
Colored Bike Lanes – Request to Experiment

I. Background

Since the publication of Chicago's *Bike Lane Design Guide* in 2002, Chicago has been considered by many to be at the forefront of bikeway design in the United States. The City currently has 100 miles of bike lanes, 10,000 bike racks, and 40 miles of off-street trails. In addition to these, the Chicago Department of Transportation (CDOT) is currently working with the Federal Highway Administration (FHWA) on an experimental installation of over 100 miles of signed bike routes throughout the City.

In 2005 the City of Chicago plans to unveil its *Bike 2015 Plan*. This plan will set forth numerous recommendations on how to improve conditions for bicycling in Chicago. One objective of this plan is to test the use of colored bike lanes—an objective this experiment aims to fulfill.

II. Nature of the Problem

Previous data collected by CDOT has shown that a majority of bicyclists (79%) feel comfortable riding on streets with bike lanes and prefer to ride on streets with either bike lanes and/or signs (74%).¹ Bike lanes help to delineate roadway space between motor vehicles and bicycles and provide for more predictable movements by each.² Bike lanes also help motorists predict where to expect bicyclists, but conflicts³ can occur at locations where motorists must cross the bike lane.

To address this concern, CDOT proposes to study the use of green pavement markings in bike lanes at locations where motorists are permitted or required to merge into or cross the bike lane. (See Attachments 3 and 5 for examples of where motorists are permitted or required to merge into or cross the bike lane.)

III. Current Examples

Colored bike lanes are used around the world. Red, blue, yellow, and green are all known colors used for colored bike lanes. Red is used in the Netherlands, Germany, Sweden, Denmark, Switzerland, and Belgium.⁴ Red is also employed in cities in Florida, Minnesota, and California. Blue is used in Denmark, Montreal, Portland, OR, Arlington, VA, and Cambridge, MA. Yellow, to CDOT's knowledge, is used only in Switzerland.⁵ Green is used in some cities in Germany, France, and Australia. Green is also used in an FHWA approved experiment in Vermont.⁶ For examples of colored bike lanes, please see Attachment 1.

Existing studies have shown that colored bike lanes improve safety at high conflict areas. One Danish study found that at signalized intersections where blue surfaces were applied, the number of bicycle accidents was reduced by 38%, and the number of killed and severely injured cyclists decreased by 71%.⁷ Likewise, a study from Portland tended to point to safer conditions for bicyclists as a result of using blue pavement to define conflict areas between bicycles and motor

vehicles.⁸ While concerns regarding bicyclists' false sense of security are discussed in the Portland report, the rate of conflict per 100 entering bicyclists decreased from 0.95 before the installation of colored markings to 0.59 after installation – a 38% decrease.⁹

IV. Development

A. Why Green?

Each of the thirteen colors identified in the MUTCD were considered for colored bike lanes. For a complete listing of the colors and pros and cons of each, please see Attachment 2.

While CDOT's findings show that blue is the most tested and widely associated color for colored bike lanes, due to its current association with parking spaces for persons with disabilities, CDOT feels it is unsuitable for colored bike lane pavement markings. Green, on the other hand, is not assigned a meaning for pavement markings in this country. Green can provide sufficient contrast to pavement, therefore providing increased visibility. It is also currently approved for a colored bike lane experiment in Vermont.

B. Application

As mentioned earlier, colored markings have proven effective at locations where motorists are permitted or required to merge into or cross the bike lane.¹⁰ At channelized intersections where there is enough width, CDOT routinely marks its bike lanes. Usually at these locations, motorists must cross the bike lane as they turn to enter the right-turn only lane. The bicyclist proceeds straight in the bike lane, to the left of the right turn-lane (Attachment 3).¹¹ CDOT's standard is to mark this crossing area with six-inch dotted lines to delineate where bicyclists are recommended to ride and alert motorists of the presence of bicyclists. It is in these types of situations that CDOT proposes to install green markings (Attachments 3 and 4). Attachments 5 and 6 shows this concept used on a one-way street with a left-side bike lane.

C. Material

CDOT proposes to use skid resistant preformed thermoplastic with a minimum thickness of 120 mils and skid resistant value of 60 BPN. Additionally, the markings shall contain a minimum of 30 percent graded glass beads by weight for retro-reflectivity.

