Case study on road landscape restoration of the underground commercial street

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Abstract. In recent years, with the intensive commercial activities in cities, the underground commercial area has developed promptly. The underground commercial street, with the intention of solving the urban field, results in negative affects to the urban landscapes. For example, the underground commercial area on Jiefang road, Linfen City is used in this paper. The project overview and present situation of its landscape, principal of its restoration, design and cost estimation, are analyzed in detail. As a whole, the paper summarizes the significance of underground landscape restoration, in a commercial area, and any issues or problems that one should be attentive to in the process of development.

1. Introduction
Due to the rise of urbanization, commercial activities have not only become more intensive, but also has led to an increasing urgent demand for land. As for the development of underground area, especially in commercial compact districts, the construction of underground commercial area is an effective way to completely utilize land resources, shape urban three-dimensional areas, and integrate commercial resources. In context, these areas are built in large scale across the country. Most, in which, are located in urban core business districts. While there is traffic congestion on ground level, its peripheral business environment is mature. This causes various elements; such as transportation, urban planning, surrounding constructions, municipal pipeline, landscape planting, and civil air defense facilities; to be taken into consideration during its development. The restoration process is an important part of urban landscape that effects resident’s well-being and, evidentially, the economic profit.

2. The situation of the underground commercial area on JieFang road, LinFen City.

2.1. Development situation

![Figure 1. Plan of the landscape restoration project](image-url)
2.1.1 Project overview. The underground commercial area is located in Jiefang road, Linfen which is part of the heartland in Yaodou District, Linfen City. It is one of the most developed streets in Linfen, which interconnects the square blocks as well as the business circle. It also connects important commercial buildings. Meanwhile, Jiefang road is also the east-west traffic artery in the center of the city. The traffic median and green belt occupy a significant role in the road, due to urban expansion. It causes the existing land resources on the ground unable to meet the needs of urban development. This greatly limits the amount of land resources, alleviates traffic pressure on the ground, and develops commercial activities. The underground commercial street is located on the 1st floor of Jiefang road. It is 1500 m and covers 72200 ㎡, which contains a three hundred and sixty space parking lot and a commercial street. The underground passage of this project adopts the basic form of shops on both sides, and dual carriageway in the middle, that serves for commercial, catering, office management, customer service, equipment rooms, etc. There are eleven underground street passage and forty one emergency exits up to ground level. Two, of which, are designated for vehicles. Because Pingyang square is designed to support large excavation, the air shaft of the gateway will damage the existing road paving and greening.

2.1.2 The present situation of the landscape planting. Jiefang road, located in the downtown area, is one of the most prosperous commercial street in Linfen city and the main east-west thoroughfare for downtown traffic. There are no zoning in the middle of the road now, while green zonation of a square with side length 1.2m on both sides, the platanus are luxuriant inside with a diameter of 20-35 cm. Each tree pool is 6-10 meters apart from another, the yellow earth appears in the tree pool with no green covered, and hard granite lays outside the tree pool. The surrounding landscaping is with green shrubs (Dickinson privet, lobular boxwood), shrub balls and sparse Chinese pagoda trees, with large areas of hard surface in Pingyang square.

2.2. Status analysis.
Currently, the oriental plane with long historical and distinctive features grows well on the side of Jiefang road. During the summer, since it’s hot, pedestrians walking in the shade of trees can feel much cooler, and the motor vehicles and non-motorized lanes are isolated by the tree pool. However, since there is nothing else but platanus and hard surfaces on the sides, the function of median for the motor vehicles or non-motorized lanes are much weaker. Therefore, the pedestrians are less safeguarded with the flimsy median. The median placed, consisting of virgin soil, should be reclaimed to plant more green trees, increasing the quantity of landscaping as much as possible in order to build the green channel on Jiefang road and create an ecological corridor. The current landscape of Pingyang square is relatively regular and monotonous, lacking of regional features. There is also a wide area of hard pavement with dull colors, lacking aesthetic feeling. The framed flower bed is not so well-arranged, the landscaping is mainly the shrubs nearly with tall evergreen trees, people have to walk the birds and play chess and card in the sun.

3. Landscape greening restoration design of underground commercial street Jiefang road, Linfen city.
3.1. The design principles of restoration

Protecting the existing trees of platanus and ancient trees as much as possible, preserves the virgin soil and allows for the growth of more green trees. In addition to this, the design of underground entrance and exit should be combined with a vertical afforestation to ensure ecological benefits. The landmark and design of the curb are supposed to be geographical and temporal which allows the construction and maintenance management to be able to walk along both lines.

