

# Color-Safe Surface™

## Durable and Cost-Effective Treatment for Special Use Lanes and Pedestrian Areas

Written by the Technical Sales Team at Transpo Industries, Inc.

*Transpo Industries, Inc. is a transportation infrastructure safety and materials company founded in 1968. We are committed to using the latest technologies to develop innovative and effective solutions for the transportation industry.*

### Abstract

Cities large and small throughout the world are seeking ways to increase safety on roads and highways while improving traffic flow and reducing pollution. This white paper looks at the increased use and applications of color pavements and specialty pavement coatings for increased friction. It will also show that the proper material selection will result in durable, cost-effective solutions.

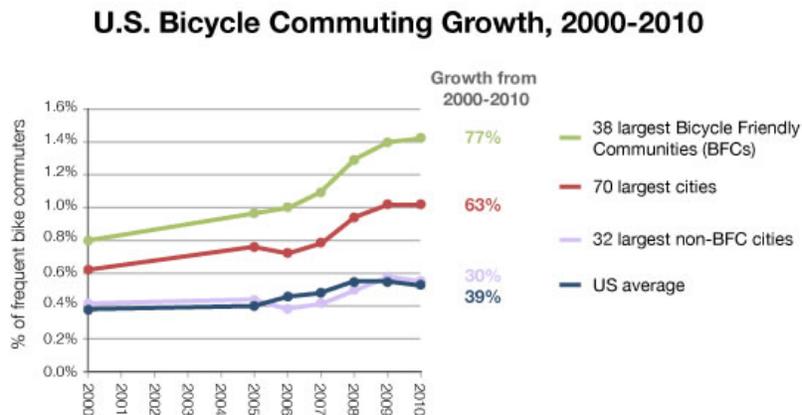
### Introduction

There is a demand for high-performance area markings for preferential lanes, crosswalks and pedestrian areas throughout the United States. Recognizing this, we combined our knowledge of the U.S. transportation industry with our resin supplier Evonik's past success, in Asia and Europe for over 20 years, to bring the re-engineered Color-Safe Surface to the United States. This high-performance material has been used on high-traffic volume highways in China, toll lanes in Japan and as bus and special use lanes throughout Europe.

## I. Special Use Color Pavement Demarcation

### BIKE LANES

As part of a world-wide effort to reduce greenhouse gasses, more and more people are using bicycles as a means to travel around urban areas. Cities have been working to develop and implement bicycle lanes adjacent to traditional vehicle lanes. The increase in the number of city workers and students commuting on bicycles is illustrated in Figure 1.



Sources: American Community Survey, League of American Bicyclists

Figure 1

Along with this increase in bicycle use the close proximity of bicycles and vehicles has caused engineers and planners to consider the safety of both types of users. Special colored pavement bicycle lanes have been installed and are being evaluated for their effectiveness with regard to safety. Some of the bicycle designated areas being tested are:

**Bike Lanes** – Painted lanes that enhance visibility and increase cycling lanes.

**Buffered Bike Lanes** – A diagonally striped lane between the bike and car lanes that provides no physical barrier from cars but offers some separation from traffic.

**Bike Boxes** – Advance stop lines for cyclists at key intersections about 10 to 15 feet ahead of the stop line for cars, increasing both visibility and safety.

**Bicycle Boulevards** – A modification of traffic-calmed streets specifically designed to facilitate cycling. Special pavement markings and signage are used to reinforce bicycle priority of such streets.

With each of the last three major federal transportation acts, funding for walking and cycling has increased considerably over the past two decades:

- 1988-1990: \$5 million prior to passing ISTEA
- 1992-1998: \$150 million under ISTEA
- 1999-2005: \$360 million under TEA21
- 2006-2009: \$1 billion under SAFETEA-LU

Funding has encouraged local and state governments to construct new and improved cycling facilities

## BUS LANES

It has long been known that efficient public transportation is the single biggest contributing factor to acceptance and increased usage. In an effort to reduce vehicle congestion, pollution and increase efficiency of public transportation, some cities have begun to install dedicated bus lanes along major commuter routes. This use of color pavement is expanding rapidly in the United States.



