B U M I C O N MISAWA Ltd

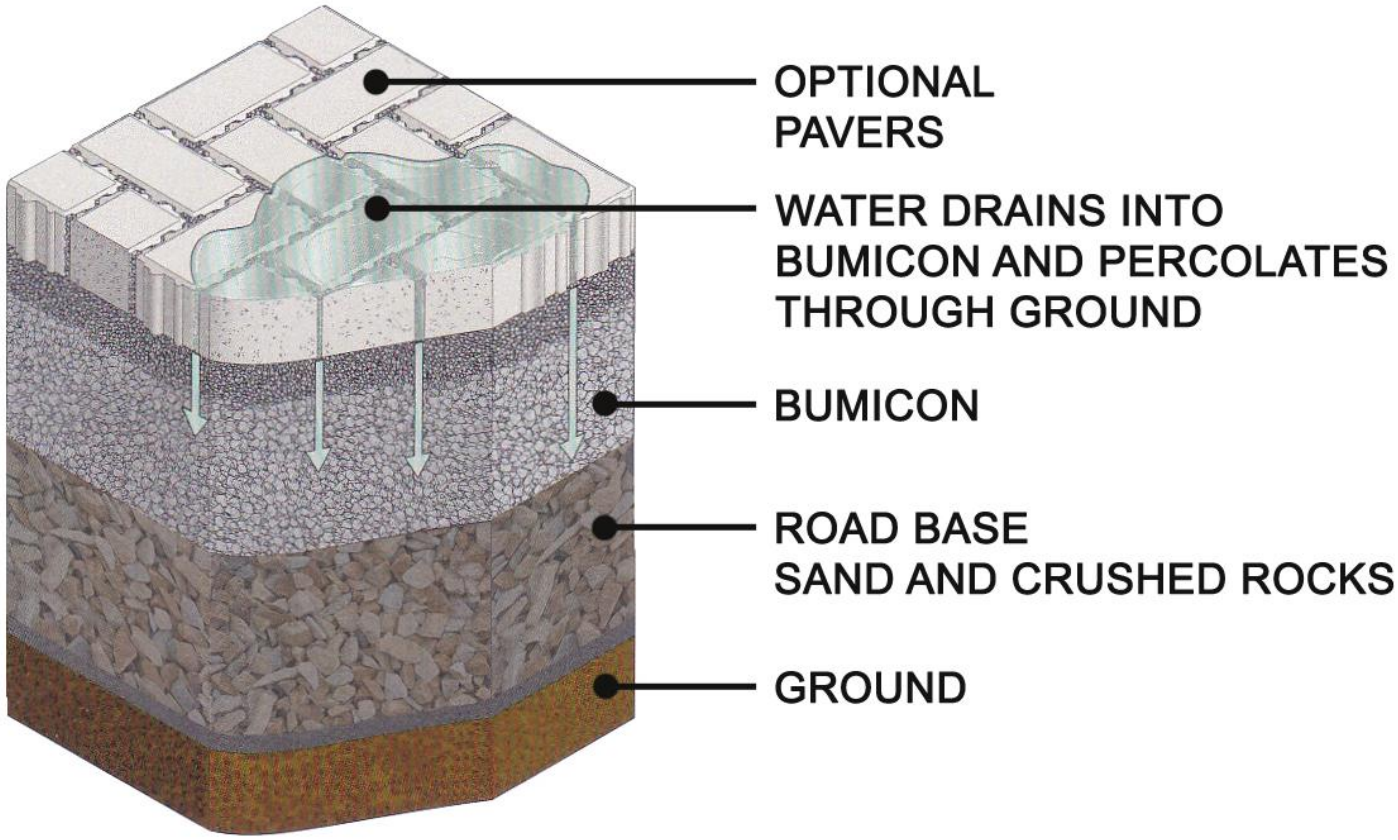
BUMICON INTRODUCTION

1. **BUMICON is a paving product that has the characteristics of permeable concrete**

2. **It is porous and composed of aggregate and cement based on a patented formula that creates the strength of concrete without the need of polyethylene polymer**

3. **It has been successfully implemented in Japan as part of on-site storm water management system**

BUMICON INSTALLATION CONCEPT




BUMICON™
CHARACTERISTICS

1. HIGH WATER PERMEABILITY

- ***BUMICON drains 10 times faster than asphalt***
- ***BUMICON drains 1000 times faster than soil***
- ***Percolation rate of BUMICON is 1 ~ 3 mm/s***

