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Kinaiyahan

Bantay Kinaiyahan is a regular publication of the Interface Development Interventions, Inc. to provide the public with relevant and concise information on pressing watershed issues

Watershed Issues in Brief



MAINSTREAMING PERMEABLE PAVEMENTS

Eco-friendly Paving Alternatives in Keeping Davao City Green and Sustainable

Davao City's Rapid Urbanization

Davao City has become one of the Philippine's fastest-growing cities, with its reputation for being safe and disciplined, culturally diverse, with livable geography and high-quality water resource attracting both national and international migrants. With a 2.3% annual population growth, the city which is home to 1.6 M people based on the 2015 census (projected 1.9 M in 2016), is considered the third most populous city in the Philippines. Population increase leads to increased demand for residential, commercial, industrial and institutional establishments constructed in the urban areas and expanding in the rural areas. Consequently, this results in conversion of surfaces to impermeable areas such as roofs, roads, pavements and car parks which rainfall could not infiltrate naturally in order to recharge ground waters and aquifers.

The Value of Open and Green Spaces

Because of the change in natural landscapes in urban areas, the city's drainage systems is put into overload resulting in flooding. Green spaces have to be preserved as much as possible to reduce rainwater run-off and try to maintain balance in our ecosystem cycles.

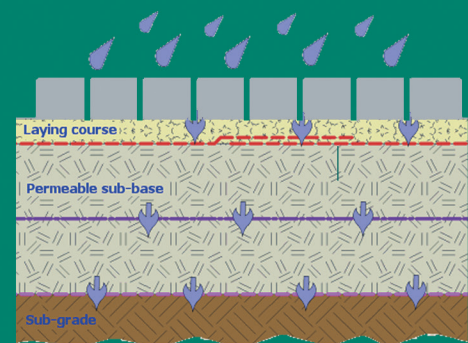
- PD 1216 (for residential development) - required the allocation of 30% of the total area of subdivisions with at least one hectare for open spaces.
- PD 1096 (National Building Code of the Philippines) Revised IRR 2004 - owners can choose between paved/tiles (hardscape areas) or unpaved areas with exposed soil and plants
- Comprehensive Zoning Ordinance of Davao City 2013 - requires owners and developers to set aside additional 10% green space on top of the 30% open spaces required by PD 1216 for projects with at least one hectare



Aerial shot of people's park, one of the major public parks in Davao City. (Photo by Patricia Borromeo)

Permeable Pavements

The permeable pavement system is a storm water management facility that allows water to move through void spaces within the pavement and eventually infiltrate into underlying soils. It is one of the alternative options eyed to solve the environmental problems caused by conventional concrete. Since its origins, the concept of permeable pavements was developed to reduce floods, raising water tables and replenishing aquifers.



Basic Layering System (c) pavingexperts

Many countries are using permeable pavements for their multiple benefits. Designed using porous materials to allow rainwater to pass through, they are the sustainable alternative for patios, plazas, parking spaces, driveways, low-traffic roads, bicycle lanes, pedestrian walkways and even for home garages.

Designers and planners choose permeable pavements because they reduce run-off volume, mitigate run-off peaks, and sequester many forms of pollution. Other benefits include groundwater recharge, minor evapotranspiration losses, light reflectivity (albedo) and visual improvement such as growing vegetation in its void spaces to have greener ambience.

Types of Permeable Pavements

The main difference among each pavement type are the total void space, spatial arrangement of the underlying pervious layers, and structural strength. There are types available in global market which are widely used by establishments.

Economic and Aesthetic Benefits

- Eliminates costs for retention basins, curbs, gutters, and other water collection installations
- Lower installation costs (no underground piping, storm drains, or sloping/grading needed)
- Low life-cycle costs with an equal life expectancy to that of regular concrete: 20 to 40 years when correctly installed
- Combines infiltration and pavement, thereby reducing the amount of drainage canals. This is important in urban areas with high land prices and highly developed sites with insufficient space for storm water drains or detention.
- Creates green space (grass groundcover, shade from tree canopies, among others)



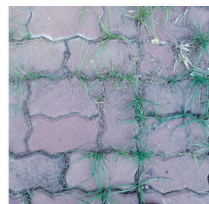
Permeable Concrete (PC)

- ✓ Pedestrians (sidewalk, pathway)
- ✓ Bicycle lanes, open plazas and patios
- ✓ Light vehicle parking spaces
- ✓ Low-medium traffic roads (driveway, auxiliary road, street, avenue)
- ✓ PWD access pedestrian/ramp
- ✓ Heavy equipment parking spaces (motorpool, stockyard)



