

Screen Capture Rate Tests

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Abstract

Bar screens with a 4.5-mm, 4-mm, or 3-mm spacing and a 3-mm perforated screen were tested at a City of Houston wastewater treatment plant to evaluate the efficiency of removing suspended sanitary trashes. The results suggest that the performance of 4.5-mm, 4-mm, and 3-mm bar screens in terms of total capturing volume are very similar. The 3-mm perforated screen has the most capturing volume per million gallons of wastewater entering the channel.

1. Introduction

Automated bar screen systems are commonly used at the beginning of the wastewater treatment process to remove suspended sanitary trashes. Previous studies have shown that the capture rate is highly dependent on the opening between bars. However, only limited tests have been conducted to measure the capture rate (or capture volume) for bar screens with spacing greater than 0.25 inch (6.35 mm). No test data for bar screens with spacing less than 0.25 inch (6.35 mm) are available. This paper summarizes a field study of testing the capture rate for bar screens with 4.5-mm, 4-mm or 3-mm spacing. The test results can be used as guidelines for the determination of the trash removal efficiency for screens having a much finer spacing.

The screen capture rate tests were conducted at the City of Houston #23 wastewater treatment plant. The test equipment, which consists of screens, a screen mounting frame and a sampling mesh-basket, was installed in a diversion channel to allow the raw sewage to flow through the test screens and capture the suspended solid waste. A schematic diagram showing the test channel and the equipment set-up is presented in Fig. 1. The test equipment was provided by the Headworks Company. Each test screen has a dimension of 2 ft by 2 ft (0.61 m by 0.61 m). The sampling mesh-basket can be attached behind a test screen to collect the sanitary trashes carried through the screen (trashes not captured by the screen). Three bar screens with slots of 4.5 mm, 4 mm, and 3 mm and a 3-mm perforated screen were tested. The overall test cases can be summarized in the following: (1) 4.5-mm slotted screen with a 4-mm mesh sampling basket; (2) 4-mm slotted screen with a 4-mm mesh sampling basket; (3) 4.5-mm slotted screen with a 1-mm mesh sampling basket; (4) 4-mm slotted screen with a 1-mm mesh sampling basket; (5) 3-mm slotted screen with a 1-mm mesh sampling basket; (6) 3-mm perforated screen with a 1-mm mesh sampling basket.

2. Test Procedure

For each test, selected screens and sampling mesh-baskets were placed in the channel (as shown in Fig. 1). The raw sewage flowing into the treatment plant was diverted to the test channel to allow the screen and the basket to capture the suspended trashes. After the designated flow time (about 6 minutes), the wastewater was redirected to the main channel. The trashes captured by both the screen and mesh basket were sampled in plastic containers. After drying, the weights and volumes of the collected sanitary trashes were measured and the removal efficiency for each test screen was calculated.

3. Results

The estimated flow rate is about 1.2 MGD, which is considered as a base flow condition. In terms of the determination of the trash removal rate, the base flow condition probably represents

the worst scenario as the suspended trash has the highest density in the sanitary sewer system. The removal efficiency (or capture rate) in percentage is calculated as the ratio of the weight (or volume) of trashes captured by a test screen to the total weight (or volume) of the trashes captured. The total weight (or volume) of the trashes is the combination of the weights (or volumes) of the trashes captured by a screen and by a mesh basket. The removal efficiencies for test cases described above are summarized in the following.

Test cases	Removal efficiency (%) by weight	Removal efficiency (%) by volume
4.5-mm slotted screen with a 4-mm mesh basket	73.4	70.0
4-mm slotted screen with a 4-mm mesh basket	82.9	85.0
4.5-mm slotted screen with a 1-mm mesh basket	51.7	69.0
4-mm slotted screen with a 1-mm mesh basket	58.0	57.0
3-mm slotted screen with a 1-mm mesh basket	60.8	54.0
3-mm perforated screen with a 1-mm mesh basket	76.2	77.0

The results indicate that the removal efficiency of a 4-mm slotted screen is shown slightly greater than that of a 4.5-mm slotted screen. However, the overall performance of a 4.5-mm bar screen is similar to that of a 4mm bar screen. Also based on the visual observation and the analysis of the trashes collected by the mesh basket, no identifiable trash can be observed after many minutes of test. The collected trashes are mostly grit, toilet paper, food, and other stringy material. The capturing of cotton buds using a 4.5-mm slotted bar screen was also tested. The capture rate is 100%. Based on the flow rate (1.2 MGD), testing period (6 min.), and the ratio of total flow area versus screen area (2.5), the capturing volume in ft³ per million gallons of wastewater for each test screen is summarized in the following table:

Test cases	Capturing volume in ft ³ / million gallons
4.5-mm slotted screen	12.5
4-mm slotted screen	13
3-mm slotted screen	12.5
3-mm perforated screen	15

The results suggest that the performance of 4.5-mm, 4mm, and 3mm bar screens in terms of total capturing volume are very similar. The 3mm perforated screen has the most capturing volume per million gallons of wastewater entering the channel.

4. Acknowledgment

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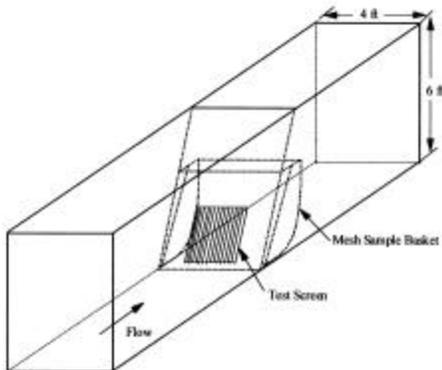


Fig. 1. Facility Set-up for Conducting Screen Capture Rate Tests