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### Short Communication

## Applications of environmental friendly concrete in Thailand

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#### ABSTRACT

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Nowadays, due to the ecological issue is worldwide - critical concerned and various attempts have been done in order to reduce the global warming phenomenon. This paper, therefore, present some of attempting in order to apply the environmental friendly concrete in Thailand for better environmental applications. The various environmental applications viz., housing sidewalk, cover of gutter, gardening decoration, urban footpath, and alternative application for greening the roof with hydroponic cultivation technique or irrigation channel is now being attractively used in Thailand.

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### 1. Introduction

“Environmental friendly concrete” or “Porous concrete” is a water permeable concrete with intentionally incorporate of continuous void inside which greatly differ from general impervious concrete, the physical feature is given in figure 1. With this special property, environmental friendly concrete is, therefore, can be applied for numerous applications especially for environmental use (Japan Concrete Institute, 2004). A great successful applications of environmental friendly concrete use in Japan led by Professor Shigemitsu Hatanaka, Mie University and then spreading out to Thailand with a strong collaboration to Khon Kaen University and Ubon Ratchathani

University. Ongoing research work in Thailand and the investigation of local material, the environmental friendly concrete block was then successfully made with void ratio of approximately 30% as shown in figure 2.



Fig. 1. Permeability of environmental friendly concrete.



Fig. 2. Environmental friendly concrete block.

## 2. Applications of environmental friendly concrete in Thailand

### 2.1. Housing sidewalk

One of the outstanding properties of environmental friendly concrete is the heat adsorption and decrement of the reflection of sunlight from outside into the house. With these superior properties than conventional concrete, it makes porous concrete be more environmental friendly concrete and be attractive for the home maker in order to make the house cooler (see figure 3). In Bangkok, Thailand, some of the land and housing company grasps this alternative issue to promote their project as “Green village”. With this agreement to construction industries of Thailand, it is expected that in coming decade, the environmental friendly concrete will be widely use in Thailand and be the new trend of greening concrete standard. Recently in Thailand, the “Thai Green Building Council” has been established with the incorporation between The Engineering Institute of Thailand Under HM The King's Patronage (EIT) and Association of Siamese Architects under Royal Patronage (ASA) as concern to the increasing of environmental crisis.



Fig. 3. Environmental friendly sidewalk.

## 2.2. Landscape-gardening decoration

Figure 4 shows the application of environmental friendly concrete block for landscape and gardening decoration such as “Gardening sidewalk” or can also be applied as the vertical garden (see figure 5). The water absorption properties of environmental friendly concrete block can keep the moisture inside the block almost 48 hours (at 20°C). With this beneficial property, the environmental friendly concrete block, therefore, is recommended to use for the housing plants which need longer period of watering. Furthermore, the excessive runoff in rainy season can be kept or refill to balance groundwater system.



Fig. 4. Environmental friendly concrete block for landscape and gardening decoration.



Fig. 5. Vertical garden.

Regarding to the gardening sidewalk, the skid resistance is very important function for the aging people including the small kids, who spend quite long period of time in their houses, hence the reduction of the probability of accident in household area. Figure 6 exhibits the application of environmental friendly concrete block for recreational area.



Fig. 6. Environmental friendly concrete block for recreational area.

## 2.3. Cover of gutter

One of the attractive and useful applications is to use as a cover for gutter surrounding the houses area. In Thailand, most of the gutter's cover is made from steel or impervious concrete. One of the problems in case of

steel use is the rust and can be easily deteriorated by water or chemical agent from factory and household waste water. The use of environmental friendly concrete is satisfactory to drain the runoff water from the rain and waste water with rather high strength capacity and longer service life than the steel gutter's cover and also increase the land use area nearby houses as shown in figure 7.



Fig. 7. Environmental friendly concrete block for cover of gutter surrounding the house.

#### 2.4. Hydroponic cultivation

A major cause of the urban heat island phenomenon, especially in a big city around the world is due to lacking of the green zone. So far this problem cannot be solved by relevant authority. On the contrary, as the city development has taken place and more expanded, the impervious area by constructional concrete has been then replaced. Therefore the higher temperature in the big city can be undoubtedly expected. One of the attempts is to green building roof deck with environmental friendly concrete using the hydroponic cultivation technique. With the approx. dead load of  $80 \text{ kg/m}^2$  (thickness of 4.5 cm) the environmental friendly concrete block is therefore the alternative choice for greening the roof deck in big city area to increase the green zone and reduce the global warming phenomenon, respectively. Furthermore, application for irrigation channel with environmental friendly concrete block would also be a choice to restore greening environment as shown in figure 8.



Fig. 8. Hydroponic cultivation and irrigation channel application with environmental friendly concrete block.

#### 2.5. Urban environmental friendly footpath

In Thailand, the general prototype of urban footpath is made from reinforced concrete and impervious floor block. Environmental friendly concrete is, therefore, strongly recommended to use in order to reduce the rising temperature, especially in large city or urban area with relatively superior performance e.g. water permeable material, lower heat reflection and etc. Figure 9 shows the example of the environmental friendly footpath prototype in urban area.



Fig. 9. Urban environmental friendly footpath in Thailand.

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