STRATEGIES FOR REFORMING BUILDINGS ROOFS IMPROVING THE EFFICIENCY AND AESTHETICS (CASE STUDY: SAMEN MUNICIPALITY OF MASHHAD)

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Abstract- Roof is known as the fifth facade after four main facades of the building and comes to a high percentage of the total area which covers the city. Roof has been part of the living space in Iran architecture but today, for some reasons which mainly are the result of lifestyle changes, not only they do not have the productivity and efficiency of their past but also they have caused confusion in city landscape. This research has investigated roofs of Samen district in Mashhad from the reforming view through the survey method. The study area was divided into tiny zones by defining criteria such as the importance of buildings that are constructed after approval of the detailed plan. Some items such as allocating large areas of the roof to installations, lack of coverage for installations that are on the roof, dispersion of installations, lack of facades for surrounding walls of roof, placement of additional equipments on roof and visibility of roof Installations and equipments from the street had important role in roof's confusion according to the survey. Also some items such as preparing an architectural plan for roofs, assemblage of roof installations, covering the installations by plates or masonry materials were seen as effective items in roof reforming. As a result items such as considering incentives and fines, preparing an architectural plan for roofs as well as planning for it, urban and architectural rules codification for roofs and supervision on roof's construction by proctor organizations were identified as reforming strategies of future roofs.

Index Terms- Aesthetics, Building roof, Efficiency, Reform

I. INTRODUCTION

Landscape Architect Diane Balmori has repurposed the term "Fifth Façade" to describe the landscape potential of the urban roof-scape. The term, which began appearing in the middle of the 20th Century to describe the architectural potential of roofs, is now a descriptor of the green potential of the roofs. Just as the vertical facades of a building are a shared public surface in a densely urban environment, the roof-scape is also shared. The concern is not merely aesthetic, although a beautifully landscaped roof is certainly preferable to a hot bubbling black tar surface [1]. Roof which is known as the fifth facade after four main facades of the building (north, south, east and west facades) is one of the most important parts of the building [2].

This surface of the building includes a high percentage of the total area which covers the city [3] and naturally absorbs large amount of energy requirements of buildings [2]. On the other hand roof has been of the earliest stages of the emergence of architecture in human life and has noticeable evolution. In addition to it's primary tasks such as protecting role and determining the scope of possession, it has gradually taken the task of expressing identity, beautifying the urban environment and many cultural functions [4]. Also roofs Play an important role in shaping the urban landscape and with vertical urban growth, what is seen from the buildings upstream as urban landscape, is roof's facade.

II. PROBLEM DISCUSS

Nowadays roofs are forgotten or have been converted to stores for equipments and this issue results to inelegant appearance of the city skyline and loss of energy [2] while gray roofs include high percentage of the total area of the city and in contemporary cities where the increase in land prices and lack of open space has become a problem, the practical use of roofs can be considered as a way to enhance the optimal utilization of urban lands [3].

III. SUBJECT BACKGROUND (ROOF IN IRAN ANCIENT ARCHITECTURE)

Vernacular roofs in Iran that were built around 200 years ago, served more than shelter. Iran is a vast country, which the geographical and cultural characteristics of it caused creating diverse architecture designs [5, 6]. Iranian vernacular roofs were built according to the climate and they provided comfort for residents [7].In the past, the type and shape of the roof was elected due to region climate in Iran. For example, in the north of the country due to abundant rainfall, sloped roofs were used or well-designed arched roofs with ventilation cap at the top were proper choices for the hot and dry climate [8, 9]

so domed and vaulted roofs were used in the vernacular residential buildings due to their thermal performance [10, 11]. Always during the past, roof specific functions and capabilities to meet the needs of families was emphasized by Iranian architects. Research about Iran ancient architecture shows that roofs had functional role and were live and dynamic in addition to adjusting the interior temperature [2].

For example, roof in Iran architecture, has been part of living space and in addition to the complex and beautiful volumes, it has been used as yard sometimes. In the past in some cities a courtyard on the roof was created through raising the roof's surrounding walls up to about a meter and a half and this courtyard provided open spaces for physical activities of residents in summer [12] and was used for sleep in summer nights. Also these walls had the secondary effect of climate by shading on the part of the roof at different times of the day. In many old houses in Iran the roof was considered beyond a roof and a barrier against sunshine and rain.

The roofs were considered as living spaces with the particular functions. Residents slept on the roofs at night and watched the stars in summers in order to enjoy the cool weather and breeze. Some residents kept and bred pigeons on the roofs as a hobby. Furthermore, flat roofs provided possibility of observing the city, passage and neighbor communication. Roofs were places for holding rituals and religious ceremonies. People could watch the ceremonies on the roofs. Moreover, the vernacular roofs provided interaction of people with the environment and natural resources. People used the roofs for sun drying purposes. They dried their washed clothes, fruits and vegetables on the roofs. Additionally, residents did economic activities on the roofs such as producing dried fruits for sale [7]. In traditional Islamic cities, ceilings and roofs of houses was as porch and flat surface which formed suspended streets to go from house to another house [14]. In the Iranian city of Isfahan, interconnected roofs of houses are a symbol of mutual trust and solidarity between neighbors [15].