New York City recently conducted a research project with new products for its bus lanes. Color-Safe Surface was one of the products used in the survey. (Figure 2)

Colored pavements in these special use lanes inform riders of bus route locations while alerting other motor vehicle operators of the special use lane and prohibiting stopping or parking in the bus lane. In cities around the world bus lane violations are being reduced with color pavement overlays.

Figure 2

## CROSSWALKS

Color pavement is applied to crosswalks to increase safety in front of schools or areas with high accident rates in order to clearly inform drivers of a dangerous intersection.

An example of such an intersection is in Denver, Colo., at the intersection of Colorado Boulevard and Louisiana Avenue. On average two people were struck each year by oncoming vehicles; one year five people were hit. Since red crosswalks were installed, only three people were struck in three years. Highlighting the brightness and safety aspects of these markings, various local news stations recognized the Colorado Department of Transportation (CDOT) for its dedication to improving the safety of all road users at Denver intersections.

With increased pedestrian safety proven, CDOT then had to find a durable product. Paint/epoxy did not have the bright color or durability needed. Thermoplastic was expensive. Color-Safe Surface was chosen to use on three similar locations for its brightness and durability.



## PEDESTRIAN PLAZAS

In an effort to make cities friendlier to workers, residents and tourists some city streets are being converted into pedestrian-only plazas. Through the use of colored pavements, some incorporating unique artistic designs, pedestrians are assured that it is safe to move about without the fear of encountering a moving vehicle.



## HIGH FRICTION PAVEMENT SURFACE TREATMENTS

Traffic engineers have become acutely aware of the effects of lack of friction and the direct correlation to higher than normal vehicular accidents on both highways and rural roads. The number of crashes on wet pavements vs. total crashes is shown in Figure 3. With an understanding of this problem the Federal Highway Administration (FHWA) has developed a test program to determine the effectiveness of the application of high-friction surfacing materials. A

single application of Color-Safe Surface non-pigmented resin with a broadcast of skid-resistant aggregate is one of these types of systems. With the ability to hold the aggregate on the surface Color-Safe Surface's long-term performance can be predicted when using various types of broadcast aggregate. The toughness of Color-Safe Surface and its resistance to UV and temperature fluctuations make it a cost-effective solution to the skid-resistance problem.

### Number of Crashes on Wet Pavements vs. Total Crashes

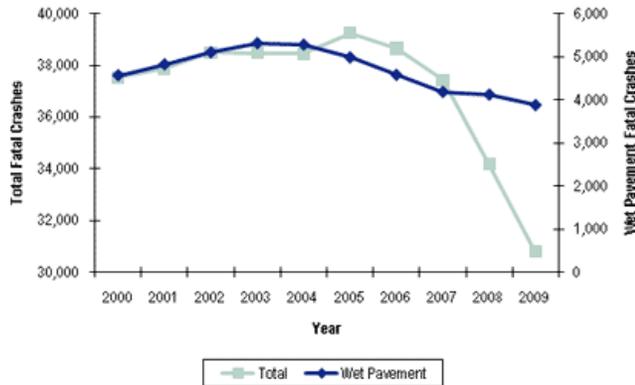


Figure 3

- 2000-2009: 371,104 fatal crashes in the United States
- 46,811 (12.6 %) of these crashes occurred on wet pavement
- Fatal crashes on wet pavement have consistently decreased from a high of 5,308 in 2003 to a low of 3,881 in 2009, a 26.9% reduction
- A significant proportion of wet pavement crashes occur on surfaces with inadequate pavement friction
- 70% of wet pavement crashes could be prevented or minimized by improving pavement friction

## II. Materials Used for Color Pavement on a Roadway Should Meet Requirements for Color Retention, Skid Resistance and Durability.

Currently most pavement area marking materials are based on standard paint/epoxy technology and do not exhibit long-term resistance to color fading, cracking and abrasion. Thermoplastic materials are also being used, but they are expensive and require special equipment for application.