CDOT currently uses skid resistant preformed thermoplastic bike symbols and arrows for its bike lanes and has been pleased with the performance and durability of the product. Additionally, the City of Portland uses skid resistant preformed thermoplastic for its colored bike lane applications.

Portland has reported no complaints regarding slickness of the markings during wet weather.¹²

V. Proposed Changes

As previously stated, CDOT proposes the use of green pavement markings in bike lanes at locations where motorists are permitted or required to merge into or cross the bike lane.

CDOT will focus on one variable – adding green markings to existing bike lanes. These markings will be applied along existing dotted six-inch lines where motorists must cross the bike lane as they turn to enter the right/left-turn only lane. Attachments 3 and 5 illustrate two typical before locations. Attachments 4 and 6 illustrate these same locations with green markings added. All signs and other markings will remain unchanged.

VI. Locations

Colored markings are proposed to be installed at the following locations:

- 1) Northbound approach of Dearborn Street south of Chicago Avenue
- 2) Northbound approach of Elston Avenue south of Division Street
- 3) Southbound approach of Elston Avenue north of Division Street
- 4) Southbound approach of Halsted Street north of Roosevelt Road
- 5) Southbound approach of Lincoln Avenue north of Webster Avenue
- 6) Northbound approach of Milwaukee Avenue south of Elston Avenue
- 7) Southbound approach of Damen Avenue north of Roosevelt Road
- 8) Southbound approach of Milwaukee Avenue north of Augusta Boulevard
- 9) Westbound approach of Roosevelt Road east of Damen Avenue
- 10) Eastbound approach of Roosevelt Road west of Damen Avenue

VII. Timeline

- 1) Winter of 2004/2005 – FHWA issues permission to experiment
- 2) Summer of 2005 – CDOT completes before analysis of each location
- 3) Fall of 2005 – CDOT provides semiannual report to the FHWA
- 4) Spring/Summer of 2006 – CDOT installs colored bike lanes
- 5) Spring/Summer of 2006 – CDOT provides semiannual report to the FHWA following installation of colored bike lanes
- 6) Summer/Fall of 2006 – CDOT collects data for after analysis of colored bike lanes
- 7) Fall of 2006 – CDOT provides semiannual report to the FHWA
- 8) Winter of 2006/2007 – CDOT provides final report to the FHWA

VIII. Analysis

The before and after analysis of green bike lanes will consist of three components: analysis of police crash data; observation of bicyclist and motorist behavior and interaction; after survey of bicyclists and motorists.

Police crash data will be collected from each location for a period of one year before and after installation at each location. This data will be analyzed and included in CDOT's final report.

Each location will be observed at least once for a 2-hour rush hour period (7 am to 9 am or 4 pm to 6 pm) before and after installation. The following data will be collected and analyzed:

- Vehicle volumes
- Bicycle volumes
- Driver behavior
 - Signaling
 - Staying on recommended route
 - Yielding
- Bicycle behavior
 - Turning head
 - Signaling
 - Staying on recommended route
 - Yielding
- Number of conflicts between bicyclists and motorists
- Weather conditions
- Date and Time

Following the completion of the experiment, CDOT will compile all data and evaluate the results. Results of the experiment will then be provided to the FHWA in a detailed report and evaluation of the experiment.

IX. Conclusion

CDOT expects the safety and bicycle friendliness of these locations to improve with the addition of these colored markings. Pending the positive results of this experiment, the use of green pavement markings in bike lanes at locations where motorists are permitted or required to merge into or cross the bike lane should be considered for standardization in the MUTCD.

Endnotes

¹ See Chicago's first semi-annual report on its experiment with a simplified bicycle wayfinding signage system, FHWA experiment 9-73(E)—Bike Route Signs—Chicago, submitted on 30 November 2004.

² AASHTO, *Guide for the Development of Bicycle Facilities*, Washington, DC: AASHTO, 1999, pg. 22.

³ In staying with the current definition of conflict per the FHWA experiment “9-76 (E) Bicycle Traffic Signal Heads-Denver,” a conflict will be defined as (1) a turning motorist and bicyclists on a collision course, or (2) a turning motorist and bicyclist where minimal space is given to the cyclists.

⁴ Nabati, Jumana M. and Matthew D. Ridgway, “Innovative Bicycle Treatments: an Informational Report of the Institute of Transportation Engineers (ITE) and the ITE Pedestrian and Bicycle Council,” Washington, D.C.: ITE, May 2002, pg. 29.