Also in many Iranian old houses by setback and gradual reduction of each floor's area than lower floor, not only part of the each floor's roof functioned such as a small and limited yard for upper floor, it could also be considered as access route in some parts of the house [2].

High and netted parapets of Bushehr old roofs preserved wide areas of roof and alley from sunshine as well as passing night breeze through itself because of its netted surface and prepared space away from the winds of the night to sleep at night [16]. Unlike contemporary homes in traditional roofs the flow of life could be seen since the residents spent hours of their day on the roof. Because of this quality, height of roof parapet should have been higher to appear as an element for limiting visibility and creating peace for residents.

IV. ROOFS PRESENT STATUS

There are some cultural factors affected by lifestyle changes as well as technical factors which affect the roof formation. lack of practical usage of roof as before and lack of attention to it by owners, condominium ownership of the building's roof which causes less inclination to the maintenance of it, no financial benefit of roof compared to other spaces of a building, privacy loss and reduction the level of confidentiality in living environment, illogical building's orientation against each other and reduction the level of engagement between building occupants are among cultural factors and difficult access to the roof specially in projects without elevator, need to be established where they directly expose to air in some units (such as chillier and cooling tower and …) and need to be in height in some facilities (such as water storage tank for firefighting and …) are among technical factors.

All of the above lead to the confusion of roofs in cities and neglect to urban rules for offering guidelines about roof reforming, lack of proctor organizations for supervision the quality of construction on the roof, lack of proper incentives and fines for this issue has lead extra confusion.

V. AIMS OF ROOF REFORMING

investigations shows that nowadays roofs are useless spaces that their only function is protecting of lower floors from rainfall and unlike lateral facades has least variety, the place where is the location of air conditioners, antennas, and the chimneys. Lack of usage for roof has changed it to dead space. If the installations and equipments on the roof be assembled or organized on roof and the use of roof's space become common, undeniable impact on improving the urban landscape will be obtained and the roof will become useful space [3].

Since development and rational distribution of urban green space specially in city centers in a way that is commensurate to urban construction, is one of the major challenges of contemporary metropolises and the expansion of urban green spaces compared to other investments has less financial support [18], changing the roofs into green roof would be suitable option to increase urban green space. Green roof in an urban environment where available land space is limited creates stable surface for implementing reduction

urban heat islands strategies. Green roofs not only have functions such as making the city beautiful and exhilarate elimination of urban pollution and reducing mental stress but also are effective in exchanging energy and heat from outside to inside spaces. This technology is an attempt to make cities sustainable by reducing heating and cooling load, air conditioning, protecting from sewage, reducing noise pollution and reducing energy consumption. Green roofs provide pleasant environment by cooling and shading feature and can develop urban open space for public recreation [20].

So the aim of roof reforming is to return intelligent and rational capacities of roof in modern times and the current architecture of buildings with these two approaches: reforming roof's installations and equipments and creating green roof.

VI. MATERIALS AND METHODS

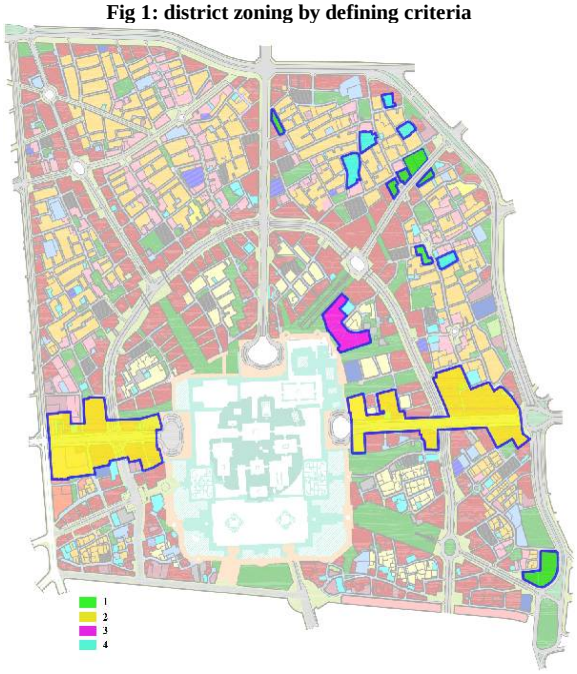
This study was conducted in the Samen municipality of Mashhad. This region of Mashhad's thirteen municipality regions has urban decade and limited construction has been done recently. Due to the very high value of land in this area of the city and investors' desire to maximize the use of land for construction, open and green space of the ground level has decreased. Also public green spaces are limited and insufficient and sometimes these spaces have been sold to investors by the municipality for economic reasons.

