New York City
Bicycle Lane and Trail Inventory

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New York City
Bicycle Lane and Trail Inventory

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Part I: Methodology and Overview

Introduction

This report is the third compilation and assessment of the physical conditions of existing bicycle facilities in New York City issued by the New York City Department of City Planning's Transportation Division (DCP). The first "Bicycle Lane and Trail Inventory" document was published in the year 2000 and the second report was issued in 2002. Similar to the previous inventories, this document focuses on the location and conditions of directional and guidance signs; and the condition of pavement, lane markings, and etched symbols along bicycle lanes, bicycle trails and bridges. Additional information, such as bicycle ridership volumes and bicycle accident data, is also included in the report in order to help draw a more complete and useful picture of the bicycle network.

As part of this project, a database was developed for storing and analyzing the data that was collected. This information was mapped using the Geographic Information System (GIS) tools. Together with this report, geographic data will be made available to operating agencies including the New York City Department of Transportation (NYCDOT) and the New York City Department of Parks and Recreation (NYCDPR) responsible for the maintenance of bicycle facilities in the city.

The report is divided into three parts. Part I, Methodology and Overview, includes the standards set for the data collection, an analysis of summarized data, and conclusions. Part II, Data and Detailed Maps, contains a map of each borough that highlights the bicycle facilities followed by summary data pages and detailed maps for all facilities within each borough. Part III, Appendices, contains detailed statistics for each bicycle facility based on field work done from 2006 to 2007 (including the condition of signs, markings, and pavement); bicycle accident data for 2005; and bicycle ridership data for 2005.

Data Collection

An inventory of existing on-street bicycle lanes (Class II), off-street bicycle trails (Class I), and bridges with bicycle access facilities was conducted for each borough in New York City. Signed bicycle routes (Class III), which do not include striped bicycle lanes, were not included in this survey. Data collected along the bicycle facilities was divided into three categories:

- Signage
- Pavement conditions
- Lane markings and symbols conditions

In the process of conducting fieldwork, an extensive archive of digital photos was created which provides a comprehensive representation of each bicycle facility within the network. This document contains a subset of these photographs; the full archive is being stored at DCP. This survey represents a snapshot in time of the condition of the bicycle lanes and routes which may have changed since the fieldwork was done (June 2006 – March 2007).

Signage Inventory

Data about signage along the bicycle lanes and trails was compiled by recording the location of each sign along the route and documenting it with a photograph. The following information for each sign was obtained from this fieldwork:

- Type of sign, whether it is a regulatory, warning , informational or greenway sign,
- Physical condition of the sign by specifying if it is bent, worn, vandalized or missing,
- Sign's visibility to roadway users, whether it is visible, blocked, upside down or facing the wrong way.

Pavement Conditions Inventory

The pavement conditions data was collected by recording the physical condition of the roadways along the bicycle lanes and the greenway paths. The following information was collected about the pavement conditions:

- The presence of potholes, bumps, patches, cracks, uneven steel covers or grates,
- The type of material used to pave the facility (asphalt, concrete, dirt, crushed stone, chipped wood, wood planks, pavers - concrete, brick, stone, cobblestone).

Lane Markings and Symbols Inventory

Lane markings and symbols data was collected on a block-by-block basis for the bicycle lanes and on a segment-by-segment basis for the bicycle trails (a segment is a portion of a bicycle route between two cross streets). Symbols are usually located immediately after and/or preceding an intersection and

on longer blocks, a symbol appears at mid-block locations. Whereas bicycle lane markings tend to be present along entire routes, buffer markings are more intermittent. Data about symbols (diamonds and/or cyclists) was collected and compiled separately.

The following information was collected and recorded on fieldsheets with photographs taken as necessary.

- Condition, by specifying if the lane markings and symbols are in good or poor condition,
- Visibility, by specifying if the markings are covered by a roadway patch work, or if no markings are visible,
- Type of symbols: pedestrian symbol, cyclist symbol, diamond symbol, etc.
- Type of lane markings: bike lane, buffer, etc.