2. HIGH WATER RETENTIVE CAPACITY

- ***BUMICON retains up to 25% of its total volume, higher if used in conjunction with GARDENCRETE***

- ***For a 100 mm thick layer, capacity is 25 litre/m^2***

3. HIGH RESISTANCE TO HEAT GAIN

- ***Surface temperature of BUMICON cooler than concrete by as much as 8 ^{o}C***
- ***Surface temperature of BUMICON cooler than asphalt by as much as 12 ^{o}C***

5. GOOD COMPRESSIVE STRENGTH

- ***Exceed or achieve the minimum Bend Strength of 2.25 N/mm2 required for pedestrian and light vehicular traffic without adding synthetic rubber***


BUMICON™
ADVANTAGES

1. BUMICON PROVIDES LARGE BUFFER CAPACITY FOR STORM WATER DRAINAGE

- ***A 420 mm thick BUMICON layer provides buffer for 10 hours of 10 mm/hr rainfall assuming percolation rate of ground to be 3.6 mm/hr***

- ***BUMICON helps to significantly alleviate or even prevent flash floods by retaining storm water and allowing it to drain through percolation and evaporation***

BUMICON ADVANTAGES

- ***BUMICON helps to manage the storm water within a site and reduces the accumulation of downstream run-off***
- ***Thickness of BUMICON can be adjusted to suit specific site requirements***
- ***The thicker BUMICON is, the larger the volume of storm water it can retain***

BUMICON ADVANTAGES

- ***Rainfall classification:***

Classification Table

Rainfall Intensity	Description	Observation
> 20 mm/hr	Very Heavy Shower	Conversation inaudible
10 ~ 20 mm/hr	Heavy Shower	Big puddles; noisy; wet even with umbrella
5 ~ 10 mm/hr	Shower	Slight puddling; rain drops audible
1 ~ 5 mm/hr	Rain	Wet ground with no puddles
< 1 mm/hr	Drizzle	Ground not visibly wet

BUMICON ADVANTAGES

- ***Sample computation of BUMICON thickness based on buffer capacity requirement:***

Parameter Table

Rainfall Intensity	10 mm / hr
Percolation Rate of Ground	3.6 mm / hr
Rainfall Duration	5.5 hrs
Average proportion of pore spaces in BUMICON layers of wearing course, base course and road base.	0.152

BUMICON ADVANTAGES

- ***Sample computation of BUMICON thickness based on buffer capacity requirement:***

Required thickness of BUMICON =

$$\frac{\left(\text{Rainfall Intensity} - \text{Percolation Rate of Ground}\right) \times \text{Rainfall Duration}}{\text{Average proportion of pore spaces in BUMICON layers}} = \textbf{230 mm}$$

BUMICON ADVANTAGES

- ***Comparing BUMICON and permeable asphalt:***

Comparison Table 1

	Permeable Asphalt	BUMICON
Total Thickness	240 mm	230 mm
Wearing Course	40mm	30 mm
Sand / Base Course	100 mm	50 mm
Road Base	100 mm	150 mm
Average % Pore Space	0.105	0.152
Buffer Capacity for 10 mm/hr	240 min	**330 min**

BUMICON ADVANTAGES

- ***With a thinner layer, BUMICON provides almost 40% higher buffer capacity than permeable asphalt for a rainfall intensity of 10 mm/hr***

