RELOCATION DESIGN OF POWER LINE AND UTILITY POLE FOR LANDSCAPE IMPROVEMENT

KAZUNOSUKE IKENO¹, TAKASHI KOSHIBA², YU SHIMOJO³, HIROKI MICHIDA⁴, HIROYUKI FUKUMOTO⁵ and TOMOHIRO FUKUDA⁶

¹-5 Hyogo Prefectural Kakogawa Higashi High School, Kakogawa, Hyogo, Japan
¹ ecle_orangelo_1203@yahoo.co.jp, ² tj94mp@bma.biglobe.ne.jp, ³ jkyts_shimojo@ares.eonet.ne.jp, ⁴ trumpetpianogarireo@yahoo.co.jp, ⁵ hiromikanatsu@ybb.ne.jp
⁶ Osaka University, Suita, Osaka, Japan
fukuda@see.eng.osaka-u.ac.jp

1. Introduction

In Japan, utility pole and power line removal projects are being conducted, but they have only a 1.9% progression rate nationally, which is very low (Oishi, 2012). The projects are time consuming and have some problems of cost and technology. Therefore, this research presents to improve the landscape of local roads by relocation design of power lines and utility poles.

2. Method and Result

We defined indices of landscape improvement as enhancing "amenity" and "spatiality". We designed four models of power line and utility pole arrangement as follows: Model A is a current situation of local road. Utility poles are set up to both sides, and power lines hang overhead along and across the road. Model B is to rewire only along the road. This idea enhances "spatiality" because no power lines cross the road. Model C is a model that has roadside trees between each utility pole. This idea makes utility poles less noticeable and enhances "amenity" by increasing green space. Model D is a model in which utility poles are set up to one side at the street. This idea enhances "spatiality", because power lines are eliminated on the other side. In this research, we executed an impression evaluation experiment by developing a large marker AR (Augmented Reality) system including the four 3D
virtual models (Yabuki, 2011), and using them as objects of evaluation (Figure 1 left). 51 respondents were 18 teachers and 33 students from Hyogo Prefectural Kakogawa Higashi High School (27 males and 24 females). We executed the experiment in December 2013. Evaluation indices were shown as below. Evaluation was set on a five-point rating scale (1-5pt).

- **Amenity**: "beautiful/not beautiful", "comfortable/uncomfortable"
- **Spatiality**: "good/bad atmosphere", "spacious/oppressive", "clear/squalid"
- **General spatial indices**: "want to walk/don’t want to walk", "quiet/unquiet"

We analysed to compare each proposed model to the current situation. As a result, the average total evaluation point, values for models B, C, and D is higher than that of model A across all the indices (Figure 1 right). Through t-test, as for model B, "good atmosphere" and "spacious" are significantly different (p<0.01). This model has a useful role in enhancing "patiality". As for model C, all the indices except for "spacious" are significantly different. (p<0.0001) This model has a great effect on enhancing "amenity". It doesn’t, however, enhance "spatiality." This is because there are many power lines overhead and the roadside trees crowd the landscape. As for model D, all the indices are significantly different (p<0.0001). It affects all the indices. This model enhances "amenity" and "spatiality" greatly.

![Figure 1. Four AR models (left) and average impression evaluation points (right).](image)

### 3. Conclusion

Through the experiment by using AR system, the effectiveness of proposed design models were validated: Planting trees between utility poles and placing utility poles on only one side of a road both improve our "amenity" standards. Changing power line system design and placing utility poles on only one side of a road make roads more spatially appealing.

### References
