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Landscape Material

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Abstract

This paper introduces landscape materials, a group of steel products which have been specifically developed to enhance the aesthetics of the environment. Recently, lighting poles and street fixtures which harmonize with the surroundings are increasingly in demand. Traditionally, the shape flexibility of these fixtures, which is important for improving environmental aesthetics, has been realized by casting, machining, welding and forming. The use of landscape steel materials realizes greater freedom of shape more economically.

1. Introduction

"Landscape" occupies an important position in the "environment" surrounding us. Steel products that contribute to improvement in the visual landscape can be considered as "environmentally friendly steel products". Traditionally, many of the steel products have been used to make good use of their excellent performance properties like strength, formability, and weldability. Steel products contributing to improvement in the physical landscape have been limited to those given surface treatment to enhance their color or luster. Steel pipes and tubes have been used as load carrying parts of circular cross section in applications far apart from the landscape, such as building structural members, oil country tubular goods, oil and gas line pipes, and automotive parts.

Nippon Steel has developed a group of new steel products, or steel pipes shaped in various forms and used to positively improve the visual landscape. These new steel products, called landscape steel pipes, are introduced here.

2. Overview of New Landscape Steel Pipes

2.1 General

Table 1 outlines Nippon Steel's new landscape steel pipes. These new pipe products can be mainly classified into fluted steel pipes and hexagonal steel pipes, each provided with characteristic cross sections, and taper steel pipes provided with freedom of shape in the longitudinal direction. As compared with conventional steel pipes of cylindrical form, the landscape steel pipes can present such profound or refined design as traditionally obtained by casting or welding.

One example would be lighting poles. Standard lighting poles specified by the Ministry of Construction, Japan Highway Public Corporation, and other organizations are generally used in Japan. They are conical steel pipe poles of circular cross section and constant taper rate, have the excellent function of holding fixtures for lighting roads and the like, and have made themselves a part of the landscape of expressways supporting motorization and industrial civilization. The progress of an expressway network, however, has diversified the landscape and environment of passing regions and has sometimes called for departure from the conventional landscape constrained by the sense of industrial value. The standard lighting poles are not enough to meet the landscape and environmental requirements such as shopping streets.

The visual landscape that includes lighting poles may be improved by using lighting poles provided with embossed surface patterns or changed in longitudinal shape like the entasis column. This freedom of shape has been traditionally obtained by secondary fabrication, such as casting, machining, or welding. The landscape quality of such lighting poles cannot be taken into account from an economic point of view in many cases. Use of Nippon Steel's landscape steel pipes economically offers vertical surface flues and free longitudinal forms, and facilities the aesthetic improvement of various environments.

With their features evaluated by many users, Nippon Steel's landscape steel pipes are adopted in many streets, parks, and other facilities. Examples of their application are introduced below.

2.2 Application examples of landscape steel pipes

2.2.1 Trapezoidal-fluted steel pipes

Photo 1 shows trapezoidal-fluted steel pipes used as columns for shelters installed by the Tokyo Metropolitan Government as rest spots for its citizens. The deep flutes make the columns appear deeply lustrous when viewed from afar. When viewed in close

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Table 1 Nippon Steel's landscaping steel pipes

Shape	Product	Feature	Available range
Characteristic cross-sectional shape	Trapezoidal-fluted steel pipe	① Steel pipe with deep flutes of trapezoidal form ② Flutes prevent fliers from being affixed	OD: 89.1-355.6 mm Wall thickness: Basically 4 mm (at flute base surface) Flute height: 2 or 4 mm
	Sinusoidal-fluted steel pipe	① Steel pipe with shallow flutes of sinusoidal form ② Flutes prevent fliers from being affixed and facilitates removal of posted fliers	OD: 34.0-206.7 mm Wall thickness: Basically 5 mm (at flute base surface) Stripe height: 0.6 mm
	Hexagon steel pipe	① Steel pipe with external hexagonal form and internal circular section	Length between sides: 19-70 mm Inside hole diameter: 6-56 mm
Change in longitudinal direction	Taper steel pipe	① Steel pipe tapered in longitudinal direction ② Taper rate can be freely selected (curved pipe is also available)	OD: 70-244.5 mm Wall thickness: 3.2-6.0 mm Taper rate: 1/100-15/100