In December of 2006, NYCDOT introduced newly designed bicycle pavement markings at several locations with a Class III bicycle route designation. These new “shared lane” markings and symbols include a bicycle silhouette with two chevrons placed on the right side of the lane. Since Class III bicycle routes were not surveyed as part of this project, data about these new markings was not collected or included in this report.

Methodology

A method for rating and classifying condition of the signs, lane markings/symbols, and pavement was developed as part of this study. In general, the criteria used to rate and classify the conditions of the bicycle facilities were derived from the guidelines described in the American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (1999).

Signage Inventory - Rating and Classification

AAHSTO guidelines indicate that signs should guide or direct cyclists, and that each sign must be presented at a location where it will be seen by the user. The general location for signs is on the side of the road or path. In addition to providing directions, signs should alert cyclists to potential conflicts, and convey regulatory messages to both cyclists and motorists.

The criteria used to rate the signs in this study were based on the physical condition of the sign and if its message could be easily read by the user. The rating criteria were:

- Good, if the sign was in excellent condition (no graffiti, not vandalized, not bent, not worn) and if the message was clearly visible;
- Fair, if it had minor defects such as a small extent of graffiti on its surface (not on the text) or slightly worn;
- Poor, if bent, distorted, vandalized, had graffiti over 25% of the sign or was worn.

In addition, the signs were rated in terms of their visibility to the targeted user(s):

- “Visible”, if the sign was clearly visible
- “Blocked”, if the sign was blocked by foliage, scaffolding or another obstruction
- “Upside Down/Sideways”, if the sign was upside down or sideways
- “Wrong Way”, if the sign was facing the wrong way

All signs that were surveyed were classified into one of the following categories:

- Regulatory sign (informs users of the traffic laws)
- Warning sign (informs users of potential conflicts and hazardous conditions)
- Informational sign (informs users of directions and destinations)
- Greenway sign (developed by the New York City Department of City Planning to provide an identity to the greenways and to guide users along the route)

Pavement Conditions Inventory - Rating and Classification

Based on the AASHTO guidelines, the pavement surface should be smooth and uniform in width. The smoothness of the surface affects the comfort, safety and speed of the cyclist. Irregularities such as

holes, bumps, cracks, joints on the roadway or path can be the cause of an unpleasant ride, fall, or injury. Drainage, grates, utility covers should be placed or adjusted to be flush with the adjacent pavement surface.

Therefore, the following rating system was developed:

- Good, if the bicycle route was in excellent condition, smooth pavement surface, comfortable and smooth riding condition;
- Fair, if less than 25% of the bicycle route was uncomfortable to ride due to pot holes, bumps, uneven pavement, wide or/and deep cracks, utility covers/grates were not flush with the pavement surface. Irregularities or defects would occur in isolated areas or sections of the bicycle route and occur occasionally, not frequently;
- Poor, if 25% or more of the bicycle route or a significant section of the bicycle route was rough or uncomfortable to ride due to pot holes, bumps, uneven pavement, wide or/and deep cracks, utility covers/grates not flush with pavement surface – irregularities or defects may occur frequently or regularly along route.

Lane Markings and Symbols Inventory - Rating and Classification

According to the "AASHTO Guide for the Development of Bicycle Facilities," guidance and specifications for lane markings and symbols are provided in the Manual on Uniform Traffic Control Devices (MUTCD). In general, adequate pavement markings are essential on the roadways and shared use paths and must be presented at locations where they will be seen by all users. Pavement markings for bicycle lanes should channel users and provide a clear message to motorists that the road must be shared with cyclists.

Since the condition of the pavement markings can affect their visibility to motorists and cyclists, the following rating system was developed:

On-Street Bicycle Lanes Rating

The rating criteria used for the condition of on-street bicycle lane striping or markings was as follows:

- Good, if a majority of the striping on a segment was observed to be clearly visible and uninterrupted;
- Poor, if a significant portion of the striping or marking on a segment is worn or missing;
- "Patchy", if the striping was significantly interrupted by pavement patches, resulting from previous construction;
- No marking , if no lane markings were visible.