In Samen Detailed plan open and green public space is low and urban spaces are predicted compact and dense. All these factors led to the selection of this region as the case study. Samen region is approximately 360 hectares which is limited to Azadi street from northwest and Andarzgoo street from southwest and Seventeen shahrivar boulevard from southeast, Vahdat boulevard from north and Shahid Kave boulevard from east. This region is the special operations plan region where is defined as one of the special cores of city center in physical structure of Mashhad.
In Samen improvement and renovation detailed plan which was approved in 1387 by authorities, this region was divided into four section by three main axis (Shirazi, Navab Safavi and Tabarsi streets). Construction rules are different in terms of usage, occupation level and density due to the location of the project in the mentioned divisions. Because of the Samen's large area and distribution of new buildings, the region was divided into smaller zones by defining criteria in order to investigate roof's confusion:

1. The importance of buildindgs that have been buit according to approved detailde plan: here the term important buildings include buildings that are higher or larger or with residential or commercial or mix usage.

2. Importance of main streets: in study region, three main streets that end to Holy shrine are Navab Safavi, Shirazi and Tabarsi streets. So the biuldings around them are important.

Fig 1: district zoning by defining criteria



3. Mass of built regions: it includes regions in which more buildings has been built after detailed plan approva.
4. Collaborative projects with manucipality
According to above criteria, Samen district was divided into smaller zones (fig 1) and surveys were done in those areas.
Overall twenty- two survey from roofs was done. Most of the buildings had residential, commercial or residential commercial usage. The aim of surveys was to investigate confusion within the roof and from the perspective of dominant projects to roof as well as from the perspective of street and urban landscape. Effective factors on reforming some roofs were also noted. Also according to the area of the roof of each project, the percentage of installations in rooftop and percentage assigned to the stair box and lift cabin (vertical elements of the building) was estimated relative to the total area of roof.

VII. RESULTS AND DISCUSSION

In surveys, following confusions on roofs were identified:
1. Allocating large surface area of the roof to installations: main installations which are on the roof are air conditioners, cooling towers, exhaust fans, vents, chillers, water tanks of firefighting, expansion

tanks and water coolers. The establishment of some facilities on roof is inevitable but unnecessary items such as utility room on roof was seen in surveys. It is worth noting that the building usage and its area is effective in the type of installations they need (Fig 2). In large projects or projects with residential, commercial or mixed-use residential use, the installations would be more and larger and will occupy greater area (about 40% of roof area) and in smaller projects or with dwelling usage the installations would be smaller and occupy smaller area (about 15% of roof area)

Fig 2: numerous installations on roof



2. Lack of installation coverage: In present status, installations on the roof have affected main building's facade as well as city perspective. According to survey in most projects, no attempt for covering the roof equipments and facilities is done.
3. Distribution of installations layout on roof: Dispersion of Installations on roof is one of the items that has led to confusion. This lead to restrictions for using the remaining space of the roof.
4. Lack of facade for roof's surrounding walls (Fig 3)

Fig3: lack of façade



5. Placement of extra equipments on roof: Establishment of additional equipments on the roof and considering it as a warehouse was observed in surveys.

Fig 4: placement of extra equipment



6. Roof installations and equipment visibility from the streets

Also the following items have been effective on the achievement of roof's reforming according to surveys:
1. Initial planning for the roof space and preparing architectural roof plan: according to surveys two projects due to preparing roof plan had desirable space and quality on roof (Fig 5)

Fig 5: preparing roof plan



2. Installations assemblage in order to release the roof space for effective utilization of that.
3. Covering the installations and channels by covering plates or masonry

CONCLUSION

According to this research the following items about roof refoming would be effective:
1. Considering incentieves: right now there is no incentive for buildings' roof reforming and landscaping. It was seen in surveys that in some buildings allocating a part of roof to profitable usage such as restaurant, has led to roof design and landscaping. So it is recommended that allocating profitable usage for reformed roofs be permitted.
2. Considering fines: considering fines about buildings which their roof confusion led to increasing visual disturbances in urban perppective, would be inhibiting factors in reducing or eliminating confusion.
3. Initial planning and prepare a plan for roof: major confusion of roofs is due to lack of planning for landscaping and usage of roof.
4. Rules Codification about roof design and performance: most of the confusion items will be eliminated by considering urban and architectural

rules. For example following items can be considered in rules codification:

- Due to lack of green space Capitation in Samen region, green roof construction is obligatory.
- The maximum area assigned to the installations on the roof considering the building usage (dwelling or residential commercial) should be limited in rules. The suggestion is 10% for dwelling usage and 40% for residential commercial usage.
- Utility room construction and the establishment of extra installations on roof should be banned.
- Coverage of installations with suitable covering plates should be necessary.
- Installations's assemblage and preventing of their dispersion as much as possible in order to prevent space loss on roof and utilizing the roof space should be considered.
- Roof's installations should be located in places that are not observable from the street.
- In order to reduce the visibility of the installations from the street or adjacent roofs, parapet height should be increased to acceptable hight.
- Roof's surrounding walls should be coverd by suitable materials especially white materials which have lower energy absorbtion.

5. Supervision on roofs' reforming: In order to avoid confusion on rooftops, in various stages of construction and exploitation, supervision by proctor organizations (including municipalities) should take place.

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