Evaluation on the Damping Performance of the Polymer Concrete by Using Pipe Structure

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Abstract

Noise of parking lot ramp section is emerging as a major problem of house area Because the quality of life has recently increased. As a result, people became sensitive to noise. Rolling noise is caused by the vibration of the rail and wheel. Therefore it is necessary for residents to solve stress from noise. The strength and vibration damping performance of polymer concrete is higher than that of cement concrete. And it is widely used as a building material. In addition, various reinforcement materials have been studied to expand for application field of polymer concrete. This was studied dynamic vibration of polymer concrete by impact damper of pipe. Polymer concrete is made of epoxy binders and aggregates, Polymer concrete was reinforced with acrylic pipe. The amount of epoxy binders used was reduced by up to 30% by pipe reinforcement. A pipe-type impact damper was built by inserting a collision particle inside the acrylic pipe. The dynamic properties of impact damper polymer concrete were measured by using beam transfer function method. the vibration response was measured by the accelerometer after the end of the polymer concrete beam has been placed with an impact hammer.

As a result of the measurement, the loss factor of polymer concrete was about 0.03 due to the insertion of the impact damper, which is about 4 times higher than that of cement concrete.

Keywords: polymer concrete, damping performance, impact damper, dynamic vibration

1. Introduction

Noise of parking lot ramp section is emerging as a major problem of house area Because the quality of life has recently increased. As a result, people became sensitive to noise. Rolling noise is caused by the vibration of the rail and wheel. Therefore it is necessary for residents to solve stress from noise. The strength and vibration damping performance of polymer concrete is higher than that of cement concrete. And it is widely used as a building material. In addition, various reinforcement materials have been studied to expand for application field of polymer concrete. This was studied dynamic vibration of polymer concrete by impact damper of pipe.Besides, one of characteristic of concrete is its low damping capacity. Polymer concrete is one of the concrete developed to improve the damping performance. The purpose of this study is to improve the damping performance of polymer concrete. The polymer concrete consisted of epoxy monomer, hardener and aggregates. To improve damping

characteristics of polymer concrete, acryl pipe structure was inserted in the polymer concrete. A transfer function method was imposed to measure the dynamic stiffness and loss factor by obtaining impact response of the concrete specimens. various reinforcement materials have been studied to expand the application area of polymer concrete. This was studied dynamic vibration of polymer concrete by impact damper.

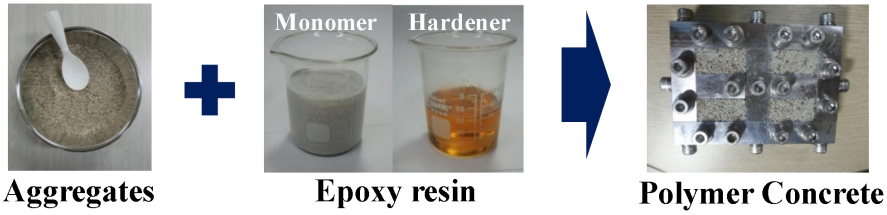


Fig. 1 A consist of polymer concrete

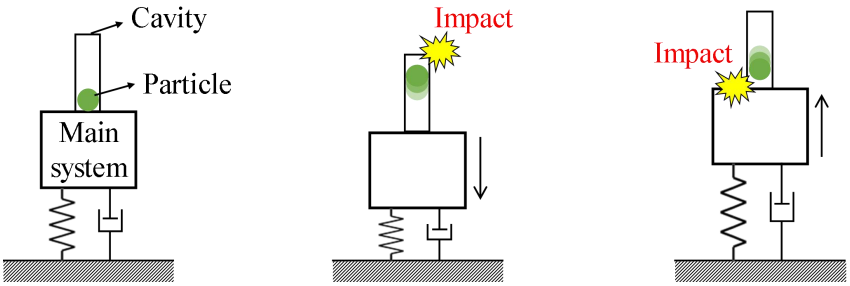
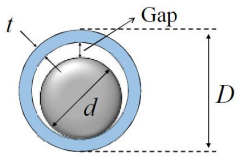


Fig. 2 The impact damper system

2. Production of the polymer concrete by using pipe structure

Polymer concrete is made of epoxy binders and aggregates, Polymer concrete was reinforced with acrylic pipe. The amount of epoxy binders used was reduced by up to 30% by pipe reinforcement. A pipe-type impact damper was built by inserting a collision particle inside the acrylic pipe.