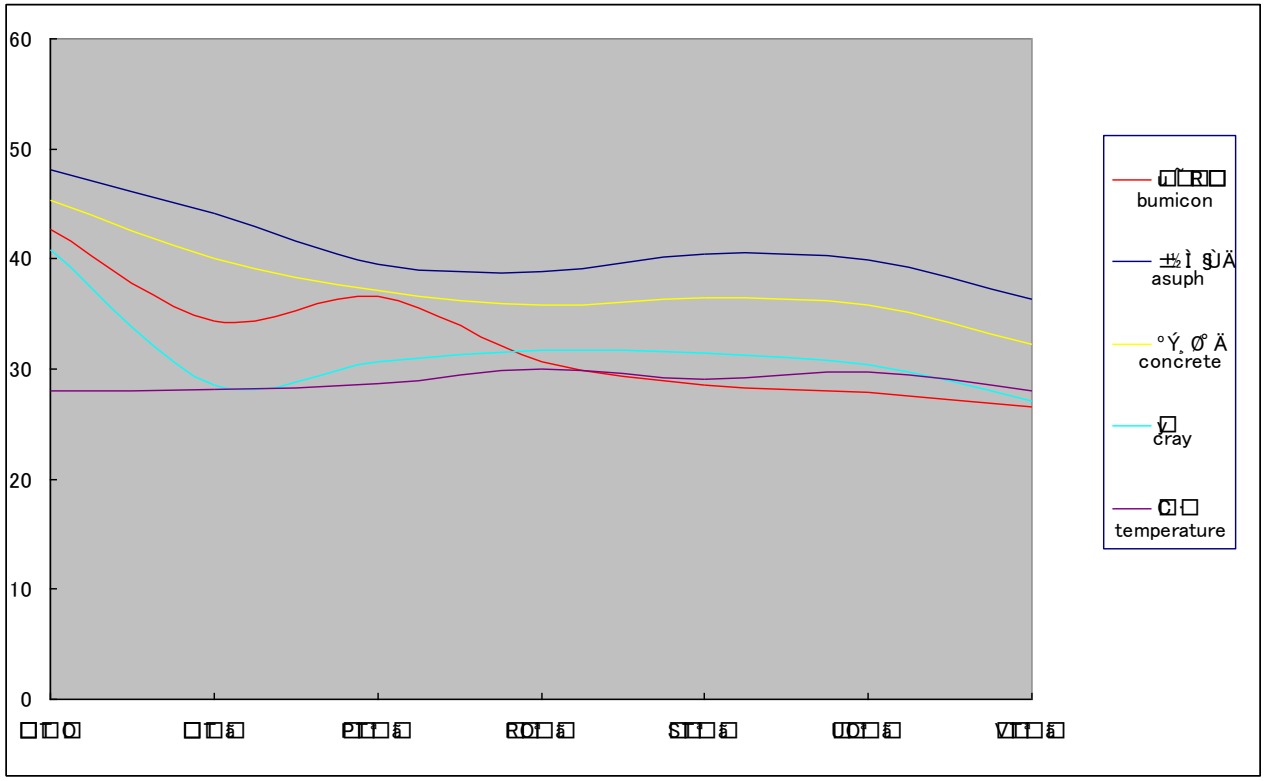
- ***BUMICON is 40% more permeable than permeable asphalt.***

2. BUMICON REDUCES SOLAR HEAT GAIN

- ***BUMICON slows down solar heat gain due to its high volume of air pores***
- ***BUMICON cools down its surface temperature through evaporation of storm water retained in its pores***
- ***Applied extensively, BUMICON can help to alleviate the Heat Island Phenomena by reducing surface temperature***

BUMICON ADVANTAGES

Comparison of surface temperature between BUMICON, asphalt and concrete



BUMICON ADVANTAGES

- ***Surface temperature of BUMICON can be cooler than concrete by as much as 8 ^{o}C, and asphalt by as much as 12 ^{o}C***

3. BUMICON IS MORE COST EFFECTIVE AND DURABLE

- ***Synthetic rubber, which constitute 13 percent of total weight of permeable concrete, is almost 60 times more expensive than other raw materials***

- ***Synthetic rubber used in permeable concrete does not contribute to the water retentive capacity***

BUMICON ADVANTAGES

- ***Permeable concrete has less than 50% of the pore spaces of BUMICON and therefore, has significantly lower water retentive capacity than BUMICON***

- ***Unlike the synthetic rubber used in permeable concrete, BUMICON is not subject to UV and bacterial degradation***

- ***Synthetic rubber tends to attract dust due to static charges on its surface, BUMICON does not have this problem***

BUMICON ADVANTAGES

- ***Comparing BUMICON, permeable asphalt and permeable concrete:***

Comparison Table 2

	Permeable Asphalt	Permeable Concrete	BUMICON
Retentive Capacity	25 mm/m^2	25 mm/m^2	35 mm/m^2
Percolation Rate	0.1 mm/s	0.1 mm/s	1 ~ 3 mm/s
Bend Strength	≥ 4 N/mm^2	≥ 4 N/mm^2	≥ 2.25 N/mm^2
Surface Temperature relative to BUMICON	12 ^{o}C	8 ^{o}C	0 ^{o}C
Not affected by UV & Bacterial Degradation	**x**	**x**	✓