Color-Safe Surface is the next-generation area marking and anti-skid surface system with more than a decade of proven history of performance and durability. It is available in a variety of high-definition colors and aggregate sizes; has excellent color retention; and its fast cure time allows the surface to be opened to traffic in as little as one hour. Applications are capable of obtaining full cure in a wide range of temperatures (40° to 100°F) without external heat sources. The material has excellent bonding strength to concrete and asphalt pavements allowing it to maintain its skid-resistant characteristics for many years of service.

### Application

Traditionally, area markings were applied using a multicoat application method that consisted of applying a base coat on the surface, broadcasting the aggregate, removing the excess aggregate and then applying a top coat.

Transpo Industries has reengineered the resin and aggregate mixture so that Color-Safe Surface can be applied in a single coat that is simple, quick, durable and cost effective. The single coat application significantly reduces the possibility of contamination that existed with the conventional multicoat application method. See Figure 4.

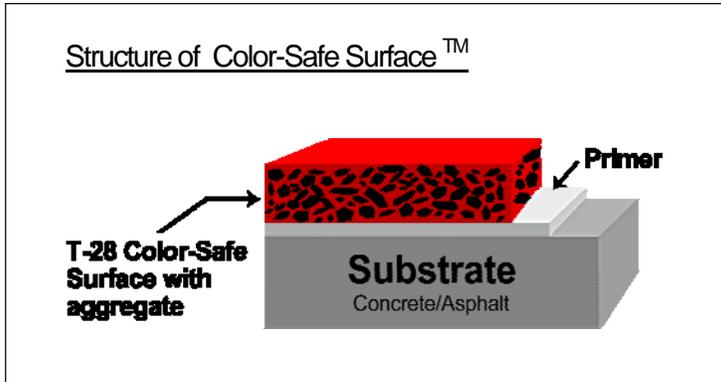


Figure 4

Durability and High Wear Resistance

Unlike most paint-based systems, the high wear resistance of Color-Safe will eliminate uneven wear in areas of high braking and turning.

The material has been used around the world and has exhibited excellent durability with a minimum service life of three years under high vehicular traffic volumes and was identified as one of the only road marking materials that passed the 4 million tire test. See Figure 5.

Wear performance simulation (performance turntable test according to EN 13197) was implemented by the AETEC in Madrid, Spain. Color-Safe received the highest possible approval class for road marking materials (P7) after running a simulation of 4 million cycles (= 40,000 vehicles per day for a period of four years). Color-Safe Surface is the only road marking material that passes the 4 million tire test. The minimum requirement for durable road markings is SRT (Skid Resistance) value of 45 after 4 million cycles. The various anti-skid aggregate properties of Color-Safe Surface measured consistently above SRT 50. See Figure 6.

Turntable test according to EN 13197 (Wear Simulation, Road Marking)

