



City of Chicago
Richard M. Daley, Mayor

Department of Transportation

Thomas G. Byrne
Commissioner

30 North LaSalle Street
Suite 1100
Chicago, Illinois 60602-2570
(312) 744-3600
(312) 744-1200 (FAX)

www.cityofchicago.org/transportation

December 14, 2009

Paul Tisano, Acting Director
Office of Transportation Operations
Federal Highway Administration
1200 New Jersey Avenue, S.E., E84-403 HOTO -1
Washington DC, 20590

**RE: Request for Permission to Experiment
3D Pavement Markings for Crosswalks in High Pedestrian Crash Corridors (Short and Long Term Results)**

Dear Mr. Tisano:

In accordance with the guidelines set forth in the Manual on Uniform Traffic Control Devices (MUTCD), the City of Chicago formally requests Permission to Experiment for the use of 3D Markings on: 1) yielding to pedestrians in the crosswalk; and 2) the number of pedestrian crashes within a high crash corridor. Dr. Ron Van Houten of Western Michigan University will evaluate the efficacy of the markings and will conduct long term follow-up data analysis to determine if any initial results persist over time.

A. NATURE OF PROBLEM

Many drivers fail to stop or yield to pedestrians in marked crosswalks at locations without traffic control devices. Numerous devices have been tested nationwide to help reduce the pedestrian crash problem, many with only marginal success. Some devices that have proven effective are the HAWK and RRFB. Although both of these devices are less expensive than a traffic signal, cost might preclude the installation of these devices at all locations.

The City of Chicago would like to evaluate 3D illusions that will increase the salience of crosswalk pavement markings. It is reasoned that drivers will be more likely to look for the presence of pedestrians crossing and also be more likely to yield right-of-way to them if the markings appear to be raised in height. Although drivers may habituate to the illusions over time, it is further hypothesized that the illusions may produce better attention to the crosswalk than markings that do not appear to be raised. The collection of long-term data (one year follow-up data) can be expected to produce useful information on whether the effects of the illusions persist. If the effects persist it would provide evidence that the marking may be a useful tool that requires further experimentation; however, if the effects dissipate over time it will provide evidence against the use of this technology for long-term crash reduction.

B. PREVIOUS RESEARCH

Blomberg and Clevon (2006) evaluated the effects of 3D pavement markings on vehicle speed against a background of speed enforcement at two sites, both of which were collectors with a 30 mph speed limit, as part of the Heed the Speed pilot program in the city of Phoenix. The results of this study demonstrated that 3D pavement markings were associated with a 94% and a 24% increase in driver compliance with the speed limit, and a 62 % and 40% reduction in the percentage of drivers traveling 7 mph over the speed limit at the two respective sites. These reductions were observed to persist for three to four months after installation. Although these increases are substantial, and statistically significant, the results of this study are limited by the following three factors: 1) the absence of untreated sites to control for difference associated with time of year, such as weather, changes in road users resulting from tourism, or other variables; 2) the failure to collect longer follow up data to determine whether the effects persisted over time; and, 3) the failure to collect data to determine whether the effects persisted downstream of the markings. One limitation of using treatments of this type is that the effects are likely strongest at the location where the markings are installed. **One application that does not suffer this limitation is the use of 3D markings to increase yielding at crosswalks.**



In this application it is only desirable to produce an effect at the point where the markings are installed.

C. DESCRIPTION OF 3D MARKING, DEVIATION FROM MUTCD and IMPROVEMENT OVER EXISTING MUTCD STANDARD

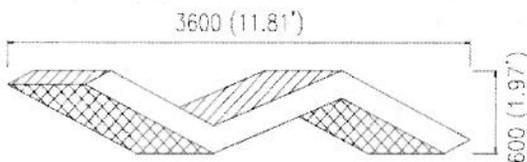
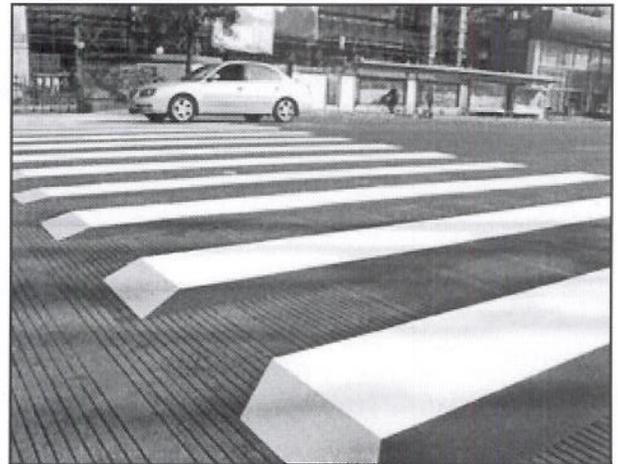
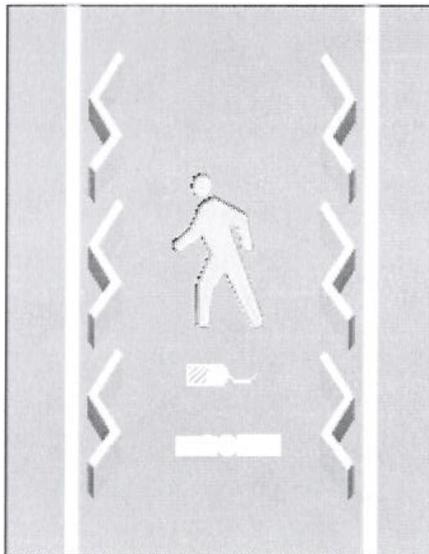
Description of the 3D markings: This type of marking consists of colored materials that are arranged in such a way as to produce a 3D effect suggesting a vertical deflection. These markings are illustrated below.