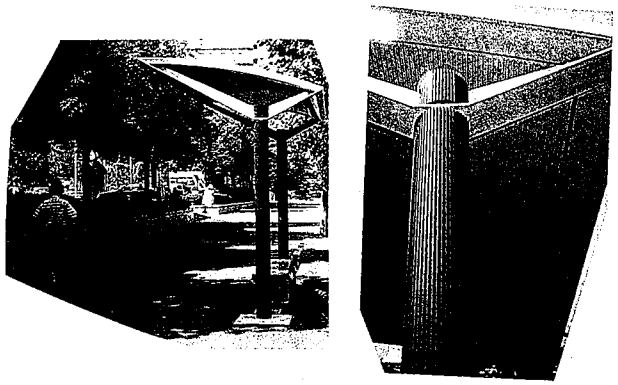

Photo 1 Trapezoidal-fluted steel pipes used as shelter columns

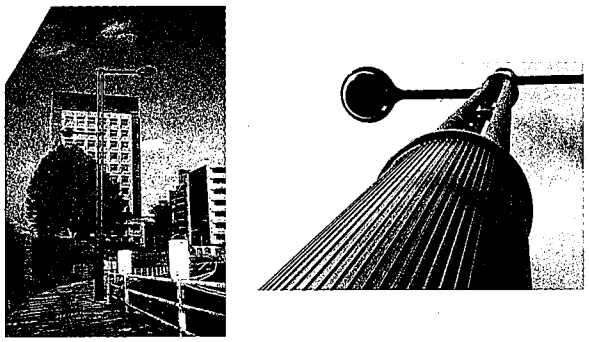

Photo 2 Trapezoidal-fluted steel pipe used in lower part of lighting pole

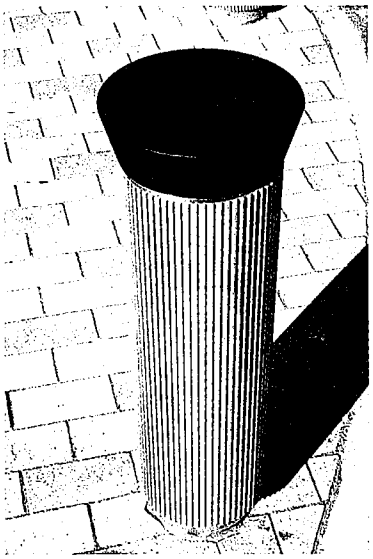

Photo 3 Trapezoidal-fluted steel pipe used in street fixtures

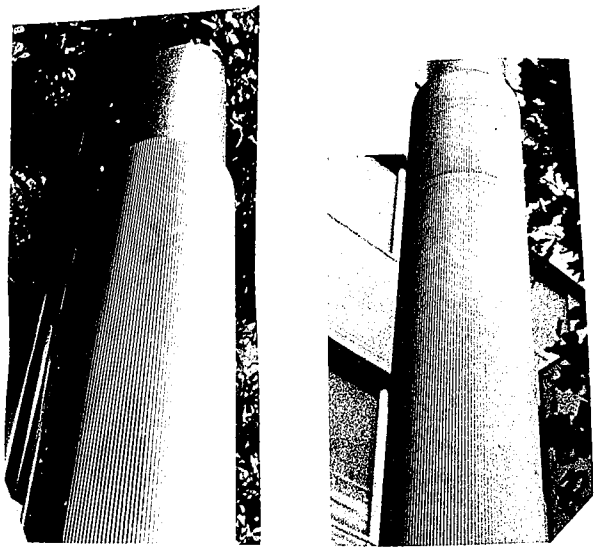

Photo 4 Sinusoidal-fluted steel pipe used as signpost

proximity, the shadows produced by the flutes of the columns match with the roof flutes, and make the columns appear thicker and heavier than they really are. **Photo 2** shows a trapezoidal-fluted steel pipe used in the lower part of a lighting pole. Like in the shelter shown in **Photo 1**, the somber luster and massive feeling of the trapezoidal-fluted steel pipe are put to good use. The trapezoidal-fluted steel pipes are effectively used in bollards and chair legs as shown in **Photo 3**.

2.2.2 Sinusoidal-fluted steel pipes

Photo 4 shows a sinusoidal-fluted steel pipe used as a signpost. As compared with the trapezoidal-fluted steel pipe, the sinusoidal-fluted steel pipe presents a soft and lustrous visual effect. The

sinusoidal-fluted steel pipes feature the excellent function of flier removal. The lateral traces visible on the signpost of **Photo 4** indicate the flier naturally came off the signpost.

2.2.3 Hexagonal steel pipes

Photo 5 shows the hexagonal steel pipes used as the horizontal beams of a fence installed in the plaza in front of the Imperial Place in Tokyo. The sharp shadows cast by the sides of the hexagonal steel pipes accentuate the visual landscape and create a sophisticated sense of depth.

2.2.4 Taper steel pipes

Photo 6 shows a design lighting pole produced by making good use of the longitudinal shape freedom of a taper steel pipe. The flexibility of the curved pole and the naturalness of the curves to the lighting fixtures create a flexible and modern urban view. The increasing speed of automobiles on expressways has produced the problem of such a travel landscape that the drivers feel oppressed by the approaching walls of standard lighting poles. The new lighting poles devised to improve this situation are shown in the right part of **Fig. 1**. The new lighting poles are straight versions of the standard ones, and the freedom of the taper shape is utilized to make the upper part that gives an oppressive feeling to the drivers slender.

3. Features of Landscape Steel Pipes

Nippon Steel's landscape steel pipes as used in typical applications have been described above. Their features are discussed below.

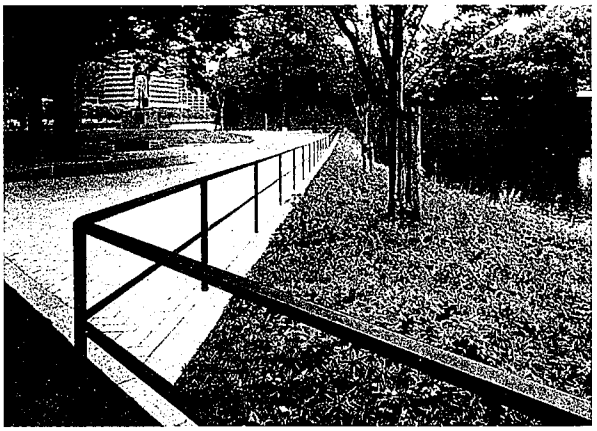

Photo 5 Hexagonal steel pipes used in fence

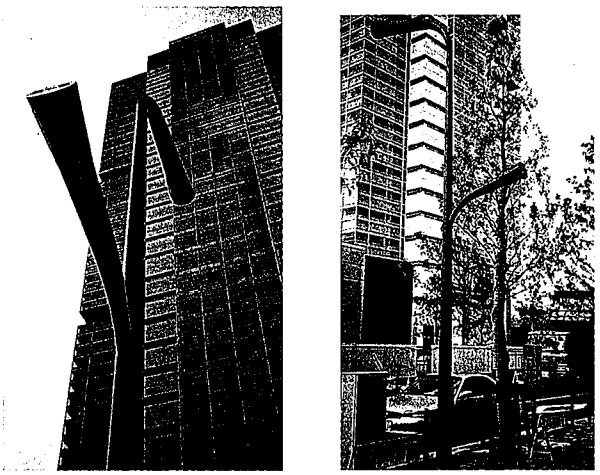

Photo 6 Taper steel pipe used as lighting pole

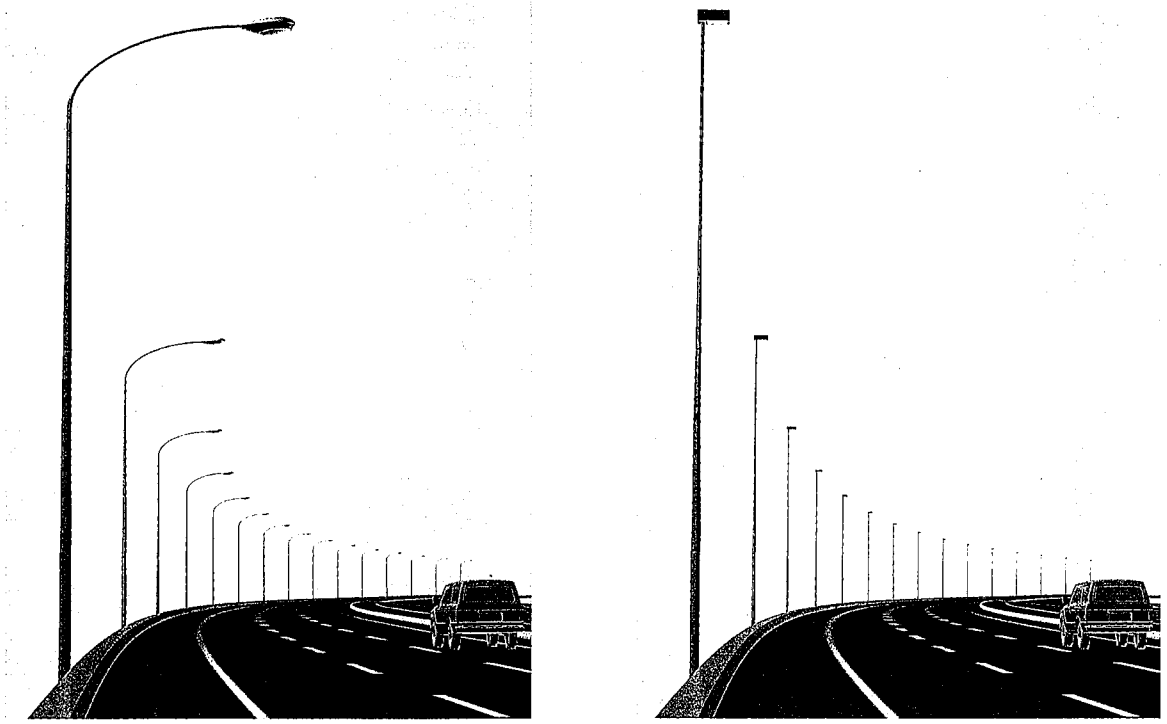

Fig. 1 Improvement in travel landscape on expressway

3.1 Trapezoidal-fluted steel pipes

The trapezoidal-fluted steel pipe is produced by roll forming steel strip with vertical flutes into a shell and electric resistance welding the shell. As compared with the fluted steel pipes produced by casting or machining, Nippon Steel's trapezoidal-fluted steel pipes are highly economical, available in 10 outside diameters, and are applicable to a variety of designs.

Since their trapezoidal flutes are sharp and high at 2 or 4 mm, the trapezoidal-fluted steel pipes appear massive and lustrous in a far view, and look sharp, delicate and heavy as castings in a near view, as already noted in the preceding chapter. Surface treatment, such as painting or plating, can enable lightness to be represented by the rhythmic feeling of the shadows. The trapezoidal-fluted steel pipes can be used as materials for lighting poles, chairs, garbage boxes, and other street fixtures to contribute to the production of landscape designs compatible with the atmospheres of specific streets and parks. They can also be used as structural members combining aesthetic appearance with the functions of preventing pedestrians from slipping and people from affixing fliers or signs on lighting poles. Nippon Steel's trapezoidal-fluted steel pipes can be fabricated from 490-N/mm^2 high-strength steel or weathering steel as well.

3.2 Sinusoidal-fluted steel pipes

The sinusoidal-fluted steel pipes are manufactured by cold drawing round steel pipes. Like the trapezoidal-fluted steel pipes, they are highly economical, available in 16 outside diameters, although smaller than the sinusoidal-fluted steel pipes, and easily adjustable to accentuate appearance or suit the limited size of the space concerned. Since their cross-sectional shape is sinusoidal and only 0.6 mm in height, the sinusoidal-fluted steel pipes cannot be expected to produce such a pronounced visual effect as the trapezoidal-fluted steel pipes do, but can produce a flexible surface feeling and a heavy feeling like that of castings when seen near.

Because their flutes are sinusoidal in cross-sectional shape, the sinusoidal-fluted steel pipes provide only a contact surface for affixing fliers and have a remarkable effect of facilitating the removal of posted fliers or signs. If the sinusoidal-fluted steel pipe is used as structural member in the portion of a conventional utility pole covered with material to prevent any fliers from being posted, it will be effective in eliminating the covering and economically preventing the landscape from being deteriorated by the degradation and peeling of the surface coverings of utility poles.

3.3 Hexagonal steel pipes

The hexagonal steel pipes are manufactured by cold drawing round steel pipes like the sinusoidal-fluted steel pipes. They are 70 mm or less in the length between the sides, hexagonal in the external cross section and circular in the internal cross section, and produced in a variety of steels from high-strength to high-carbon grades. Since the corners of the hexagonal cross section can be changed in radius from 0 to 3 mm, the corner line sharpness that adds to the shadows cast by the respective sides can be selected to suit specific design applications. The hexagonal steel pipes can be used as compact members as fence beams and lighting poles by taking advantage of their high strength and advanced design features.

3.4 Taper steel pipes

Conventional steel pipes for lighting poles (called taper poles) were manufactured by press forming trapezoidal sheets into conical form using dies and butt welding the conical sections by CO_2 gas-shielded arc welding, for example. The taper poles were poor in freedom as to the taper rate and other shape features due to the constraint of press forming dies, and were produced by casting or similar processes, except for standard types.

Nippon Steel's taper steel pipes are manufactured by continuously spinning a medium-diameter electric resistance welded steel pipe in the warm condition by using numerically controlled rolls. They can be thus easily formed to various shapes, such as double tapers, steps, or curves. As compared with conventional press-formed taper steel pipes, the spun taper steel pipes are superior in cross-sectional circularity, free from weld bed projections, and high in weld strength. The taper steel pipes are planned to be produced in more steel grades and wall thicknesses, and will find use in more applications.

The taper steel pipes are ideal for lighting poles of refined design as previously introduced, and are already used in many applications. They can also make good use of their shape freedom in shelter columns (entasis columns) and bollards. Nippon Steel's taper steel pipes feature overwhelmingly high weld strength as compared with conventional taper steel pipes, and are effective as measure against the failure of welds due to the freezing of water in the steel pipe in winter.

4. Conclusions

The features and uses of Nippon Steel's landscape steel pipes have been described above. These new steel products can be used in combination to meet specific design needs, of course. We would be happy if our landscape steel pipes will prove helpful in improving the visual landscape of specific environments.

5. Acknowledgments

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Photo 1: GK Sekkei Incorporated

Photo 2, 3 and 6: KIMMON Electric Co.,Ltd.

Photo 4 and 5, and Fig. 1: YOSHIMOTO POLE CO., LTD.