Regarding this rating system and the conditions mentioned above, if the striping has a relatively

small interruption which does not affect the overall integrity of the bicycle lane segment (either from a construction patch or missing lane striping paint) this was noted, but the lane striping was classified as the general condition of the segment.

For pavement symbols, the following rating criteria were used:

- Acceptable, if symbols are in good condition and clearly visible;
- Poor, if symbols were worn, partly missing, or distorted, making it difficult for cyclists and motorists to distinguish them.

Off-Street Bicycle Trails Rating

The rating criteria used for the off-street bicycle trails striping and markings were the same as those used for the on-street bicycle lanes.

It should be noted that not all bicycle paths have lane striping. In some cases a small fence, planters, grass, or a distinct pavement surface is used to separate users. Many off-street bicycle trails have no separation between cyclists and pedestrians. This is only acceptable in locations with low volume and adequate width.

The rating criteria for pavement symbols along bicycle trails were as follows:

- Acceptable, if the symbols were in good condition and clearly visible;
- Poor, if the symbols were worn, partly missing, or distorted, making it difficult for users to distinguish them.

The most common pavement symbols include cyclists, arrows, pedestrians, and rollerbladers (these account for 93% of all observed symbols). In some locations perpendicular strips (intended to slow cyclists) or cautionary text appears as markings and was included in this report.[1]

A “Notes” category is included in the data in order to provide additional and useful information about the bicycle lane or path. For example, some sections of the roadway or bicycle path were not rated or classified in terms of markings or pavement condition if they were under construction, being repaired or had temporary steel metal plate covers at the time of observation. This type of information would be provided in the “Notes” category. In this report notes on bicycle route segments are described at the bottom of the summary page when necessary.

1 Note; only cyclists, arrows, pedestrians, and rollerblader symbols were specifically indicated in this report while additional symbols were recorded in an “other” category, the detailed records are available in the GIS data.

Analysis and Conclusions

This section contains two types of analyses based on the data that was collected for this study. The first part, "Analysis by Facility Type," discusses the sign, pavement, lane marking and symbols conditions citywide. The second part, "Analysis by Borough," shows these conditions on a borough-by-borough basis with an additional category for bridges with a bicycle path.

The conclusions presented in this section include observations and recommendations for future improvements to New York City's bicycle network.

Analysis by Facility Type

Signs

According to the data compiled, the majority of the signs were in good condition: 85% in good condition for the off-street bicycle paths, and 95% in good condition along the on-street bicycle lanes. See Charts 1 and 2.

Chart 1
Citywide Off-Street Bicycle Paths (Class 1)
Signs Condition

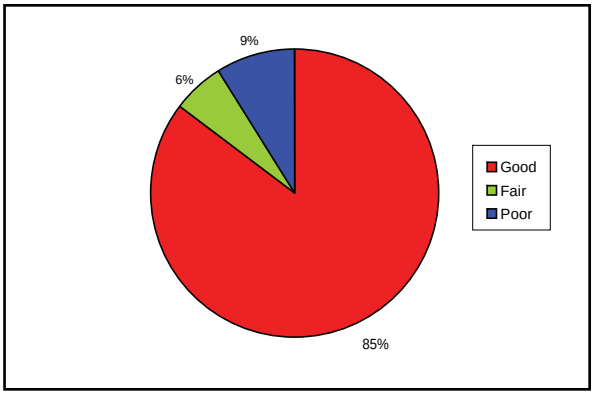
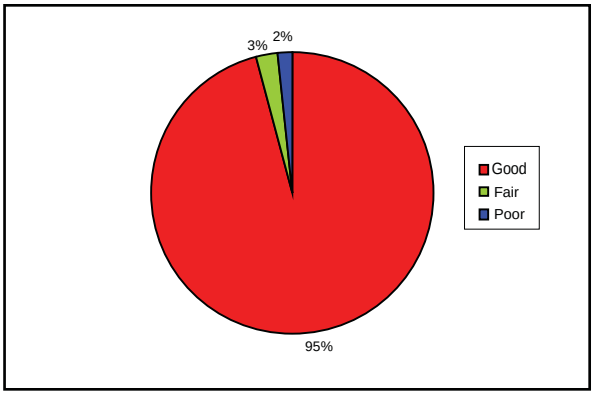


Chart 2
Citywide On-Street Bicycle Lanes (Class 2)
Signs Condition



Pavement

For the pavement condition, the off-street routes had slightly more than half of the paths (54%) in good condition, compared to the on-street bicycle lanes which had close to three-quarters (73%) in good condition. See Charts 3 and 4.

