

CIB W062 Symposium 2017

# Study on a technology to suppress calcified urine in a horizontal branch drainpipe system where multiple urinals are installed successively



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# 1. Introduction

## Purpose of this study is...

To obtain basic knowledge of adhesion of calcified urine in drainpipe.



Urinal drainpipe  
Blocked by calcified urine

**Blockage of drainpipes caused by adhesion of calcified urine has become a problem** in various facilities.

In order to suppress calcified urine, It is necessary to understand the mechanism of deposition of calcified urine.

- Field Survey
- Experimental Verification

We found a relationship between the utilization of urinals and the trend of calcified urine adhesion.

## 2. Method 1: Field Survey

We investigated the utilization of urinals and the adhesion of calcified urine in two methods.

### ■ Surveyed Facilities

- School Facility (A, C, D, E, F)
- Office Building (B)
- Commercial Complex (G)



### Pre-survey using Questionnaire

- Years of use.
- Numbers of daily usage.
- Working hours.
- Frequency of daily cleaning.
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### Observation of Drainpipe inside Using Industrial Videoscope

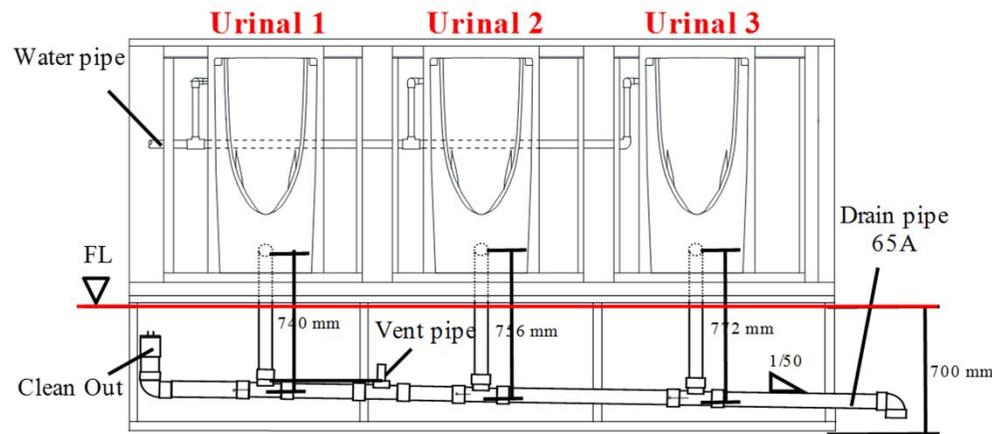


The thickness of calcified urine was estimated from the photograph of Videoscope.

# 3. Method 2: Experimental Verification

**We conducted experiments using urine substitute (1%-NaCl aq.) and verified the tendency for urine to remain in drainpipe.**

**• Urinal drainpipe system plumbed under a slab**



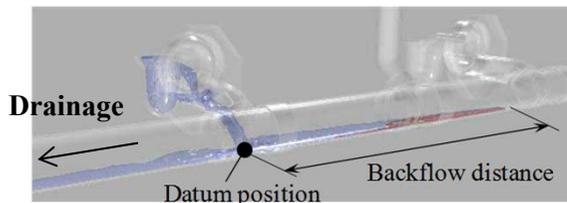
**Urinals were flashed with 1.0L of water respectively.**

