

# Stainless Flexible Service Line

**Simply Fit and Forget!**



# Water leakage

Leaks in distribution systems are costly. Added to the direct cost of the lost water that cannot be sold are the financial and environmental costs of finding, treating and storing more water to compensate for the losses. This problem affects rich and poor cities alike, as shown in the graph below. Many utilities do not know the exact extent of the water loss in their system.

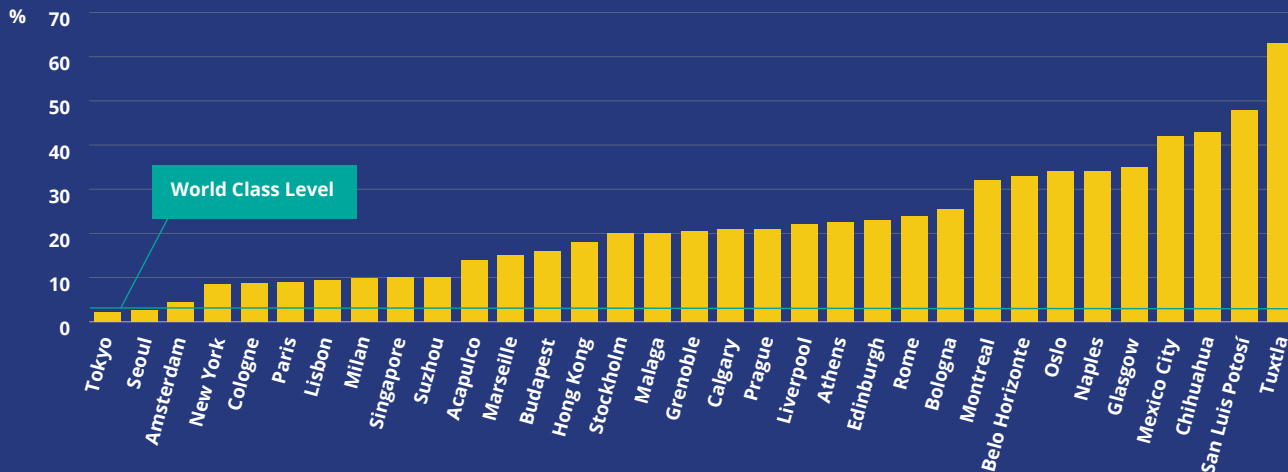
Both Tokyo and Taipei have determined that some 95 % of leakage repairs affect their service pipes of 50 mm (2 inch) diameter or less. Historically, service lines in those cities had been constructed of lead, iron or plastics.

Once a service line is in the ground, various forces, such as:

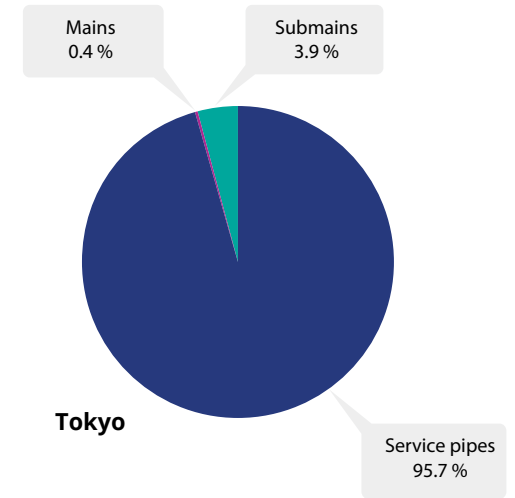
- Vibrations from traffic and construction work
- Subsidence and land slides
- Seismic events

can cause the tubes to deform, become disconnected or even break.

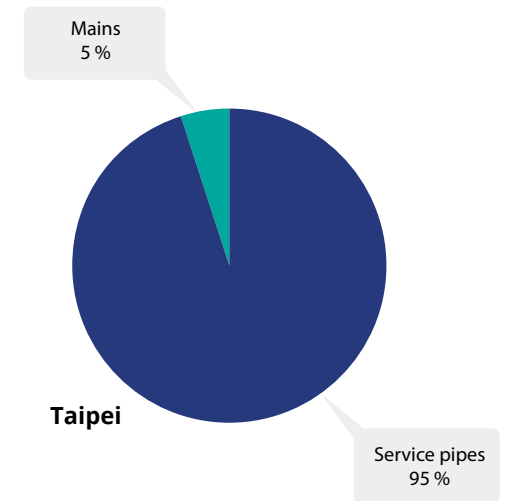
The lead lines not only had leakage problems, but they also presented grave health concerns which accelerated their replacement.



