

Going to Extremes: Principals of Plastic Under Extreme Conditions

INTRODUCTION

Matrax, Inc. is a solution-based design, engineering, manufacturing and distribution company specializing in a range of matting products including plastic, timber and steel. Matrax's products and the expertise of our personnel have been utilized domestically and internationally in the special event, construction, power transmission, mining and energy exploration industries in a variety of applications that have included warehouse flooring, natural and artificial turf protection, construction of access roads over soft or environmentally sensitive ground and spill containment liner protection.

HIGH DENSITY POLYETHYLENE (HDPE) PROPERTIES

When a thermoplastic matting system is chosen as the best solution for a project it is important to consider the effects extreme environmental conditions will have on the system's performance. All thermoplastic materials will soften when exposed to high heat and will become brittle when the temperature is cold to varying degrees depending on the type of thermoplastic. High Density Polyethylene (HDPE) is a thermoplastic in the polyethylene family, made from petroleum, and is known for its high strength to density ratio. The density of HDPE can range between 0.93 to 0.97 grams per cubic centimeter. Although having a density only slightly higher than low-density polyethylene (LDPE) HDPE has stronger intermolecular forces and tensile strength than LDPE. HDPE can also withstand higher temperatures (120°C/248°F for short periods, 110°C/230°F continuously). HDPE maintains its physical properties over a wider range of temperatures than other thermoplastic materials making it the first choice for manufacturing the Matrax plastic matting system for most applications.

ADVANTAGES

Without modifications, on the high temperature end the HDPE will soften and lose its strength around 230°F and on the low end become brittle as the temperature approaches its "glass" transition temperature of -80°C (-112°F). The load bearing capacity and resistance to cracking will vary throughout this temperature range as it becomes softer at high temperatures and less ductile or brittle at lower temperatures. A primary attribute important to the end-user is the behavior of the HDPE matting system as temperatures vary. In other words, daily temperature swings at a specific site or overall temperature extremes based on the physical location of a project will have an effect on the matting system's performance. Daily temperature swings cause expansion and contraction of the HDPE. Matrax products are designed with a unique "shiplap" connection that incorporates the expansion/contraction of the panel within the useable range without buckling, warping, disconnecting or otherwise suffering degradation and loss of or a reduction in use or

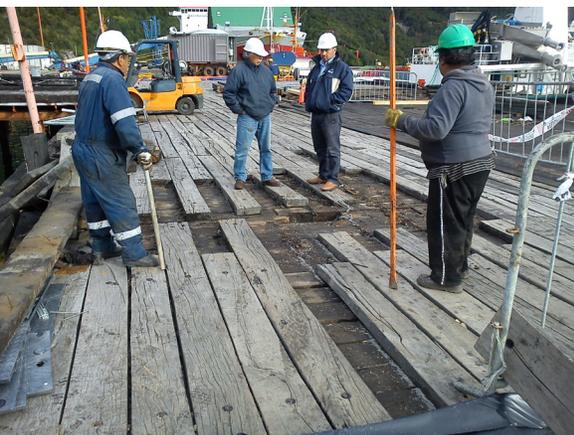
serviceability. Extremely hot or cold job locations can pose a challenge to the load carrying characteristics of the system. Matrax uses additives to formulate the best possible material for each location.

Matrax products are designed to withstand a wide range of environmental conditions including variations in temperature, strong winds, variable moisture conditions, and chemical spillage. Our products are also durable and can serve as temporary flooring that can easily hold palletized freight and permit the safe movement of fork lifts without buckling, bowing, or cracking. Other applications include temporary ground covers to reduce turf disturbance, temporary access/construction roads, and temporary construction platforms replacing concrete; an expensive alternative to place and remove.

Two recent plastic matting applications presented challenging tests of our products in extreme conditions. In both cases Matrax demonstrated the flexibility of our products' design and application in responding to the needs of our customers. Matrax products are designed and engineered for harsh conditions and we can guide customers in the selection of the correct product for each specific application.

CASE STUDY NO.1: PUERTO CHACABUCO, CHILE

Matrax worked with the Chilean port of Puerto Chacabuco to upgrade the existing infrastructure by installing our plastic matting system as part of a modernization of its port facilities in accordance with the National Fishing Services of Chile (known as "SERNAPESCA). Puerto Chacabuco is the main port of the region and is used extensively by the local fish farming industry. The requirements of the Matrax matting used in this application were that it be non-porous, capable of handling vehicles, have the ability to withstand high levels of moisture (Puerto Chacabuco receives an average of 108 inches [2741 mm] of precipitation per year occurring on an average of 172 days) as well as temperatures, on average, ranging between a high of 93oF (33.9oC) and a low of 18oF (-7.8oC), and strong winds reaching gale force during the winter months of July and August.