Chart 3
Citywide Off-Street Bicycle Paths (Class 1)
Pavement Condition

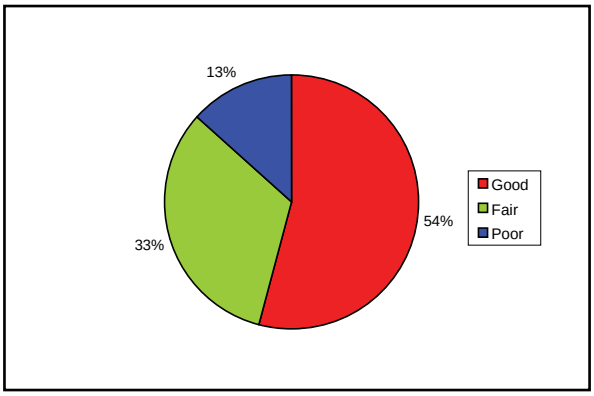
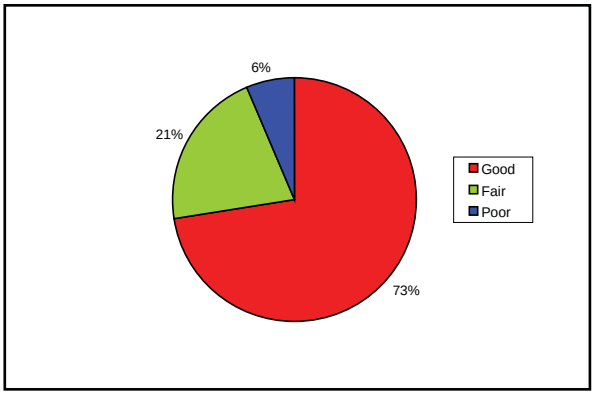


Chart 4
Citywide On-Street Bicycle Lanes (Class 2)
Pavement Condition



Lane Markings

An assessment of the lane markings revealed that 33% of all off-street paths were in acceptable condition, while 72% of all on-street bicycle lanes were in acceptable condition. However it is important to state that a significant percentage of the off-street bicycle paths (57%) had no visible markings which skewed the percentage of markings in acceptable condition.

The classification of “no marking” is of greater significance for on-street bicycle lanes than for off-street paths which are often designed without markings. If no markings are found on an on-street bicycle lane, it suggests that either the lane has been worn to the extent that it is no longer visible or markings were not implemented. See Charts 5 and 6.

Chart 5
Citywide Off-Street Bicycle Paths (Class 1)
Lane Markings Condition

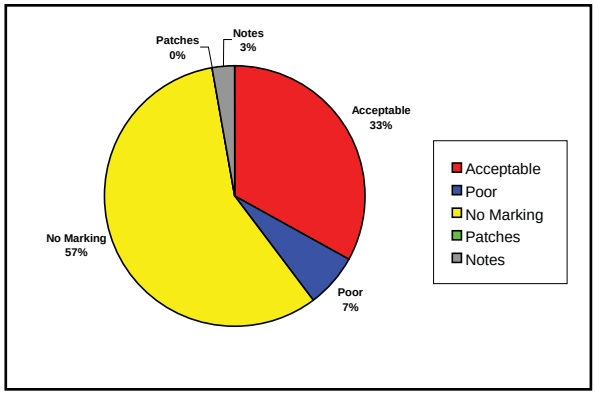
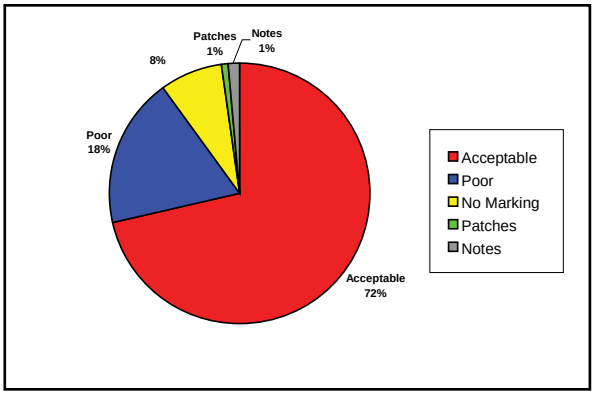