Concrete Grid Pavers (CGP)

- ✓ Light vehicle parking spaces
- ✓ Pedestrians (sidewalk, pathway, ramp)
- ✓ Low traffic roads (driveway)
- ✓ Open plaza and patios
- ✗ PWD access (pedestrian, ramp)
- ✗ Heavy equipment parking spaces (motorpool, stockyard)
- ✗ Low-traffic roads (street, avenue)
- ✗ High traffic roads



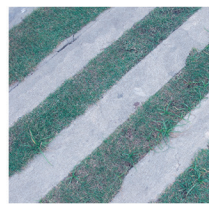
Pervious Pavers (PP)

- ✓ Low-traffic roads (driveways)
- ✓ Bicycle lanes
- ✓ Open urban plazas and patios
- ✓ PWD access (pedestrian, ramp)
- ✓ Light vehicle parking spaces
- ✓ Pedestrians (sidewalk, pathway)
- ✗ Heavy equipment parking spaces (motorpool, stockyard)
- ✗ High traffic roads



Single-sized Aggregate (SA)

- ✓ Heavy equipment parking spaces (motorpool, stockyard)
- ✓ Heavy equipment parking
- ✓ Industrial stockyard/parking space
- ✓ Light vehicle parking spaces
- ✓ Low traffic and low speed roads
- ✗ Bicycle lane
- ✗ Pedestrian (sidewalk, pathway)
- ✗ PWD access (pedestrians, ramps)
- ✗ High traffic roads



Concrete Pavement Cutouts (CC)

- ✓ Light vehicle parking spaces
- ✓ Pedestrians (sidewalk, pathway, ramps)
- ✓ Low traffic roads (driveways, auxiliary roads, streets)
- ✓ Open urban plazas and patios
- ✗ Bicycle lanes
- ✗ PWD access (pedestrian, ramp)
- ✗ Heavy equipment parking spaces (motorpool, stockyard)
- ✗ High traffic roads

Permeable vs. Conventional Paving

Most urban development use conventional concrete paving, although it poses ecological disadvantages, since it requires easy labor and quick construction. While permeable paving is a relatively new trend, it offers a range of ecological benefits:

Concrete Pavements	Permeable Pavements
Contributes to drainage clogging and run-off water flooding	Reduces water run-off up to 95% ² that would otherwise add to the water in canals, drains and sewers during storms and heavy rain
Blocks natural sequestration for carbon and other pollutants	Helps in filtering and trapping pollutants ³ up to 85% of undissolved pollutants, including CO ₂ and heavy metals
Increases atmospheric heat	Produces surface cooling ⁴ , and channels vital air and water for urban trees to grow”
Contributes to pollution risk	Helps prevent salt seawater intrusion in coastal areas and protects critical watershed areas in sub-urban areas



Establishments with Existing Permeable Pavements in Davao City

The Interface Development Interventions Inc. conducted a research on establishments using permeable pavements in the central business district of Davao City. Out of the 20 establishments surveyed, five establishments were selected as case studies based on the availability of documents and willingness of the management to go through the interviews. The five types of permeable pavements were then assessed based on the data gathered through the case studies. For typologies not covered in the case studies, existing studies and an expert in landscape and environmental architecture were consulted.

Majority of the 20 establishments surveyed (80%) used permeable pavements in their entrance ramps, path walks, patio and driveway while the rest used it in their entrance ramps, path walks, patio and driveway. Most of the establishments also used the concrete grid paver (CGP) type, widely available in the market and opted for its aesthetic value, especially when covered with grass. This was followed by single-sized aggregate (SA) which was used in parking spaces or low traffic roads.

Case Studies Observed Advantages of Permeable Pavements

Five establishments selected for the case studies represented varied business type and land usage. Anisabel Suites and Rekado Filipino Comfort Cuisine represents small-scale commercial lodging and restaurants, Davao Light Admin Office for large-scale offices, Ateneo de Davao University Gradeschool for educational institutions and Toyota-Davao Catitipan Workshop for industrial and manufacturing factories.

5/5

Reported no major flood cases after construction, claimed permeable pavements helped manage storm water runoff



All cases affirmed permeable pavements reduce “urban heat effect” especially during hot or dry seasons



4 out of 5 applaud permeable pavements contribution to the good condition of urban ecosystem



Anisabel Suites/ASF Building

Owners used to cover large windows with thick blinds due to heat reflectance. Now, with grass pavers, even without the covers, the establishment is cooler and more attractive, with the interiors more visible to the customers.



