

сосны до 30–40 %) на ППП в регионе Среднего Урала в 1993 г. после обильного снегопада в конце мая (Менщиков и др., 1997). Этот факт подтверждают данные по динамике состояния древостоев на ППП в Рефтинско-Асбестовском районе. Через

два года ситуация на ППП опять стабилизировалась, и динамика жизненного состояния древостоев вернулась к прежнему уровню.

Таким образом, приведенные данные свидетельствуют о значительном ухудшении состояния лесов под воздействием

аэротехногенного загрязнения в неблагоприятные по климатическим условиям периоды. Устойчивость лесов к выбросам в это время снижается. В такие периоды, как правило, проявляется эффект так называемого «накопленного воздействия».

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GREENING OF LOWER SURFACES OF URBAN CONSTRUCTIONS (ОЗЕЛЕНЕНИЕ НИЖНИХ ПОВЕРХНОСТЕЙ ГОРОДСКИХ СООРУЖЕНИЙ)

Cities are three-dimensional systems. Nowadays, we use mainly illuminated by the sun vertical surfaces for landscaping. Large effective area for landscaping is not applied. Inverted landscaping can change that situation. Appropriateness of inverted technique is well supported by calculations of potential areas of landscaping on not vertical or shaded sites.

Города являются трехмерными системами. В настоящее время для озеленения используются преимущественно освещаемые солнцем горизонтальные поверхности. Большие площади, пригодные для озеленения, не используются. Это поверхности, обращенные вниз, к земле. Перевернутое (инвертированное) озеленение способно изменить ситуацию. Целесообразность применения этого метода озеленения подтверждается расчетами доступной площади.

Introduction

Urban construction of any type provide a lot of utility area for many purposes. The area of the cities is limited. If there is a need

to add an element, it can be done in different ways. It is possible to cut down other objects or to remove some of them. Therefore, if we reduce, for example, the area of

lawns for carriageway expansion, efficiency of transport system will increase, but the ecological condition on the transformed site can be worsen considerably. Other option

is using new levels, up or down. Skyscrapers, multi-level parking, tunnels, bridges have large area, which is inconvenient for using on floors lower surfaces.

Inverted plants' benefits

There is an opportunity to use multi-level objects for providing the city with gardening. Thus, plants can be placed on a reverse side of occupied sites, which is under them. Use of this reception is limited, but the advantage of it can be considerable.

It is known, that the plant reaches in the direction of light source. Thus, roots develop in an opposite direction. Plants have to be close to surface edge of multilevel construction to receive a diffused light.

Some advantages of this landscaping method are:

- Good appearance of plant band along the floor or wall edge;
- An opportunity to place a lot of plants on sites where is no free

space for standard landscaping approach;

- Inverted plants and vertical gardens are quite simple way of environment ecological improvement;

- Plant protection from human impact by reducing physical contact with plants and tree trunk sites

Complexity of the application of technology

Inverted plants, as usual ones, require water and nutrients. There is a risk of drying or lack of nutrients while planting technology is not tested in different conditions. Anyway, it takes load calculations for provide construction safety.

Other requirement refers to light intensity. Shade-enduring plants well develop at illumination 500-800 lux. It is possible to observe such indicators at distance about 2 meters from an aperture. Using of illumination allow to use all suitable area (fig. 1).

Unfortunately, lighting is not a single problem of inverted landscaping. It takes water to plants growing. It is not difficult to create a special irrigation system for plants from the technical point of view. That is so expensive. Rainwater in cities may contain too many pollutants when it washes dust from buildings and pavements. Theoretically, there are at least two possible ways of water providing: using tap water or creating watersheds that do not collect water from pavements.

Calculations

In a pair of round-drives of a five-floor parking with an open top floor can be located about 1810 square meters of green plantings in case the external radius of round drives will be equal 25 meters (Irmscher, 2013).