⁵ Ibid.

⁶ FHWA experiment IX-67(E) – South Burlington STP BIKE(28)S Project.

⁷ Jensen, S.U., et. al., “The Marking of Bicycle Crossings at Signalized Intersections,” *Nordic Road and Transport Research No. 1*, 1997, pg. 27.

⁸ Hunter, W. W., et. al., *Evaluation of the Blue Bike-Lane Treatment Used in Bicycle/Motor Vehicle Conflict Areas in Portland, Oregon*, McLean, VA: FHWA, 2000, pg. 25.

⁹ Ibid.

¹⁰ See Hunter, W. W., et. al.

¹¹ Explanation taken from “Portland’s Blue Bike Lanes: Improved Safety through Enhanced Visibility,” City of Portland, 1999, pg. 8.

¹² 15 October 2004 phone conversation between Grant Davis, Bikeways Project Manager, CDOT and Roger Geller, Bicycle Coordinator, City of Portland, OR.

Attachment 1 - Colored Bike Lane Examples



Attachment 2 - Color Options for Chicago Colored Bike Lanes

(Only Colors defined in the MUTCD are shown)

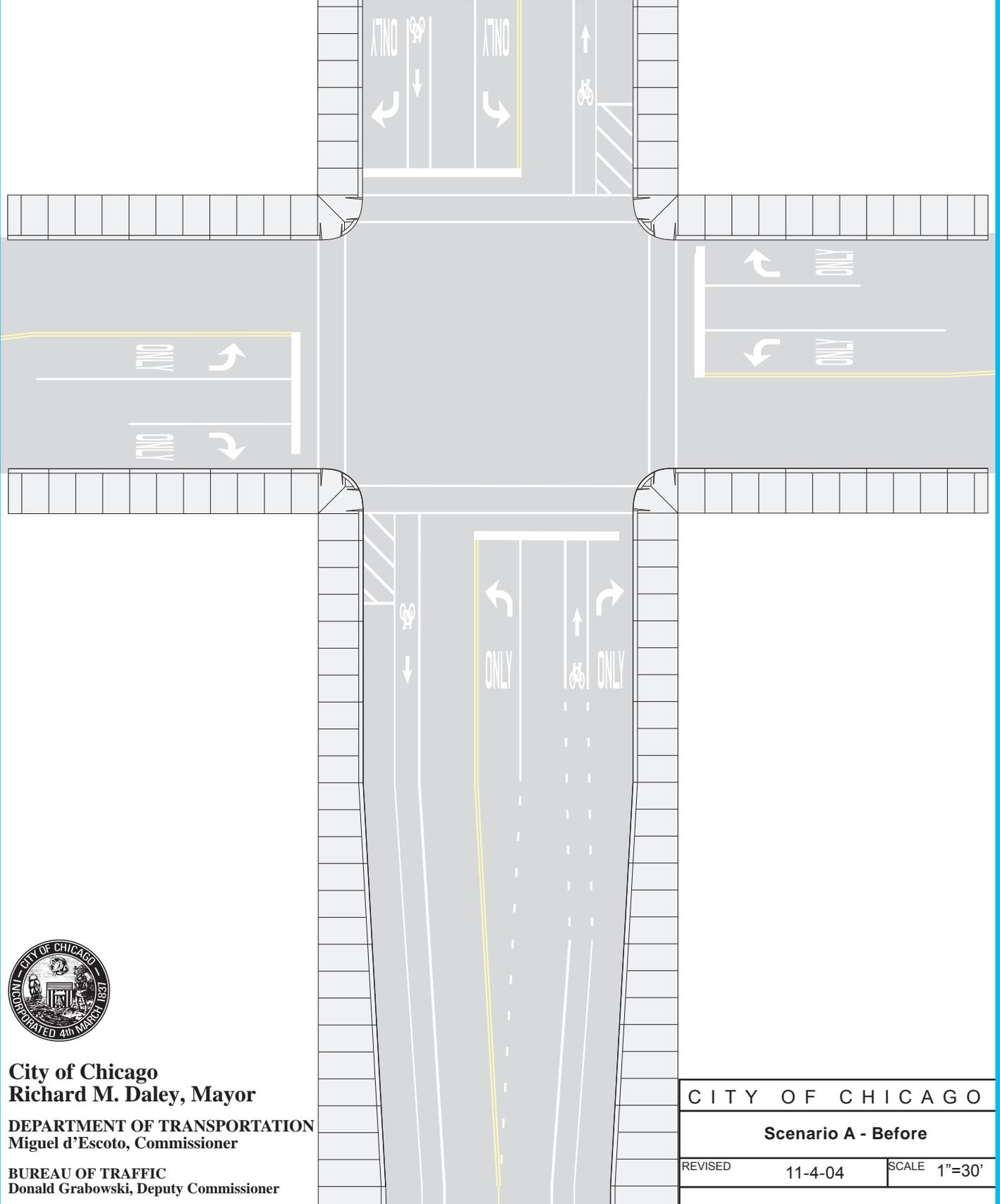
Colour	General Meaning	Current Marking Usage	Pros	Cons
Black	<ul style="list-style-type: none"> regulation 	<ul style="list-style-type: none"> may be used in combination with other colors where a light-colored pavement does not provide sufficient contrast with the markings 		<ul style="list-style-type: none"> may not provide sufficient contrast or visibility
Brown	<ul style="list-style-type: none"> recreational and cultural interest area guidance 			<ul style="list-style-type: none"> may not provide sufficient contrast or visibility
White	<ul style="list-style-type: none"> regulation 	<ul style="list-style-type: none"> separation of traffic flow in same direction delineate right edge of roadway 		<ul style="list-style-type: none"> currently widely used for roadway markings could be confused with normal markings (one big line)
Yellow	<ul style="list-style-type: none"> Warning 	<ul style="list-style-type: none"> separation of traffic traveling in opposite directions left edge of roadway of divided and one-way highways and ramps separation of two-way left turn lanes and reversible lanes from other lanes 		<ul style="list-style-type: none"> currently widely used for roadway markings could be confused with normal markings (separating opposing lanes)
Orange	<ul style="list-style-type: none"> temporary traffic control 			<ul style="list-style-type: none"> associated with construction
Fluorescent Pink	<ul style="list-style-type: none"> incident management 		<ul style="list-style-type: none"> may be highly visible 	<ul style="list-style-type: none"> used solely for incident management