Ateneo de Davao University Botanical Garden

Permeable Pavements’ Easthetic Quality and the capability to reduce heat and glare, is very pleasant and student-friendly. Psychologically, green color of the grass pavement contributes to the “light and calm” environment in the school, making it conducive for learning for both students and staff.



Davao Light Power and Co. Admin Office

Its office is located in a flood-prone area, with flood sometimes reaching to knee-level due to its low-elevated entrance ramp. In 2015, the establishment had a major renovation which include 80-vehcile parking spaces and roads converted into permeable pavements. Since then, no recorded cases of flooding and ponding after the renovation.



Rekado Filipino Comfort Cuisine

Customers appreciate the grass pavements, contributing to a more relaxing and cozy ambiance of the place. Overall aesthetics attract more customers.



Toyota-Davao Catitipan Workshop Stockyard

The loose single-sized aggregate pavement design improved the underground soil quality and contributed to the healthy condition of Talisay trees and urban ecosystem.



How much does it cost?

There are plenty of options on permeable pavements depending on the type, quality and layering system. Prices range from P180-P200 for each turf to P300-P1,500 per square meter which includes turf, base compaction and grass supply.

Policy Recommendations



Permeable pavements shall be required in local building permit application process.



The City Engineers Office (CEO) shall present different permeable design options to building permit applicants and regulate the permeable design types based on appropriate usage as proposed.



Local Government shall allot incentives to applicants with permeable paving systems, including tax reduction and faster building permit processing.



Permeable pavements should be featured in the drafting of a local "green" building ordinance as part of Sustainable Drainage Systems (SuDS) and as part of the development plan to reduce percentage requirements for construction of drainage canals.



The City Government should lead the adoption of the design among government offices and government-owned buildings, especially for public parks, waiting sheds, pedestrians, crosswalks, among other public spaces.



Permeable pavements shall be required in both public and private schools, administrative offices, and hospitals.



Intensive requirements in terms of the use of permeable pavements shall be given to large shopping malls and commercial centers since they have wide parking areas.



For industrial establishments, single-size aggregate is recommended to be used for low traffic roads and parking spaces, stockyards and motorpools.



The use of pervious paving systems is preferred in water resources zone but they should be constructed with appropriate considerations, such as requiring geo-textile filtration sheets for parking spaces if at least 100 feet from drinking water supply wells, streams, and areas of high aquifer recharge.



Coun. Mabel Acosta, one of the reactors during the permeable research presentation, welcomed the options that the permeable technology offers, saying that environment and progress can go together. (Photo by IDIS)

Highlights Permeable Pavements Research Presentation

IDIS environmental research specialist Lemuel Ibanez-Manalo debunked the premise that permeable pavements are expensive and that they only offer environmental benefits. This study showed that permeable pavements have the potential to produce economic savings for the city's sewerage systems and is a solid investment for the city's disaster risk reduction and management.

The study concluded that as Davao City pushes towards sustainable growth, the City Government should maximize permeable pavements as a valuable alternative and simple strategy to spare more "true open spaces" for the city.

"Progress and environment need not cancel each other, rather complement each other. We cannot stop urbanization but we need mitigating measures so that sustainable development can be attained."

–Councilor Mabel Acosta

"I recommend that you submit this to our Bureau of Research Standards since all technology, whether old or new, need to pass the Bureau's test before we can implement them."

– Engr. Allain Sotto, DPWH

"I used to think permeable was purely aesthetic. But it's only when we started using them that we realized their benefits. We need to intensify IEC on this since not many people know the value of this [technology]."

– Fermin Edillon, DLPC

Endnotes

¹Philippine Statistics Authority www.psa.gov.ph

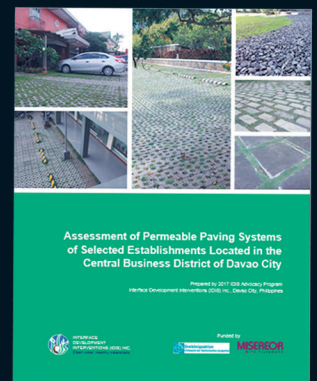
²Su Lin Terhell et. al. (2015) study show that permeable pavements reduce runoff up to 95% as compared to 32% runoff of impermeable laboratory asphalt pavements.

³Fach and Geiger (2005) laboratory testing results proved that permeable paving can remove between 65-85% of undissolved pollutants and heavy metals such as cadmium, zinc, lead and copper.

⁴University of California Pavement Research Center tests on permeable vs conventional pavements showed pavements blocks have the lowest heat temperature resulting in 52°C-49°C.

Assessment of Permeable Paving Systems of Selected Establishments in Davao City's Central Business District

Download the electronic copy of the study at www.idisphil.org



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