D (mm)	12	15
d (mm)	6.5	10.3
Gap (mm)	1.5	0.7
Ball mass (g)	1.05	5.6

Fig. 3 A Pipe inserted polymer concrete

The dynamic characteristic of the polymer concrete is measured by beam transfer function method. The vibration response was measured using accelerometer with the impact hammer at the free end of the polymer concrete beam. According to the measurement result, the loss rate of polymer concrete was about 0.03 due to insertion of impact damper, which is about 4times higher than that of cement concrete.

Fig. 4 The measurement method

3. Beam transfer function method

To analyse the characteristics of noise generation, the wave propagation characteristics of bending of the structure should be understood. After the beam transfer function measurement, the loss rate and the dynamic stiffness are calculated by comparing with the theoretical model.

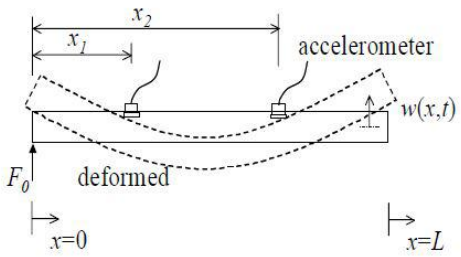


Fig. 5 The vibration characteristic of the free end beam using accelerometer

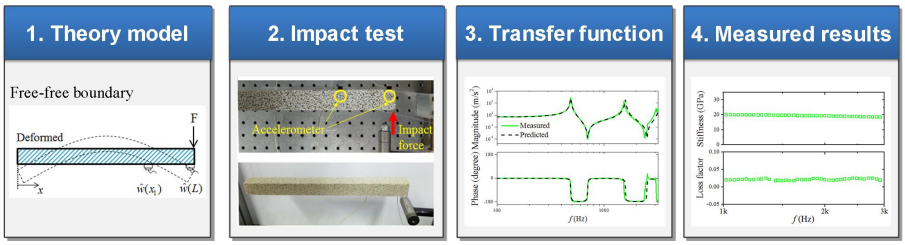


Fig. 6 The process of beam transfer function method

4. Experiment results of measurement of polymer concrete

Experiment results of impact damper polymer concrete, polymer concrete, cement concrete were as follows.

Flexural strength of polymer concrete was the highest, Whereas that of flexural strength of cement concrete was the lowest. Polymer compounds have excellent stiffness and flexural strength. That is because polymer concrete has little air gap and good binding force. On the other hand, cement concrete has an air gap because it is a mixture of cement and aggregate.

Loss factor of 15mm type impact damper polymer concrete was the best. And the loss factor of 12mm type impact damper polymer concrete was the second. Loss factor of 12mm type impact damper polymer concrete was the lowest. The diameter of 15mm type impact damper polymer concrete is the largest. also mass of 15mm type impact damper polymer biggest. The larger the impact damper, the larger the loss factor.

In the results of the Loss Factor experiment, the effect of the impact damper was excellent. This is because the impact dampers reduced the dynamic vibration through physical exercise. Between 1k(HZ) and 3k(HZ) 15mm type impact damper polymer concrete the highest.