Chart 6
Citywide On-Street Bicycle Lanes (Class 2)
Lane Markings Condition



Symbols

For the pavement symbols, both the off-street and on-street bicycle routes had more than half of their symbols in acceptable condition (73% of off-street in acceptable condition; 66% of on-street in acceptable condition). It is likely that the percentage of on-street symbols in acceptable condition is lower than off-street symbols due to the presence of bicycle lane diamond symbols, which are not repainted or maintained because they are being phased out. See Chart 7, Chart 8, and Table 1.

Chart 7
Citywide Off-Street Bicycle Paths (Class 1)
Symbols Condition

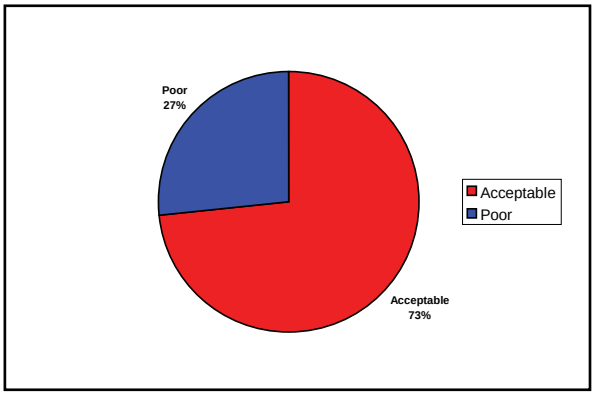
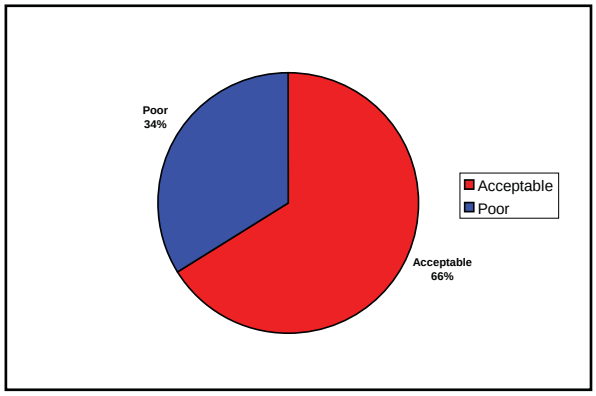


Chart 8
Citywide On-Street Bicycle Lanes (Class 2)
Symbols Condition



Analysis by Borough and for Bridges

Signs

The data revealed that more than 85% of the signs were in good condition within each borough for both off-street and on-street bicycle facilities. The borough with the highest percentage of signs in poor condition was Queens with 3% of off-street, and 2% of on-street signs in poor condition. While the vast majority (more than 90%) of signs on lanes and trails within the boroughs were in good condition, 33% of the signs on the bridges surveyed were in poor condition. See Charts 9 and 10.