Pre-Installation

The challenge faced by Port Chacabuco was that the fish farming industry that utilizes the docks for loading and unloading its product and supplies was experiencing a recurrence of harmful parasites and contaminants that adversely affected their productivity. Attempts were made to address the issue by decontaminating the equipment through a cleaning process on the docks. The problem was that the some

contaminants were being washed back into the sea but an undesirable concentration of these parasites and contaminants remained in the porous wood from which the docks were constructed. It became impossible to eliminate the issue. The Matrax plastic matting system was used in conjunction with a liner and water treatment process to solve the problem. A plastic liner material was used to cover the docks allowing for all the contaminated wash water to be recovered while restricting the contaminants from reaching the wood structure below. The Matrax system was placed over a liner to allow for a variety of operations to continue on top of the liner without compromising it while also providing a nonporous surface that could be completely decontaminated.

With the successful completion of a yearlong test of the Matrax matting system installation, Puerto Chacabuco is now in compliance with regulatory legislation that took effect the same day as the National Fishing Services of Chile approved the project. Puerto Chacabuco was awarded the official “Biosafety Certification” and the facilities are now being used regularly. The Matrax plastic matting solution has become the new standard for facilities in Chile trying to achieve certification under the new legislation.



Post-Installation

CASE STUDY NO.2: ALBERTA, CANADA

In contrast to the Chilean project conditions, Matrax worked with its partner, Tegra Structures, to supply Suncor Energy with the same Matrax matting system as a solution for flooring requirements in temporary fabric buildings to be used for warehousing. This project, located in Fort McMurray, Alberta, Canada is in the harsh climate of northwestern Canada which created challenges for Matrax and our design and engineering group.

In 1967 Suncor Energy pioneered commercial development of Canada’s oil sands, one of the largest petroleum resource basins in the world. Suncor extracts and upgrades oil sands into high-quality, refinery-ready crude oil products and diesel fuel. The refined Suncor products are marketed through more than 1,450 retail outlets throughout Canada. Suncor explores for, develops, and produces conventional oil and natural gas from both onshore and offshore developments. Suncor Energy has requirements for its operations that must be met successfully, safely and be environmentally sound. Sustainability is a key component to all of Suncor’s operations.

Given the extreme cold temperatures experienced in Alberta Province of western Canada, extending to typical winter temperatures of -6°F or below, the load bearing capacity

and durability of Matrax products under vehicular loading needed to be considered. The Matrax design and engineering team went to work to make modifications to our product to suit the demands of this harsh environment.

The alternative under consideration was to construct a concrete floor. Constructing a concrete floor would have required a prepared subgrade, placement of an open-graded stone a minimum of six inches in thickness, a plastic vapor barrier, and likely 4-6 inches of at least 4,000 psi steel reinforced concrete. When the use of the temporary structure was completed the concrete would require breakage with a hoe-ram or other heavy machinery, crushed, and disposed off-site all of which would have been extremely expensive and time consuming in this area of western Canada. Stone for the sub base is not available locally and would have had to be obtained from a source a significant distance from Fort McMurray, adding even more to the cost of the temporary floor.



The plastic Matrax matting system is a perfect solution to solve this problem and avoid an expensive concrete floor. The extremely low temperatures were beyond the capabilities of the standard plastic products so Matrax added plastomers (materials designed to alter the crystallinity of the HPDE) to the formula and manufactured flooring panels specifically for this Suncor Energy application. The modification of the HPDE with plastomers resulted in better

ductility, resistance to cracking and higher impact resistance; all important considerations for a floor supporting heavy freight moving on forklifts. The additives have a much lower “glass” transition temperature than the base plastic and will lower the temperature slightly but, more importantly, they allow the base plastic to remain ductile at much lower temperatures.

These project examples illustrate the depth of knowledge, flexibility and adaptability of the Matrax organization. Matrax excels because it analyzes a client’s operations carefully and develops ideal solutions for the specific application. Many years of combined material, manufacturing, design and field experience allow Matrax to develop products for extreme conditions. With a flexible approach to each project and a willingness to listen closely, Matrax takes a leadership position in the manufacturing and supplying of quality matting products. Our slogan “One Size Does Not Fit All” signifies our commitment to understanding the different needs of each client and responding to those needs on time and with the product most suitable for the application at hand.