Deviation from the MUTCD: Standard markings specified in the MUTCD do not produce a 3D effect. The manual does not address the use of 3D markings.

D. ILLUSTRATION OF 3D MARKINGS:

“Look for Pedestrians” Raised Markings are proposed for Clark St. and Halsted St.

Raised Crosswalk Illusions are proposed for 79th St.



E. EXPERIMENTAL DESIGN AND DATA ANALYSIS

We will adopt a multiple baseline experimental design that examines the effects of two 3D material strategies at four sites. In a multiple baseline design, a treatment site is compared with a control site that is subsequently treated. This staged treatment approach controls for other variables that may have been correlated with the treatment at the first site, while later replicating the effect at the second site. By staging the treatment across sites, it is possible to control for community wide variables that may have been responsible for the treatment effect at the first treated site. By collecting longitudinal data it is possible to document that the change is closely associated with the treatment introduction at both sites. This design is diagrammed below.

	Week 1-4	Week 5 - 10	Week 11 - 16	Follow-up 4 months	Follow-up 8 months	Follow-up 12 months
Site 1	Baseline	3D Markings Installed				
Site 2	Baseline	Baseline	3D Markings Installed			

The streets selected for treatment are:

- Minor Arterials and/or Collectors
- Two-lane, two-way streets with parking allowed on both sides
- Locations with a crash history of several pedestrian crashes in the past three years

To assess the full effect of the 3D material, the following measurements will be taken at the two experimental and two control locations:

- Pre/post crash counts, both pedestrian and vehicle-to-vehicle. These will be further analyzed to determine which crashes were speed-related and which were rear-end vehicle events. In this case there will not be a sufficient number of treated sites to form any clear conclusions.
- The percentage of drivers yielding right-of-way to pedestrians.
- The percentage of hard braking by drivers of vehicle following drivers that yield right-of-way to pedestrians in a crosswalk.

Data will be recorded before and after the 3D markings are installed and follow-up data will be collected on a monthly basis for up to a year after installation. A time series statistical analysis will be employed along with the multiple baseline design to control for variables such as regression toward the mean and trends produced by other variables.

F. PATENT

It is our understanding that Sekisui Jushi is supportive of the use of their 3D material and have signed the waiver of rights.

G. TIME PERIOD and LOCATIONS

The 3D markings will be placed at crosswalks with a history of pedestrian crashes. Follow-up data will be collected for a minimum of one year to assess whether the effects produced by the markings diminish over time.

The table below shows the proposed treated and control locations.

Treatment Type	Status	Major Road	Minor Road	2006 AADT	Lanes	Speed
Raised Crosswalk Illusion	Treatment site Raised crosswalk	79 th St	Bishop St.	17,300	2 + Parking	30
	Control site Raised crosswalk	79 th St.	Lowe Ave.	19,200	2 + Parking	30
“Look for Pedestrians” Raised Markings	Treatment site Look for Pedestrians	Halsted St.	Buckingham Pl.	22,100	2 + Parking	30
	Control site Look for Pedestrians	Clark St.	Deming Pl.	12,600	2 + Parking	30

H. RESEARCH RESULTS

Research on the effectiveness of the 3D raised markings is currently part of a NHTSA contract awarded to Western Michigan University to reduce nighttime pedestrian crashes in high night crash zones. Results of this experiment will be reported in the NHTSA Final Report.

I. AGREEMENT TO RESTORE

In the event that data indicate the 3D markings produce a safety problem, the City of Chicago, Department of Transportation will remove the markings.

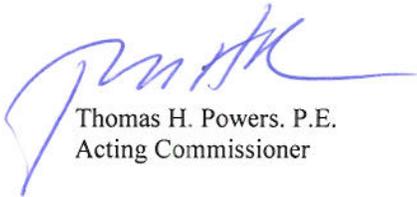
J. SEMI-ANNUAL PROGRESS REPORTS

The City will keep FHWA apprised as to the results with a report six months after installation and one year after installation.

In addition, the City will coordinate with the City of Philadelphia, although the exact form of 3D marking varies between the two cities.

We look forward to receiving FHWA approval to experiment with 3D Markings. If you have any questions please feel free to contact Chris Wuellner at (312) 744-3528.

Sincerely,



Thomas H. Powers, P.E.
Acting Commissioner

Originated by:



Luann Hamilton
Deputy Commissioner

THP:LH:CW:KG

c. Wuellner
Samadi
Montezary
Grove