Chart 9

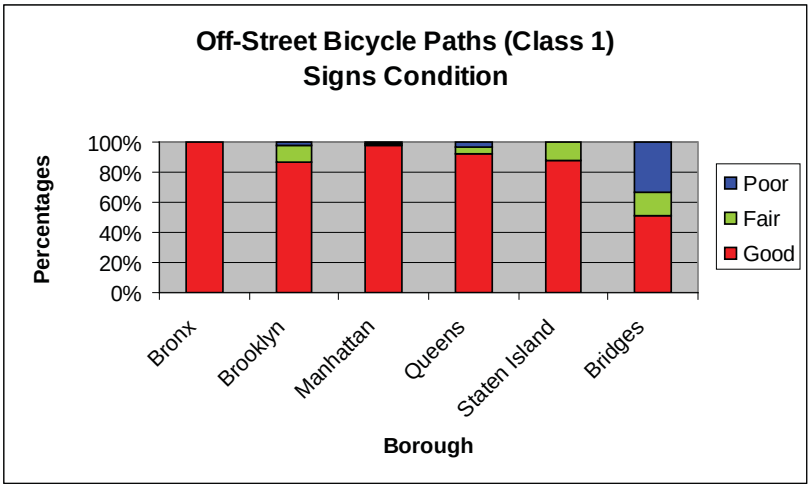
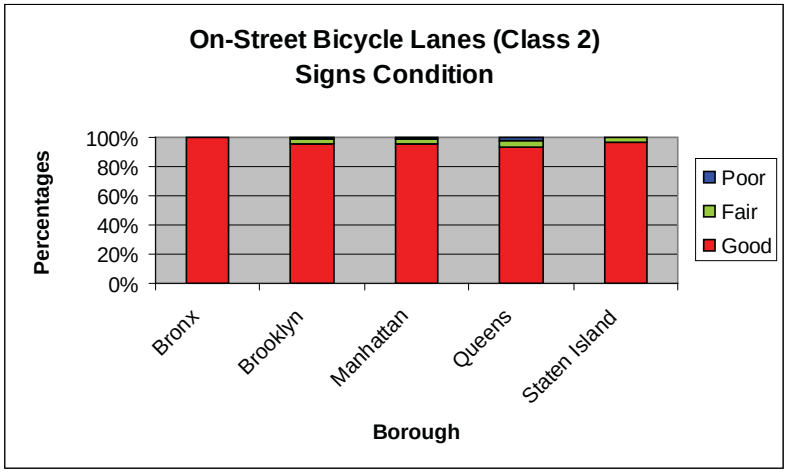


Chart 10



Pavement

The analysis of pavement conditions along the off-street paths indicates that Staten Island had 0% of its pavement in poor condition while Brooklyn had the highest percentage in poor condition with 25%. For the on-street bicycle lanes, Staten Island's lanes were in excellent condition with 0% of its pavement in poor condition. The Bronx, however, had the highest percentage (27%) of pavement surface in poor condition. Of the bridges that were surveyed only 11% of their pavement was in poor condition. See Charts 11 and 12.

Chart 11

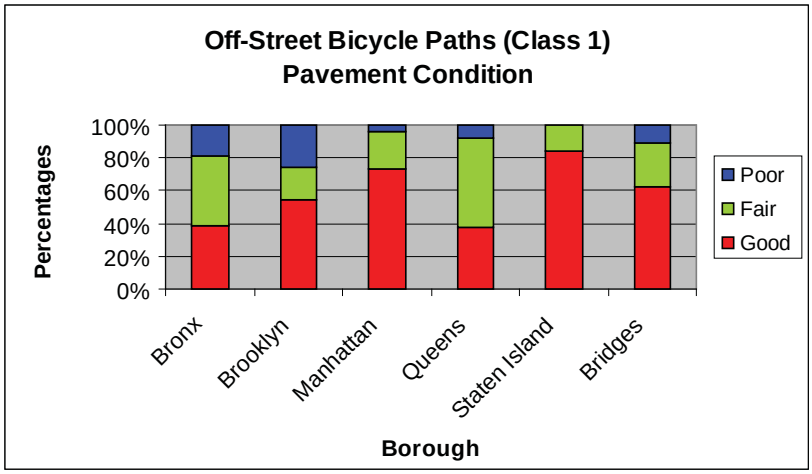
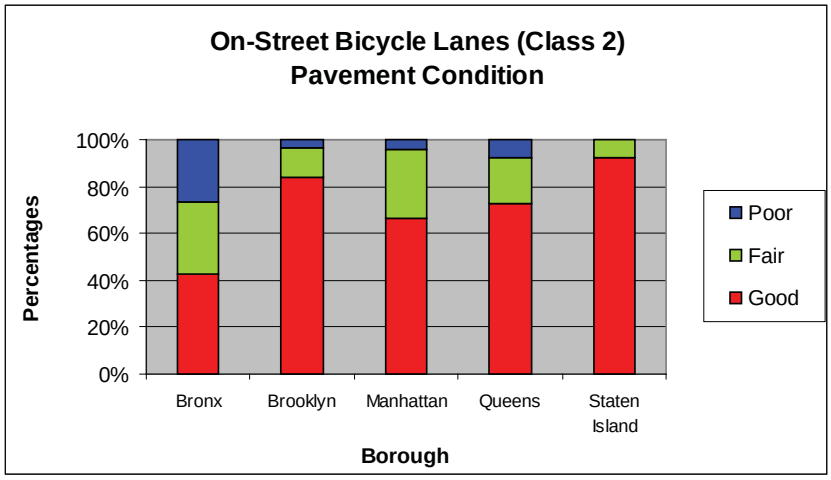