	JIS-DT-Fittings	JIS-LT-Fittings
<b>Inflow 1/50</b>		
<b>Inflow 45 deg</b>		

**Pattern of inflow gradient and drainpipe fittings.**

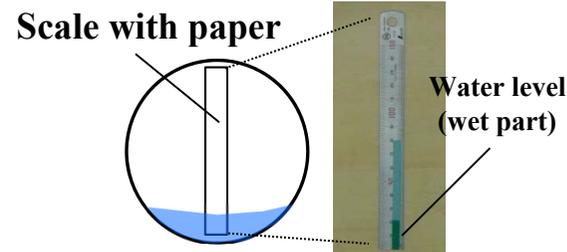
**• Evaluation indices**

**1. Backflow distance**



**Distance from datum position of merging point.**

**2. Max value of water level**



**Measured the height of wet part**

**3. Concentration of residual Urine substitute**



**This index was measured using dilution ratio of EC of salt water.**

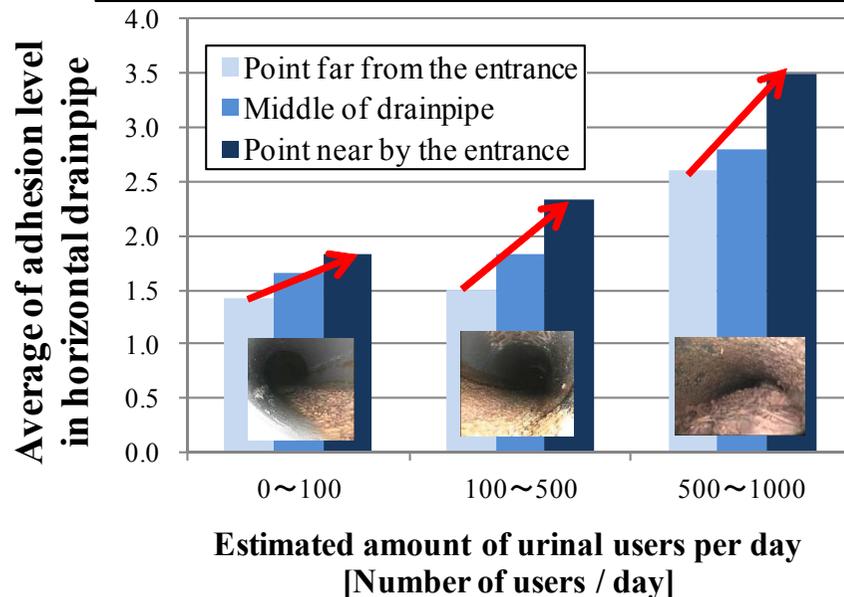
# 4. Results and Discussion 1: Field survey

## Results of Field Survey :

1. The number of urinal users has a huge effect on adhesion of calcified urine.
2. The adhesion of calcified urine in top end of the drainpipe was observed.
3. Periodically flushing was effective on suppress calcified urine.

### 1. Adhesion level of calcified urine

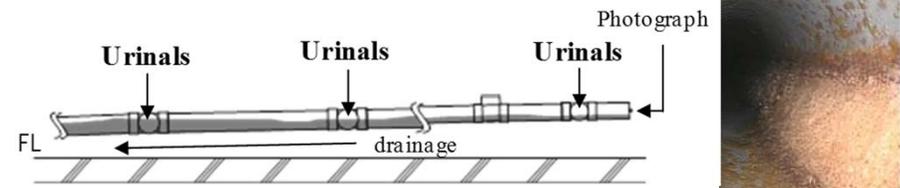
Adhesion Level	1	2	3	4
Estimated Thickness of calcified urine	0~5mm	6~15mm	16~30mm	31mm~



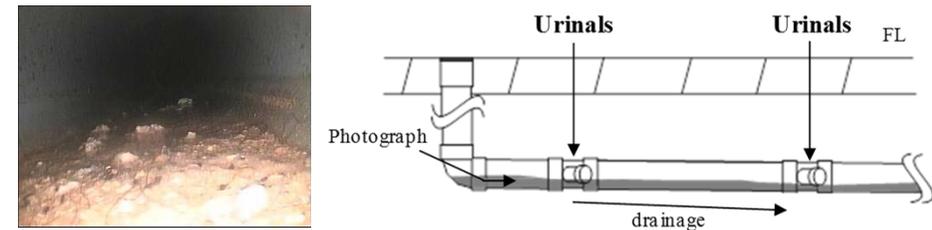
A large amount of calcified urine adhered to the upstream and downstream of urinal located **closest to the restroom entrance.**