BUMICON™
APPLICATIONS

PEDESTRIAN PLAZA

Sensouji Temple, Asakusa, Japan

PEDESTRIAN PLAZA

Sensouji Temple, Asakusa, Japan

B U M I C O N MISAWA Ltd

TEMPLE COURT YARD

Sensouji Temple, Asakusa, Japan

B U M I C O N MISAWA Ltd

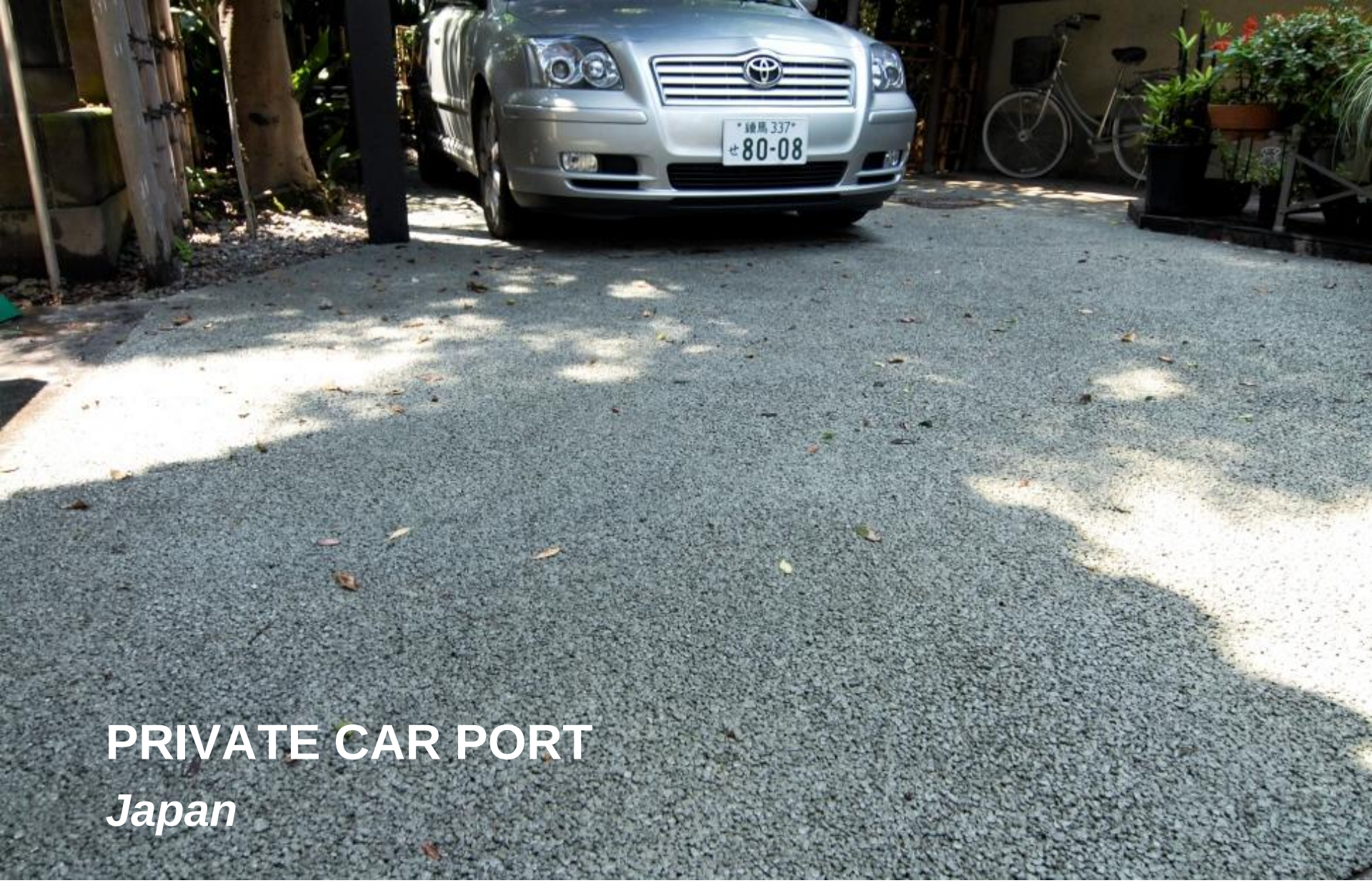
TEMPLE COURT YARD

Sensouji Temple, Asakusa, Japan

PUBLIC CAR PARK

Japan

BUMICON MISAWA Ltd



PRIVATE CAR PORT

Japan

BUMICON MISAWA Ltd

PRIVATE CAR PORT

Japan

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BUMICON MISAWA Ltd


GARDEN PATH
Japan


PRIVATE COURT YARD
Japan

ODD SPACES

Japan

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