Chart 12



Lane Markings

For the off-street bicycle paths, the results show that Staten Island was the only borough with all markings in acceptable condition (0% in poor condition). Brooklyn had the highest percentage (15%) of markings along the bicycle paths in poor condition. However, over half of the bicycle paths surveyed citywide had no markings with only Queens and the Bronx having more than 50% of their lanes marked. The bridges with bicycle paths had 13% of their markings in poor condition, which was significantly higher than the percentage of paths in poor condition for individual boroughs.

The lane markings data for the on-street bicycle lanes shows that Queens had the highest percentage of its markings in good condition compared to the other boroughs, with 82% of the lanes in acceptable condition and only 6% in poor condition. The Bronx had the worst conditions, with 57% in poor condition, representing more than half of its lanes. See Charts 13 and 14.

Chart 13

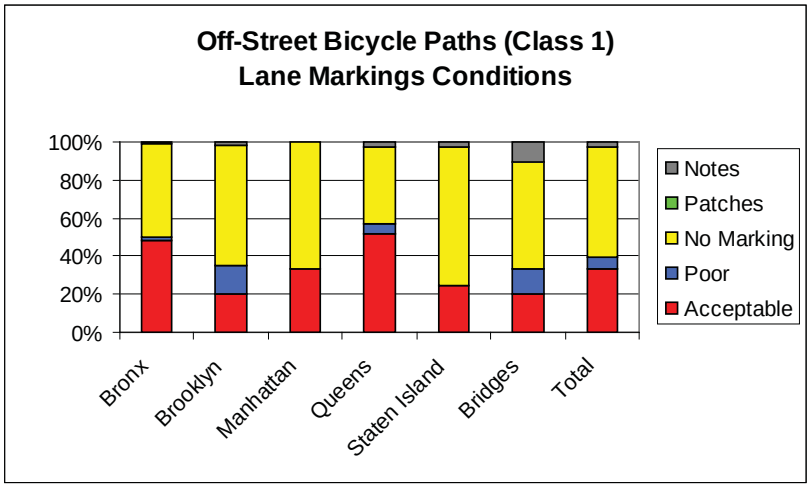
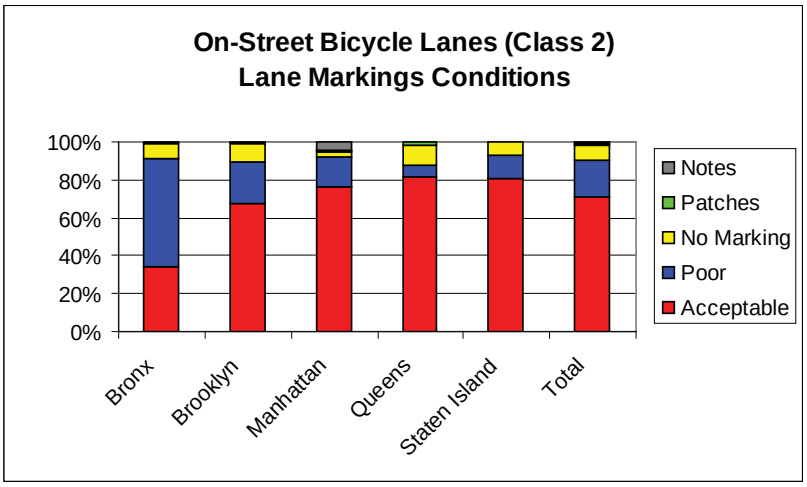