Available area can increased, without resorting to artificial lighting if to use light coverings and

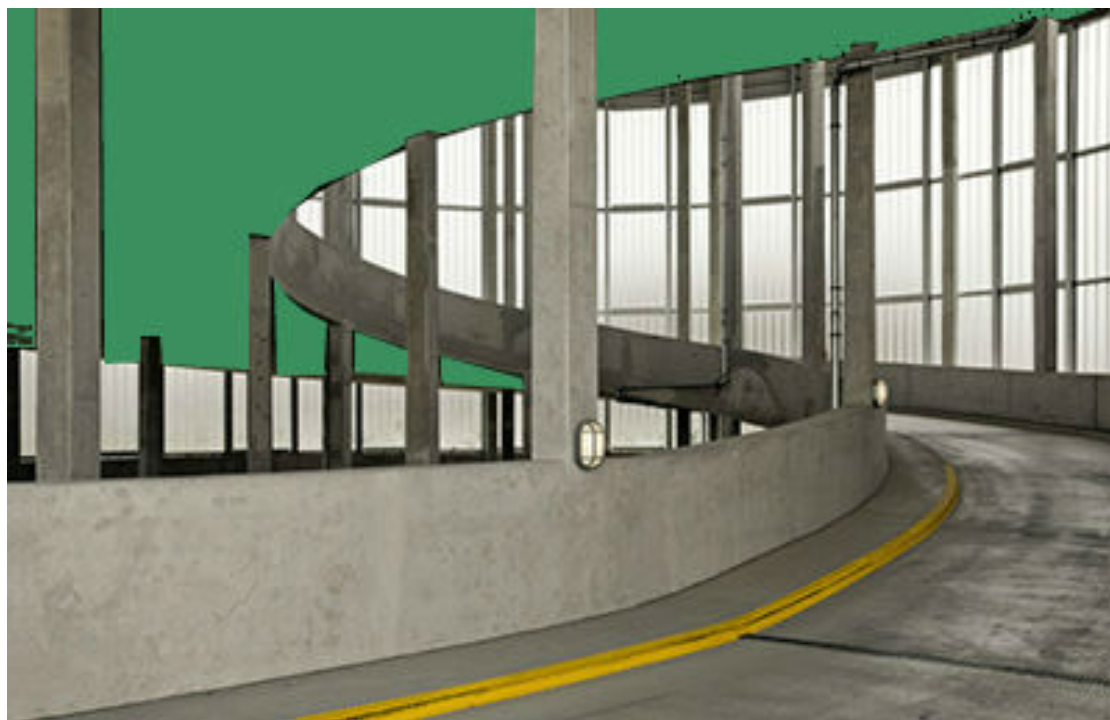


Fig. 1. Useful area of multi-level parking.

reflecting light. The reflection coefficient of asphalt is about 0.07, and light-gray concrete is 0.6 (Karlen, 2007). The useful area thus will increase. Use of illumination will allow using all area of a parking. Total area will depend on the sizes of the main unit of a construction. So, when using ceilings on four floors and drives on three floors, the parking on 700 places will contain nearly 9500 square meters of plants. Such quantity can suffice for gardening of a small street or a square.

Conclusions

The technology of considered gardening type creation is similar to cultivation on vertical surfaces. Distinctions are only in system of support of plants. Patrick Blanc

created a set of vertical compositions (fig. 2) with polyamide felt, which has a number of merits (Blanc, 2008).

Proceeding from the aforesaid, it is possible to draw the following conclusions:

- large area is available to the inverted plants;
- multilevel constructions are capable to contain more greening, than streets at the same area in a horizontal projection;
- there are the available technologies which are necessary for creation of inverted systems of gardening.

As practice shows, interior and garden plants, grow well in the turned condition. Therefore, further work on this subject should be direct on selection of the plants

suitable for street gardening in different climatic and ecological conditions.

There are many unoccupied and appropriate constructions for greening in cities. Inverted systems have a great potential. That technology can be also used in horticulture because of considerable space saving. Other advantage is no need to use light reflectors, which loose part of energy that can be noticeably for large growing volume.

It is necessary to develop a support system for large plants and to conduct experiments before wide application of the technique.

Using walls and floors for growing is the great way to improve the environment (Korson-Knowels, 2012), and it is logically to expand to new spaces.



Fig. 2. Vertical garden by Patrick Blanc.

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