### 2. Adhesion on top end of the drainpipe

#### ■ Schematic drawing of drainpipe Office Building B



#### ■ Schematic drawing of drainpipe Commercial Complex G



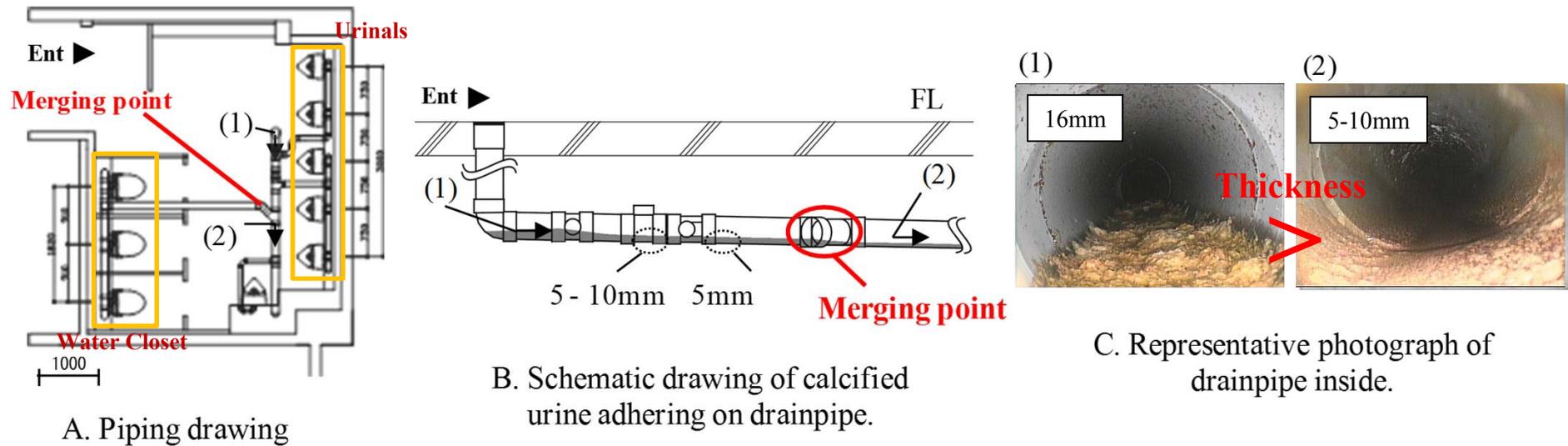
We found the deposition of calcified urine **mostly upstream of the drainpipe.** As previously reported, it is considered that **water with a high urine concentration backflows to the upstream side of the drainpipe.**

# 4. Results and Discussion 1: Field survey

## Results of Field Survey :

1. The number of urinal users has a huge effect on adhesion of calcified urine.
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### 3. Suppress effect of calcified urine by water from water closet.