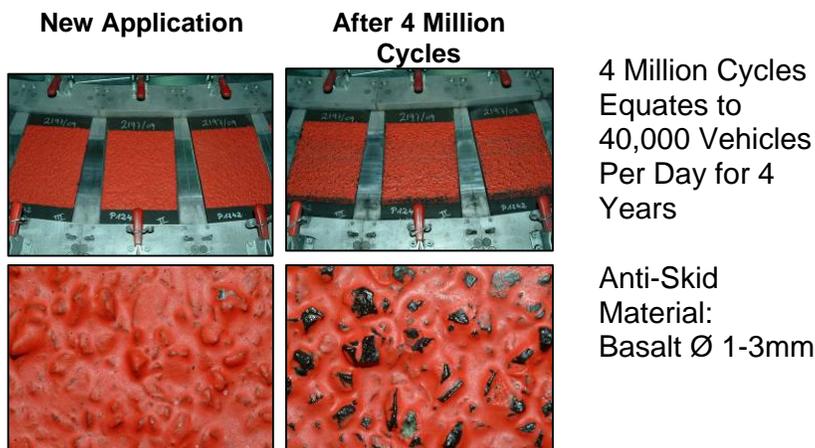


Figure 5

### High Wear Resistance Graph

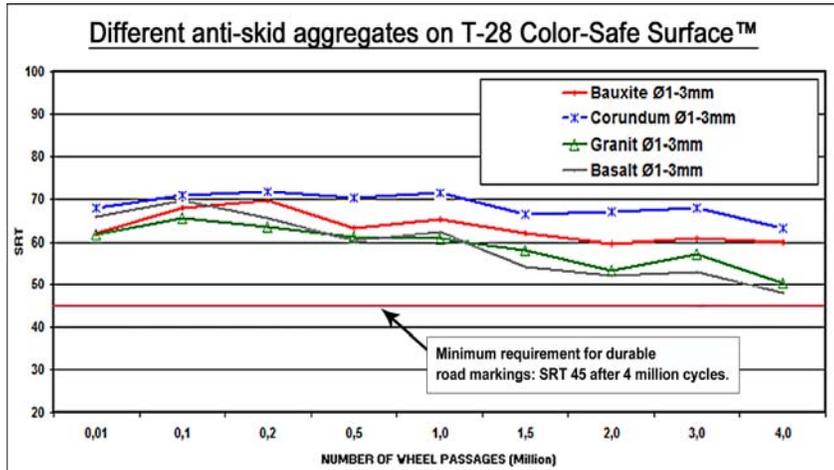


Figure 6

#### Adhesion

As an acrylic-based material, Color-Safe Surface has great adhesion to concrete and asphalt surfaces, which prevents perimeter cracking and age embrittlement. Acrylic resins exhibit superior interlayer bonding characteristics on various types of surfaces as well as on existing markings.

#### UV Resistant

The material is UV resistant, which allows it to maintain its high-definition color even after years of service and will not fade like conventional marking materials. Because of its excellent color retention, any required pavement cuts can be recoated with Color-Safe and the new application will blend uniformly with the original application. High thermal and mechanical stability in cold and hot climates allows the material to maintain its form even in adverse weather conditions.

#### Snowplow Impact and Road Salt Resistance

The acrylic resin is also resistant to salt, magnesium chloride and other de-icing chemicals, and fares well under adverse conditions such as abrasion from snowplows and freeze/thaw cycles.

#### Skid Resistance

Skid-resistant aggregates can be varied according to job specification. Both color coated or natural quartz, bauxite and corundum of different sizes are used to obtain the desired wear resistance and surface finish.

#### Maintenance

If maintenance or refreshing of material is needed after years of service life, simply clean the surface to remove dirt and contamination and apply new material. Due to the excellent inter-coat adhesion it is not necessary to remove the existing material.

#### Examples of Product Installation

Color-Safe acrylic resins have been used for/on: Bus lanes, toll lanes, as high anti-skid coating for highways and bridges, bicycle lanes, motorcycle lanes in Asia, speed zones, footpaths, pedestrian crossings, pedestrian areas/plazas, school zones, speed indicators, jogging/running tracks, speed bumps, parking lots/garages, ramps, curb markings, driveways and more.

## Physical Properties\*

Properties	Unit of Measure	Test
<b>Neat Resin</b>		
Elongation	70%	ASTM D638
Hardness	15-20 Shore D	ASTM D2240
Water Absorption	< 0.25%	ASTM D570
Pot Life @72 <sup>o</sup> F (22 <sup>o</sup> C)	15 Minutes	AASHTO T237
Solids Content	100%	ASTM D1644

\* To be used as general guidelines only

### Conclusion

Both the benefits of color treatments in modifying driver behavior and the increased public acceptance of color treatments is evident. The challenge facing municipalities is finding the appropriate material and the easiest implementation of that material without increasing maintenance costs.

Color-Safe Surface is easy to apply and repair and has a low life-cycle cost. It is great for demarcating bicycle paths, pedestrian plazas, toll lanes, school zones, bus lanes and other specially designated areas. It can also be used to improve the aesthetic appeal of historic towns, college campuses, parking lots and driveways. It has proven effective as a surface coat to enhance skid resistance on hazardous turns and other high-accident areas on asphalt and concrete roadways.

Color-Safe Surface's durable, high-definition color is your solution to creating and maintaining color pavements.