3.2. The restoration plan

3.2.1 Design of landscape and afforestation restoration. As for the afforestation restoration program, protecting the existing platanus by raising the curb up 10 cm to 15 cm, reducing the loss of rainwater supply, planting more lower bushes, and increasing the area of afforestation are necessary, is essential to isolate the motor vehicle and non-motor vehicle lanes. Protective measures should be taken before construction to protect the platanus in underground facilities. Transplanting the nursery stock to suitable places in advance, is necessary in case of any damages when the construction of the underground tunnel entrances are started. The nursery stock can be reattached when the construction is over. Shade-tolerance evergreen shrubs; such as boxwood, ligustrum japonicum 'howardii'; should be planted by the rear green-belt pool besides the platanus. A variety should be used in order to make it more colorful and diverse. As for the pedestrian entrance, roses can be placed vertically for an appealing visual effect.

The proposed Pingyang square displays the original design, retaining the basic functions, combined with updated engineering and uses the curve of dynamic composition to reflect the longevity in structure showing its natural perennial. The square forms a circular green shape, which will be divided by a number planted tall trees to provide a shaded premises. The native tree species; for example, locust tree, tree of heaven, elm, golden rain tree, hackberry, ginkgo; and those flowering, colored-leaf species; such as purple-leaf plum, midget crabapple, magnolia soulangeana soul, clove, crape myrtle, etc.; allows for blooming throughout all four seasons year-round.

3.2.2 Pavement design. Permeable bricks are used to cover the soil as a pavement design. Different colors of bricks will be used to differentiate parts in order to enhance the sense of sequence and form a concise and lively atmosphere.

3.2.3 Public facilities design. Jiefang road, in Pingyang square, is the most prosperous part of the city due to the amount of traffic, public facilities (trash bins, street lamps, metope adornment of the barricade, benches, and metope adornment of the underground entrance) which is a regional characteristic in Linfen. Applying elements of its regional culture to the design of these facilities’ design, Linfen shows its historical infrastructure with modern technical influences.

3.3. Cost estimation

Table 1. Investment estimation table.

| No. | Event            | Unit | Quantity | Unit-price/yuan | Total amount /thousands yuan | Notes       |
|-----|------------------|------|----------|-----------------|------------------------------|-------------|
| 1   | side green belt  | m²   | 2789     | 30              | 8.3670                       | Jiefang road|
| 2   | Curb             | m    | 3718     | 150             | 557.7                        | Jiefang road|
The landscape greening restoration project of the underground commercial street of Jiefang road in Linfen city includes the contents of landscape and greening, with a total project budget of about 10.54137 million yuan. The cost for landscape greening restoration of Pingyang square, with a budget of about 9 million yuan, consumes the majority of costs. This 9 million yuan accounts for 85.4% of the total investment. Pingyang square is the core node of the underground commercial street, due to it being the most densely populated and commercial area. As the focal point of the city, it deserves the highest cost for recovery. The curb will be produced by placing optimal spacers made out of polished gray granite. Each will be spaced out by three meters, to add primitive features to the design of the road. The cost of curb is 557.7 thousand yuan, which accounts for 5.3% of the total investment and the hard paving materials of pavement costs 900 thousands yuan, 8.5% of the total investment. It mainly consists of the dark red permeable brick and the local granite used in orderly division, which is interspersed with characteristic reliefs to spiritually serve the community. The planting cost of rear green belts are about 300 thousands yuan, and the proportion is the smallest (about 0.8%).

4. Conclusion

Jiefang road’s underground commercial street restoration project in Linfen, increases the road greening area, improves the environment of urban business district, and promotes the effect of landscape and cultural taste. The design promotes socialization, which is convenient for people to chat, rest, and obtain an enjoyable experience. This underground commercial street is significant to urbanization and contributes to the development and utilities of the area. The greening landscape restoration should follow customary principles of local people, streets, pavement, and public facilities. In terms of ecological recovery, procedures should be followed to protect the original mature green vegetation which will gain support to the construction of new green environment. This will also reduce the noise through afforestation and environment pollution. With this, the landscape greening restoration must be combined with the original urban features, making good use of techniques to protect the traditional features and combine traditions with the modern techniques. Overall, the construction of this urban underground commercial street covers a range of subjects and organizations. This means that the traffic, commercial layout, underground design, municipal pipeline, and distribution format are closely coordinated together to achieve the objective of the underground commercial street.

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