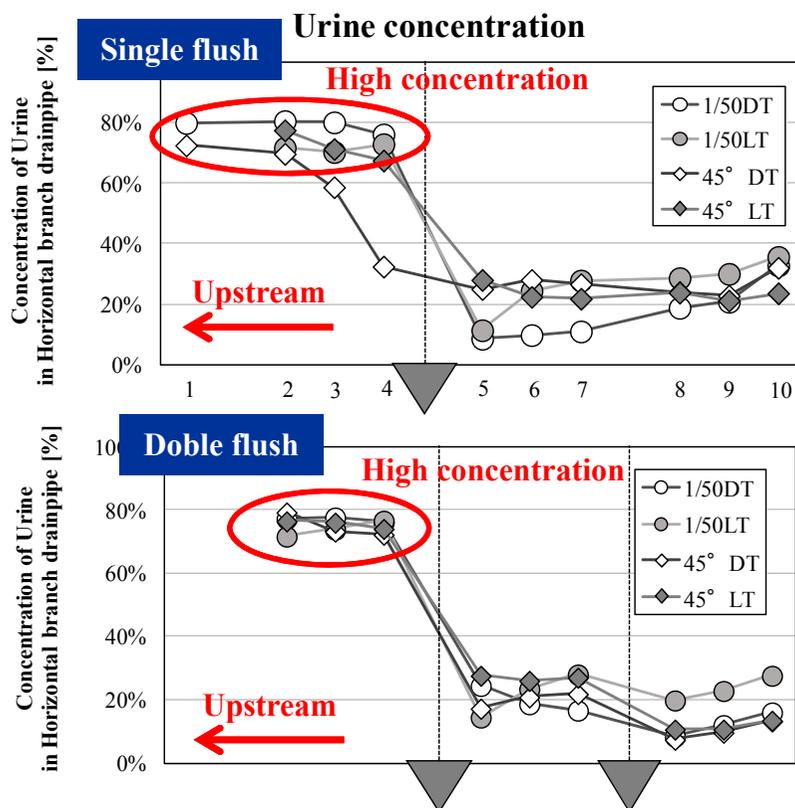
**In the upstream side: a large amount of calcified urine.**  
**In the middle: Due to the periodic flushing with high flow rate water from water closet, the amount of calcified urine was less than in upstream and downstream.**  
**(Effect of exfoliation and wash out by water)**

# 5. Results and Discussion 2: Experimental Verification

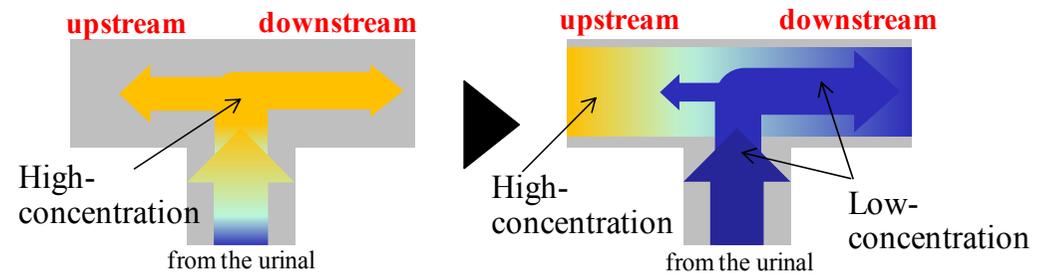
## Results of Experimental Verification :

1. In any experimental condition, the concentration of urine was high in upstream side of horizontal drainpipe as well as our previous study<sup>1)</sup>.
2. The backflow distance was short when and small inflow gradient and LT-Fittings were used.

### Residual concentration of urine.



### The mechanism of high concentrated urine at upstream side<sup>1)</sup>.



- Water with high-concentration urine from urinal trap is discharged toward both upstream and downstream.
  - Simultaneously, water with high concentration is pushed up to upstream side by clean water from urinal.
- ▶ Remaining high concentration urine in upstream side (considered as main cause of adhesion in top end of drainpipe)