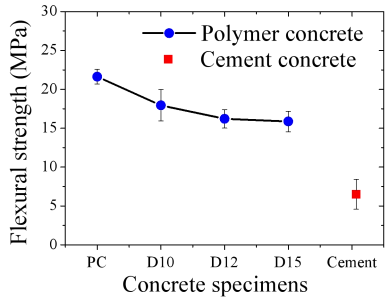


Fig.7 Flexural strength

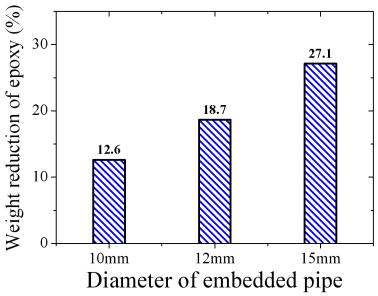


Fig.8 Weight reduction epoxy

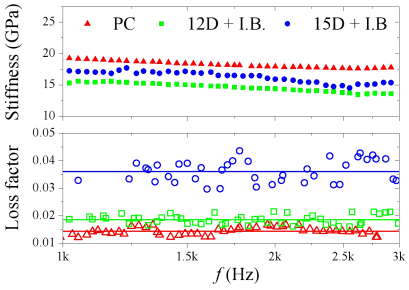


Fig.9 Loss factor stiffness

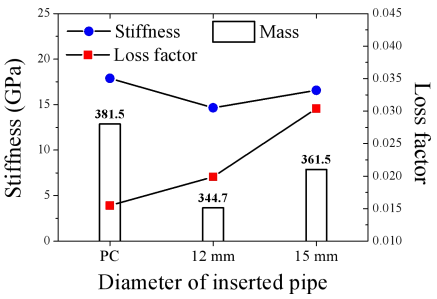


Fig.10 Stiffness

5. Analytical model

The rails are assumed to be mass-stiffness-damping models to represent a single degree of freedom of a single unit impact damper. To simulate the collision conditions,

the momentum conservation law and the impact damper are used. Each time acollision occurs, the initial condition of the collision is changed. Therefore, in order to calculate this easily, the fourth-order Runge-Kutta method was used, and the fourth-order Runge-Kutta method was repeatedly performed when the initial conditions were changed.

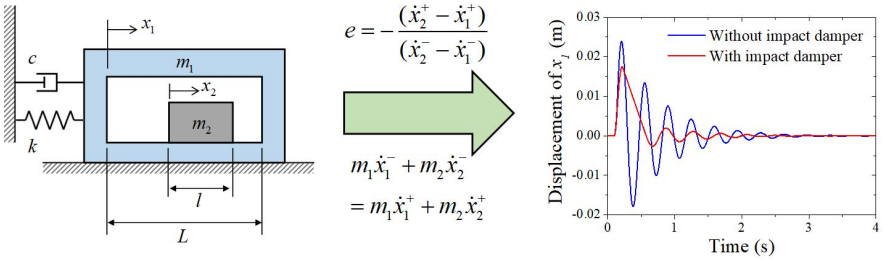


Fig. 11 The impact damper theory and the result of time response

Displacement response was calculated by considering collision coefficient and momentum. The damping ratio was more sensitive to changes in the gap than the mass ratio. It can be seen that the gap of the 15mm type damper is more advantageous for vibration reduction. Displacement response of 15mm type impact damper polymer concrete is smaller than that of 12mm type impact damper polymer concrete. Displacement response of 15mm type impact damper polymer concrete is below 0.0010m

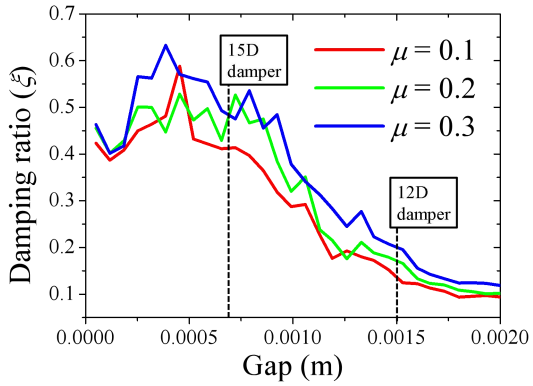


Fig. 12 The vibration reduction according to the gap

6. Conclusions

Flexural strength of polymer concrete was the highest, Whereas that of flexural strength of cement concrete was the lowest. Polymer compounds have excellent stiffness and flexural strength. That is because polymer concrete has little air gap and good binding force. On the other hand, cement concrete has an air gap because it is a mixture of cement and aggregate.

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The experiment results of Polymer concrete is better than cement concrete. and the impact dampers are judged to be effective in vibration reduction. In this study, the impact damper was tested with thtee types. and the impact damper was excellent for vibration reduction. Therefore, detailed experiment of the mass and length of impact damper is necessary. The experiment on various types of impact damper will be carried out.

7. References

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