Leakage rate in major cities.  
Source: OECD (Water Governance in Cities, 2016)



Tokyo



Taipei

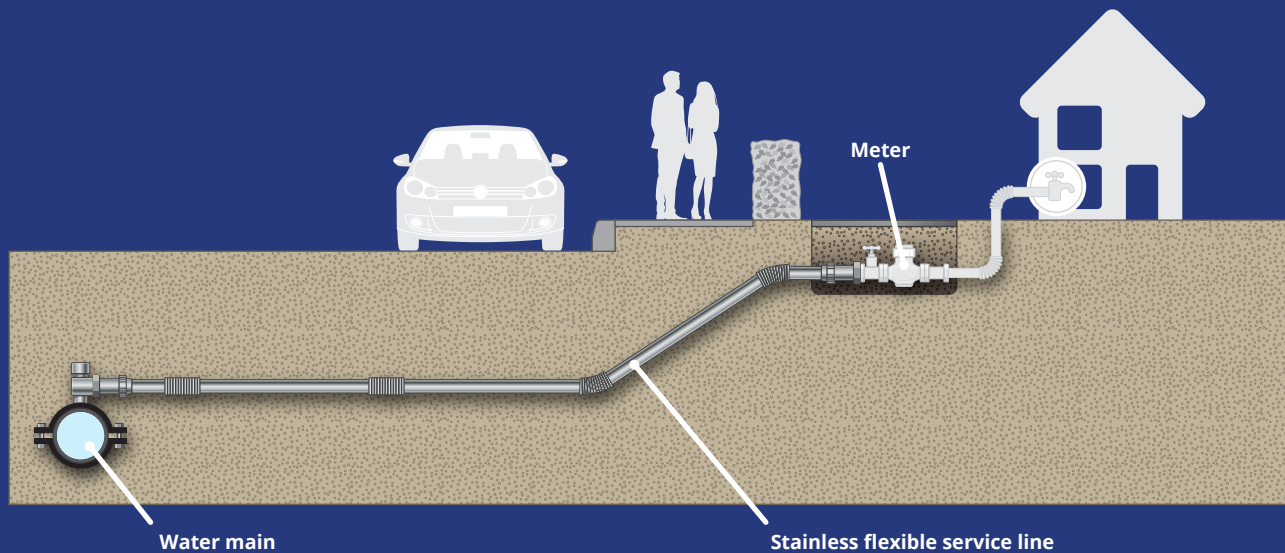
Most leakage cases are in service lines.  
Sources: Tokyo Bureau of Water Works;  
Taipei Water Department

## The stainless solution

In 1980, to combat the scourge of leaks, Tokyo instituted a three part solution to the problem:

- Replace the existing service lines with Type 316 stainless steel and the cast iron mains with ductile iron
- Improve leakage detection
- Improve response time when a leak is detected

In 1998, Type 316 stainless partially corrugated tube was introduced instead of straight tubes. The tube is corrugated at regular intervals so it can be easily bent during installation to accommodate changes in direction without additional joints. It also allows the tube to absorb the stresses from vibrations, subsidence and seismic events. The number of joints was also significantly reduced by using a single length of corrugated tube.



Schematic representation of the stainless flexible service line.  
Source: Team Stainless



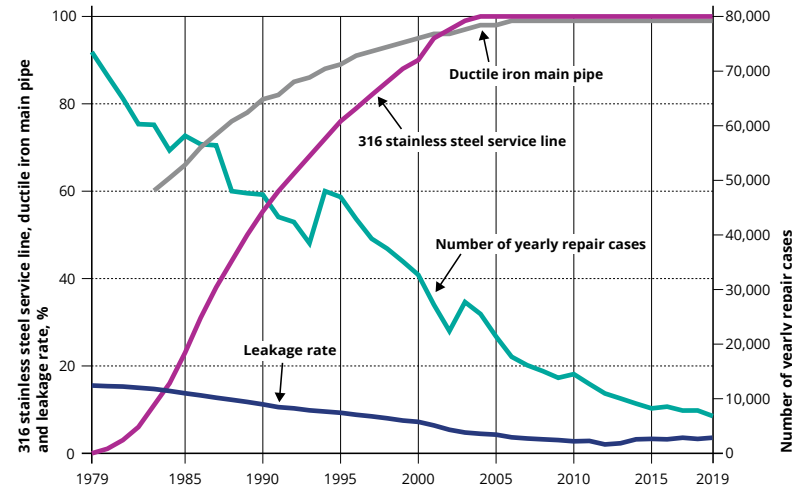
Stainless partially corrugated tube.  
Photograph: Ph. De Putter