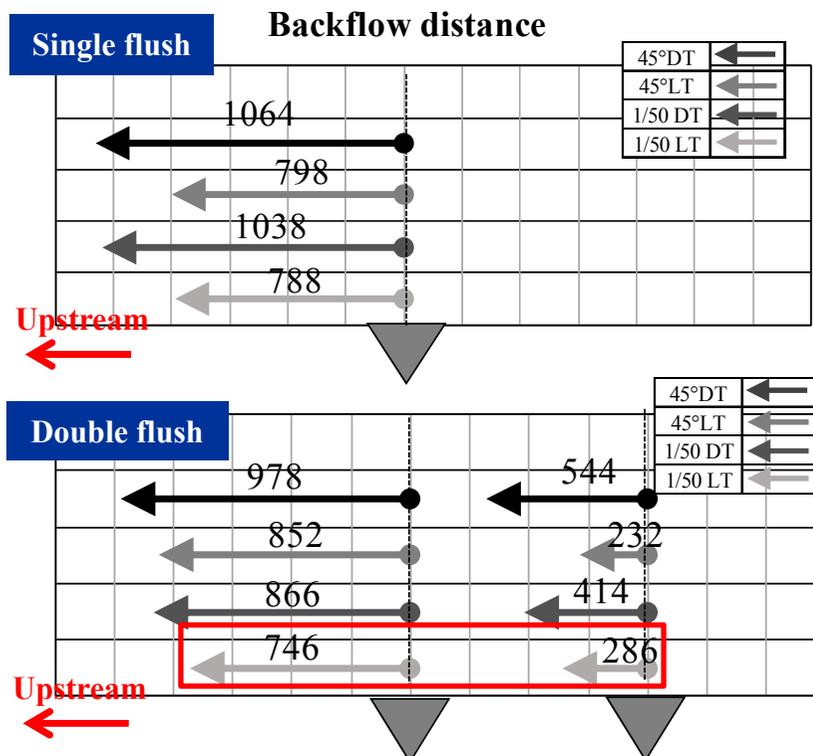
1) Y. Furuta et al., 'Study on a technology to suppress calcified urine in a horizontal branch drainpipe system where multiple urinals are installed successively.' PROCEEDINGS of the 42<sup>nd</sup> International Symposium of CIB W062 on Water Supply and Drainage for Buildings 29<sup>th</sup> August – 1<sup>st</sup> September 2016

# 5. Results and Discussion 2: Experimental Verification

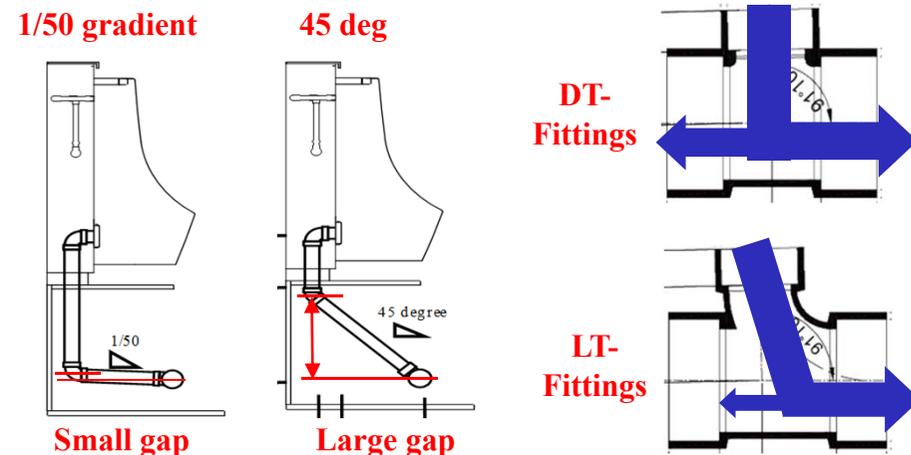
## Results of Experimental Verification :

1. In any experimental condition, the concentration of urine was high in upstream side of horizontal drainpipe as well as our previous study<sup>1)</sup>.
2. The backflow distance was short when and small inflow gradient and LT-Fittings were used.

### • Backflow distance of urine.



### The effect of inflow angle and pipe fittings.



The value of the backflow distance of 1/50 LT system was the smallest.

Because of ...

- slowdown of urine by small gap of inflow
- flow direction to downstream of drainpipe

## 6. Summary and Conclusions

- The adhesion of calcified urine in top end of the drainpipe was observed on field survey.
- **The main cause is the backflow of high concentration urine.**
- The periodic flushing is effective on suppress calcified urine.
  - Inflow angle and variation of fittings affect the residual concentration and backflow distance of urine.
- **To suppress the calcified urine, It is preferable to select small inflow gradient system for reducing backflow.**

It is possible to suppress adhesion of calcified urine by elucidating the basic characteristics of behavior of urine, and the effect of pipe geometry.

**Thank you for your attention.**

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**TOTO**