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Artikel: Car parking structures (Japan)
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10. Car Parking Structures (Japan)

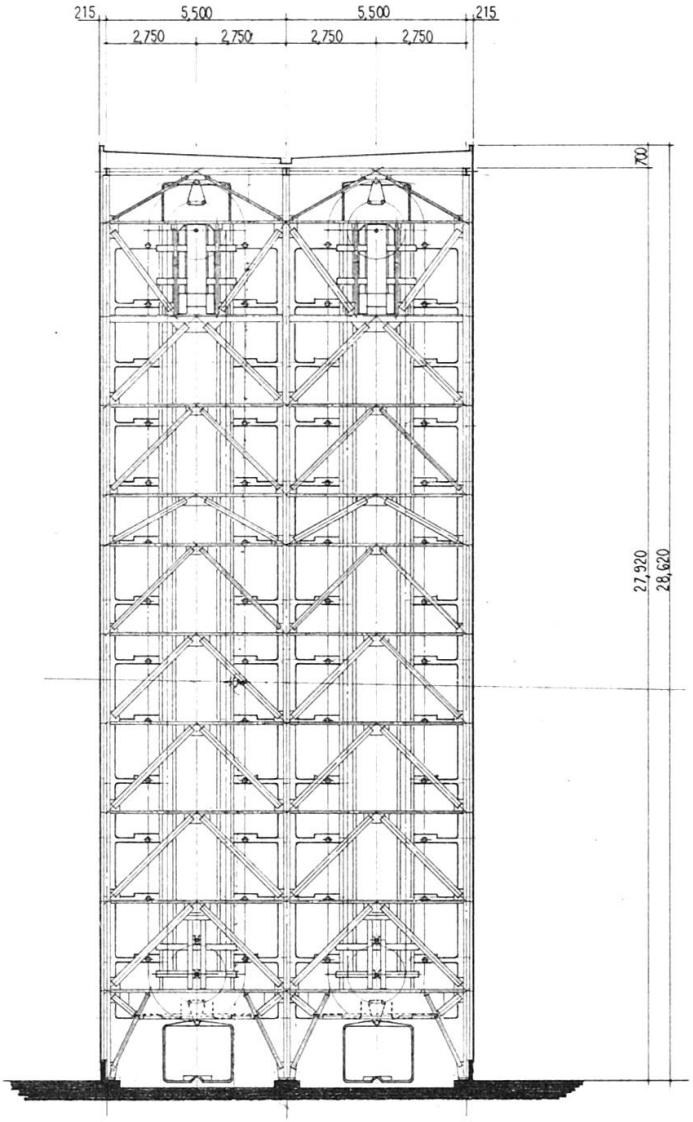
During the last 10 years there has been an outstanding increase in the amount of motorized traffic in Japan. The number of automobiles in the country rose to 17'380'000 in 1976, as compared with 3'000'000 in 1966.

This has inevitably led to a subsequent rapid rise in the demand for the provision of additional parking facilities. Laws have now been passed by the Tokyo Metropolitan Government making it illegal to possess an automobile without adequate parking space, a practice which is also being carried out in other cities.

In order to offset the severe shortage of land in Japan a number of car parks in the 3-dim. system have been designed by which it is hoped to ensure the most economical use of the minimum amount of space. The types thought to be the most likely to gain the approval of the Ministry of Construction are the automatic parking systems which seem the most suitable, except in those cases where the driver has to operate the system himself. 150 such specially constructed systems were approved as of 1977.

The "Merry-go-round" – a typical example of the system – is described in this report.
It appeared for the first time in Japan in 1960 and since then 1776 of these car parks, capable of garaging 47'910 cars, have been completed. The steel structure of this system has a K-truss, above which a driving unit has been erected. In the lower driving unit two pairs of sprocket wheels (2 wheels at the front and rear respectively) are attached over which 2 endless chains are fitted. To accommodate medium-sized cars (5050 long x 1850 wide x 1650 high) cages of 1820 mm pitch have been installed; the upper driving system is remote-controlled. The motorist drives his car into the cage, after which the automatic control takes over.

"Merry-go-round" type parking tower (Kyoto Financial Bank)



"Merry-go-round" type – cross section

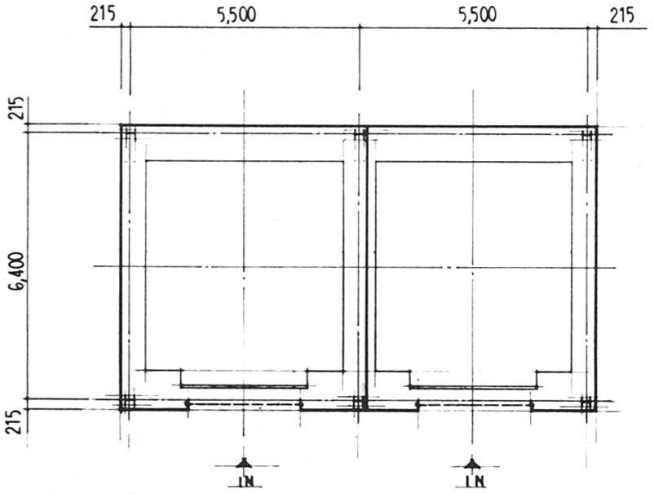
Owner: Kyoto Financial Bank, Kyoto City
Engineer & Contractor: Ishikawajima-Harima Heavy Industries Co., Ltd.

Dimensions:	*Column*	*H – 200 2 x 8/12*
	Beam	*⊓ – 200 x 80 x 7,5 x 11*
	Bracing	*+ – 90 2 x 7*
Capacity:	*28 x 2 cars*	

Work's Duration: 6 months
Service Date: 1972

As bracing cannot be constructed at ground level, diagonal members are reinforced to increase torsional rigidity, which is of the characteristics of this steel structure. The combined load of a car and the supporting mechanism is entirely concentrated on the upper structure. As a result of this the problem of horizontal force distribution in the event of earthquakes arises. However during practically the whole of the vibration test a uniform distribution was observed. The reason for this is attributed to the fact that the gap between the chain and the guide rail of the cage is only approximately 5 mm and therefore the horizontal frame absorbs the horizontal force. The result of dynamic analyses agree for the most part with the test results at the upsetting limit at about 300 gal. of input wave, as carried out in El Centro in 1940.

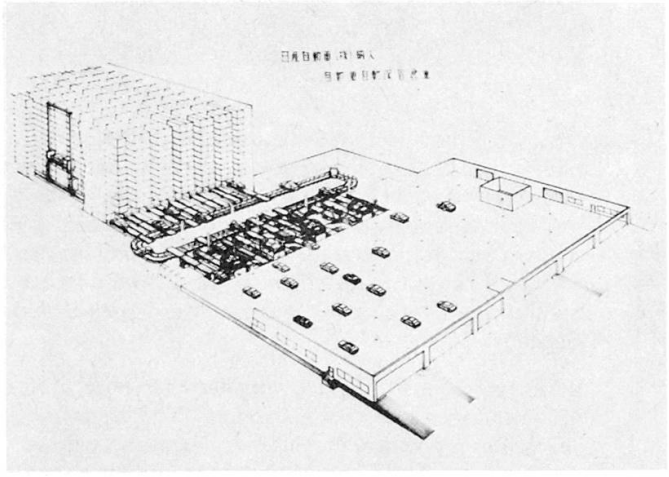
Another characteristic is that the upper and lower blocks are standardized and adjustment of distances between the horizontal steel beams is effected in the middle part of the structure.



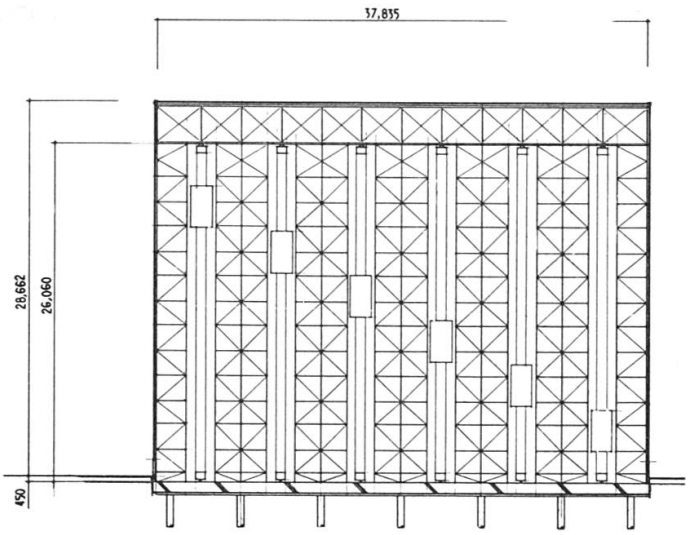
Automated warehouses for new cars off the production line is described in the following paragraphs.

These warehouses have been constructed in various parts of the world to eliminate or reduce labor in the wholesale and distribution industry.

The first automated warehouse for automobiles was constructed in Japan in 1965 and by 1976 about 1100 had been built.



Automated warehouse
(Nissan Motor Co., Ltd.)



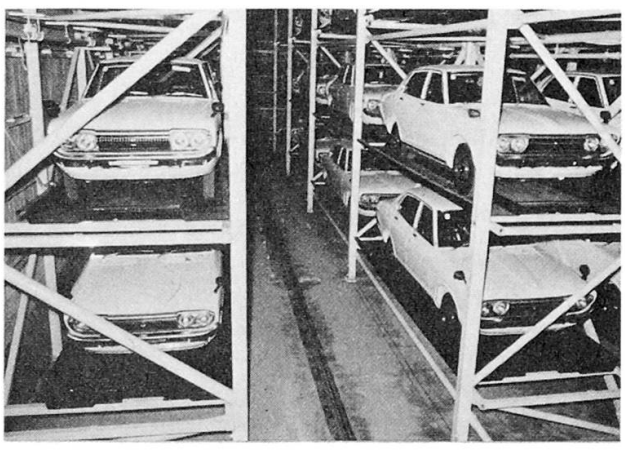
Automated warehouse – cross section
Work's Duration: 14 months
Service Date: 1977 Capacity: 5.124 cars

In these warehouses racks are installed on both sides of 6 stacker cranes in rows consisting of 13 racks vertically and 33 horizontally. Each rack contains one automobile which is brought in and out by means of a conveyor, a car truck and a stacker crane. A driver is only needed to run a car onto a pallet made of pressed steel plates and the program is then operated automatically by computer. Typical of these structures are the square steel and round steel used as main materials, short column distance, 3200 x 5500 mm, and the light movable load of 1.72 tons. Bracings in the beam direction are situated between the cars in the racks. On the stacker crane side no bracing has been provided but torsion due to earthquake load has been considered in the design.

Racks for each panel are manufactured in factories, blocks are assembled on the site and each block is lifted and put into position by means of a crane.

The advantage of this system is that, owing to the three-dimensional form of structure, the space needed for a car is only 1.32 m2, which compares very favourably with the 15.5 m2 required in normal ground parking lots. The number of personnel required for handling cars can also be considerably reduced.

(Ishikawajima - Harima Heavy Industries Co., Ltd.)



Automated warehouse
(Nissan Motor Co., Ltd.)