## Results

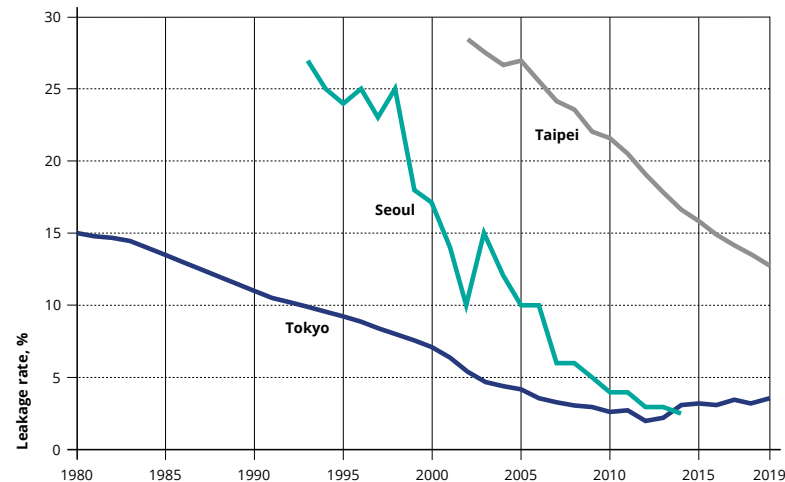
Tokyo's replacement program resulted in a water loss reduction from 260 million m<sup>3</sup> (15.4 %) in 1980 to 56 million m<sup>3</sup> (3.6 %) in 2019. At the same time, repair cases were reduced from 69,000 per year to 7,000 per year. The total savings amount to almost 500 million USD per year.

Tokyo's success at reducing leakage attracted the attention of Taipei and Seoul. Following a drought causing severe water shortages, Taipei began evaluating their program in 2002 and started their 20-year stainless flexible service line installation program in 2005. This resulted in a water loss reduction from 365 million m<sup>3</sup> (27 %) in 2005 to 109 million m<sup>3</sup> (12.7 %) in 2019, in just 12 years. At the same time, repair cases were reduced from 11,300 per year to 2,600 per year in 2019. When even more severe drought conditions returned in 2014, Taipei had no service disruption. In fact, it was able to maintain a surplus which was distributed to storage reservoirs and other utilities.

In Seoul, following the installation of stainless steel service lines, water leaks reduced from 27 % to 2.5 %. It has also enabled the city to reduce its total water production from 7.3 million m<sup>3</sup> to 4.5 million m<sup>3</sup> per day, leading to the closure of four of the original ten water treatment plants.



Gains made by using stainless steel in Tokyo.  
Source: Tokyo Bureau of Water Works



Leakage reduction in Asian cities through use of stainless steel service lines.  
Sources: Tokyo Bureau of Water Works; Ministry of Environment, Republic of Korea; Taipei Water Department

## Stainless steel benefits

Type 316 stainless steel with typically 17 % chromium, 2 % molybdenum and 10 % nickel content has excellent corrosion resistance in a wide range of soils and is recommended for this type of application. Tokyo expects service life to exceed 100 years. Type 316 stainless steel is essentially inert in potable water, with negligible leaching of alloying elements, and therefore does not adversely affect water quality.

The benefits of Type 316 stainless steel can be summarized as follows:

- Corrosion resistant
- Durable
- Hygienic
- Strong
- Lower life cycle cost
- Not susceptible to cracking
- Lower maintenance costs
- Improved water quality
- 100 % recyclable

Stainless partially corrugated tubes offer:

- Reduced leakage by minimizing the number of joints
- Improved workability
- Flexible and easy to install
- Resistant to seismic shocks and subsidence
- Matching fittings to connect to the water main and valves and meters

## Conclusion

The corrosion resistance, durability, resilience and reduced number of joints of stainless flexible service lines has played an important role in stopping leaks. The experience of Tokyo, Seoul and Taipei proves the effectiveness of stainless steel for service lines even for very large municipal systems. While the initial cost compared to competing materials may be higher, stainless steel has been shown to be a good investment over its long life, paying back each year in cost reductions for both maintenance and unit volume of water processed.



[teamstainless.org](http://teamstainless.org)

Alliance of non-profit organizations demonstrating the benefits of stainless steel for water distribution:

