.6, prismatic tiles usage is much more complex due to its realization of complex form. In this case, by using specially shaped glass, which can both permit the light to pass and also redirect it to darker areas. This superior quality, by using small constructed surfaces of tilts, helps to light a greater interior area with natural illumination. This method can be improved by using adequate geometric shapes that are able to catch the light reflected by the water. Hence, the captured light may have a better use when the position of the sun and the directions would generate obscurities.

CONCLUSIONS

These low tech technologies, especially glass prisms, even though they are not used those days due to artificial illumination, they can be a source of inspiration for architects and ship builders as possible solutions of natural illumination during the sunny part of the day;

Currently modern materials with superior optical and mechanical properties adequate for this purpose can be used. We can evaluate these possible effects from the images of the New York metro stations, presented above, which show that the aesthetic and functional effect is very useful and practical;

If we take into consideration the superior qualities of modern day rubber and plastic, mounting systems of prisms in elastic framings with very good seals and thermal and phonic isolation;

The qualities of see-through materials and the current technology performance permit the production in profitable conditions of prisms with outstanding geometrical forms and great optical qualities;

Typing and standardization of such, "windows'' could further optimize these solutions, currently considered by some people as utopian;

We must not neglect the aspects of surface design using catchers of different geometrical forms, adequately placed;

It is hard for the crew members to conceive and believe that going down into the engine room they could find an atmosphere similar to the images presented in pictures 2.5 a and 2.5 b, although a strategic approach from more complex angles the solution would no longer be a utopia, as it is considered simplistically now;

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