Blue	<ul style="list-style-type: none"> road user services guidance tourist information evacuation route 	<ul style="list-style-type: none"> handicapped parking spaces locations of fire hydrants (raised markers) used for blue bike lanes in Portland (non FHWA approved) 	<ul style="list-style-type: none"> previous usage in US may provide good visibility 	<ul style="list-style-type: none"> may cause confusion with markings for handicapped Vermont requested this colour, but FHWA refused the request and said to use green
Fluorescent Yellow-Green	<ul style="list-style-type: none"> pedestrian warning bicycle warning playground warning school bus and school warning 	<ul style="list-style-type: none"> school and pedestrian crossings (experimental only) 	<ul style="list-style-type: none"> may be highly visible currently associated with "bicycle warning" 	<ul style="list-style-type: none"> FHWA is currently leaning towards only using yellow-green for school markings used exclusively for school markings in Chicago
Red	<ul style="list-style-type: none"> stop prohibition 	<ul style="list-style-type: none"> do not enter do not use 		<ul style="list-style-type: none"> widely associated with "Stop" associated with bus lanes in Chicago
Coral	<ul style="list-style-type: none"> Unassigned 		<ul style="list-style-type: none"> not assigned in the MUTCD 	<ul style="list-style-type: none"> may look like red or orange after wear FHWA recommended against using due to issues with contrast may not provide sufficient contrast or visibility untested in marking applications
Purple	<ul style="list-style-type: none"> Unassigned 		<ul style="list-style-type: none"> not assigned in the MUTCD 	<ul style="list-style-type: none"> may not provide sufficient contrast or visibility
Light Blue	<ul style="list-style-type: none"> Unassigned 		<ul style="list-style-type: none"> not assigned in the MUTCD FHWA didn't see any problems with using this color for colored bikeways 	<ul style="list-style-type: none"> may be too close to blue untested in marking applications
Green	<ul style="list-style-type: none"> indicated movements permitted directional guidance 	<ul style="list-style-type: none"> used for colored bike lane in Vermont for FHWA approved experiment 	<ul style="list-style-type: none"> FHWA has previously approved for experimentation FHWA recommended looking at 	

From Section 3E.01

- Colored pavement located between crosswalk lines to emphasize the presence of the crosswalk is not considered to be a traffic control device.
- Colored pavement used as traffic control devices should be used only where they contrast significantly with adjoining paved areas.

Attachment 3

Scenario A - Before



City of Chicago
Richard M. Daley, Mayor

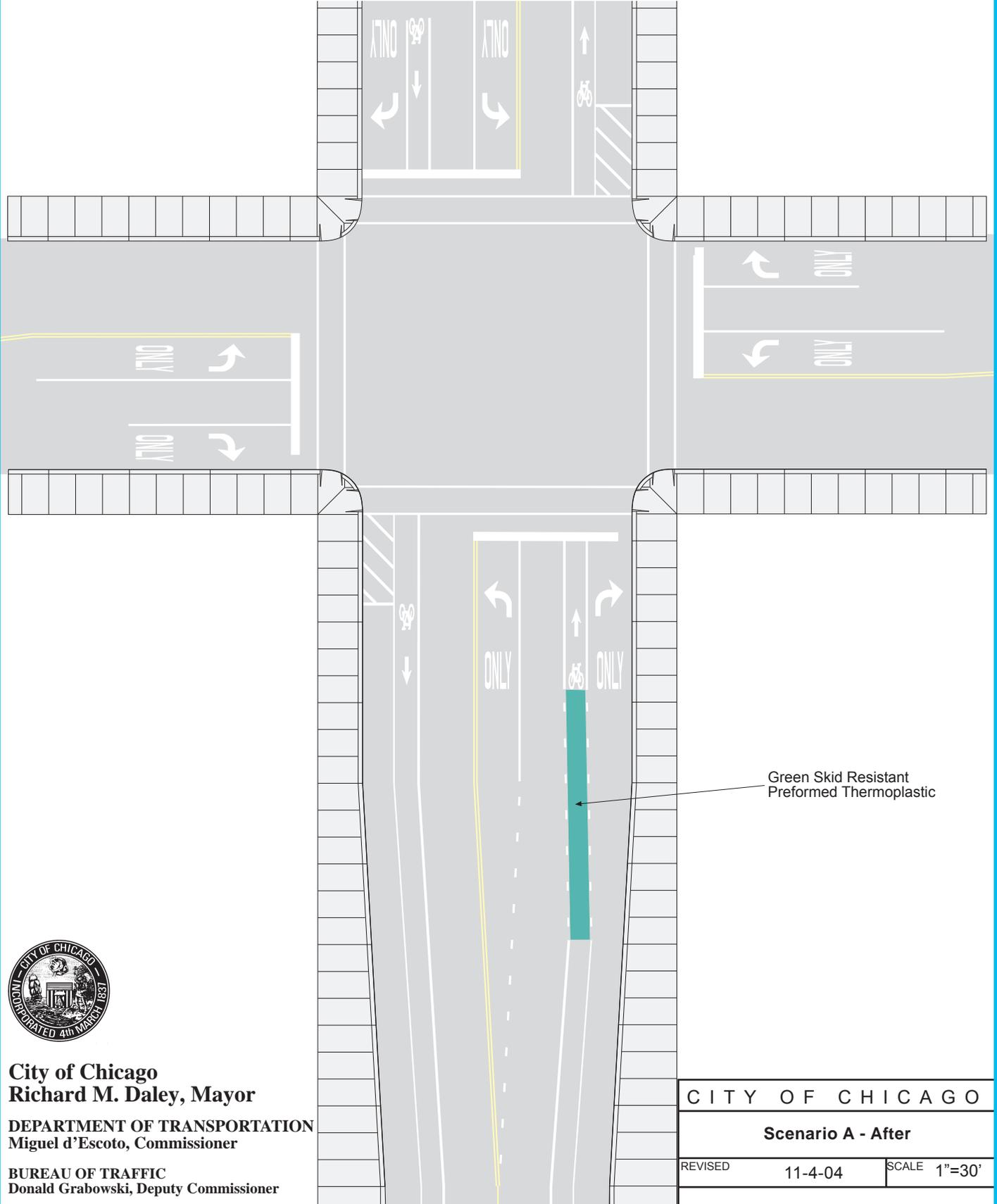
DEPARTMENT OF TRANSPORTATION
Miguel d'Escoto, Commissioner

BUREAU OF TRAFFIC
Donald Grabowski, Deputy Commissioner

CITY OF CHICAGO		
Scenario A - Before		
REVISED	11-4-04	SCALE 1"=30'

Attachment 4

Scenario A - After



City of Chicago
Richard M. Daley, Mayor

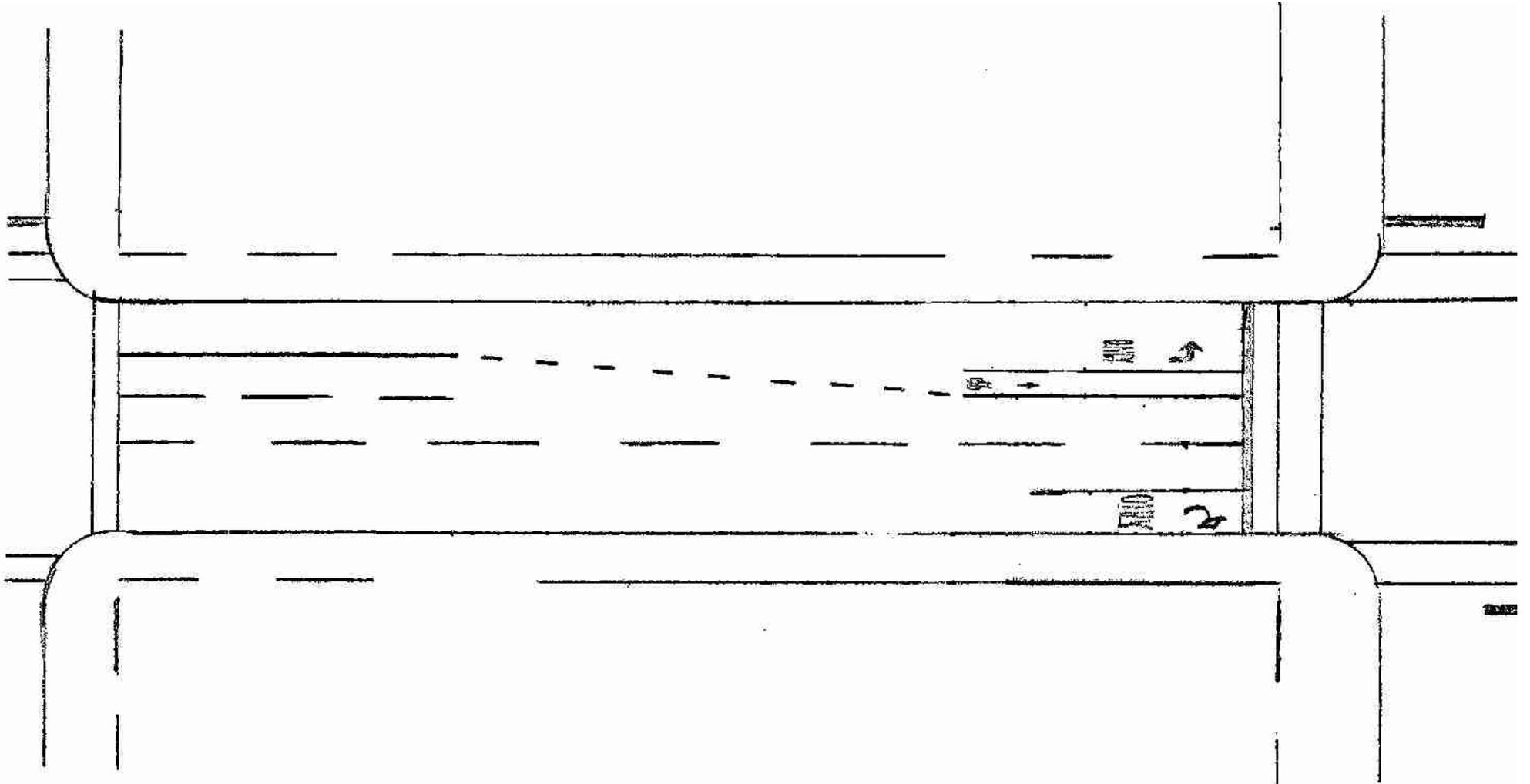
DEPARTMENT OF TRANSPORTATION
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BUREAU OF TRAFFIC
Donald Grabowski, Deputy Commissioner

CITY OF CHICAGO		
Scenario A - After		
REVISED	11-4-04	SCALE 1"=30'

Attachment 5

Scenario B - Before



Attachment 6

Scenario B - After