Chart 14



Symbols

The off-street routes of Staten Island had all symbols in acceptable condition (100%), while Brooklyn had the lowest percentage of symbols in acceptable condition (62%). For the on-street bicycle lanes, the Bronx had the highest percentage of symbols in acceptable condition (77%), while Manhattan had the lowest with 60%. The bridges had approximately half of their symbols (58%) in acceptable condition (see Tables 1 and 2). To illustrate the impact of the diamond symbols on the percentage calculations for the Class 2 symbols, a breakdown of the different types of symbols and conditions are provided in Table 1.

Table 1
On-Street Bicycle Lanes (Class 2)
Symbols Condition

Borough	Acceptable		Poor		Total
Bronx	241	77%	71	23%	312
Brooklyn	1,184	66%	609	34%	1,793
Manhattan	736	60%	499	40%	1,235
Queens	680	69%	300	31%	980
Staten Island	153	75%	52	25%	205
Total	**2,994**	**66%**	**1,531**	**34%**	**4,525**

	Diamond				Bike				Other				
Borough	Acceptable		Poor		Acceptable		Poor		Acceptable		Poor		Total
Bronx	92	29%	45	14%	149	48%	26	8%	0	0%	0	0%	312
Brooklyn	38	2%	170	9%	1,063	59%	417	23%	83	5%	22	1%	1,793
Manhattan	149	12%	254	21%	549	44%	241	20%	38	3%	4	0%	1,235
Queens	236	24%	143	15%	444	45%	157	16%	0	0%	0	0%	980
Staten Island	16	8%	40	20%	137	67%	12	6%	0	0%	0	0%	205
Total	**531**	**12%**	**652**	**14%**	**2,342**	**52%**	**853**	**19%**	**121**	**3%**	**26**	**1%**	**4,525**

Table 2
Off-Street Bicycle Paths (Class 1)
Symbols Condition

						Types of symbols included				
Borough	**Acceptable**		**Poor**		**Total**	**Bikes**	**Ped**	**R blader**	**Arrow**	**Other**
Bronx	259	85%	46	15%	305	65	9	47	151	33
Brooklyn	372	62%	226	38%	597	147	79	43	246	82
Manhattan	1221	80%	298	20%	1519	377	159	307	448	228
Queens	127	91%	13	9%	140	27	4	27	59	23
Staten Island	95	100%	0	0%	95	39	0	0	38	18
Bridges	466	58%	340	42%	806	370	340	0	96	0
Total	**2540**	**73%**	**923**	**27%**	**3462**	**1025**	**591**	**424**	**1038**	**384**

In order to add context to the analyses presented above, Chart 15 and Chart 16 show the length (in miles) of the on-street bicycle lanes and the off-street bicycle paths throughout the network, within each borough and on the bridges.

Chart 15
On-Street Bicycle Lanes (Class2)
Miles of Bicycle Lanes by Borough

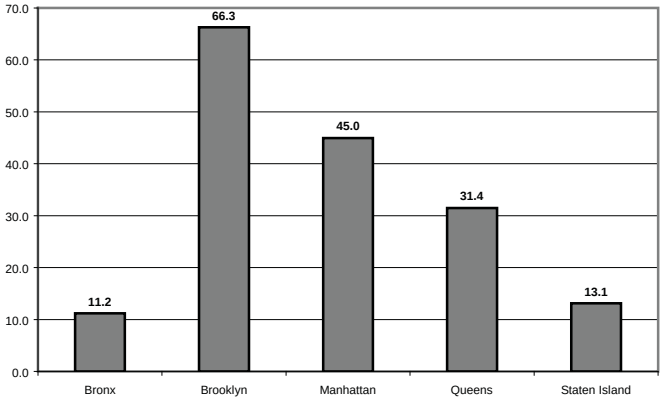
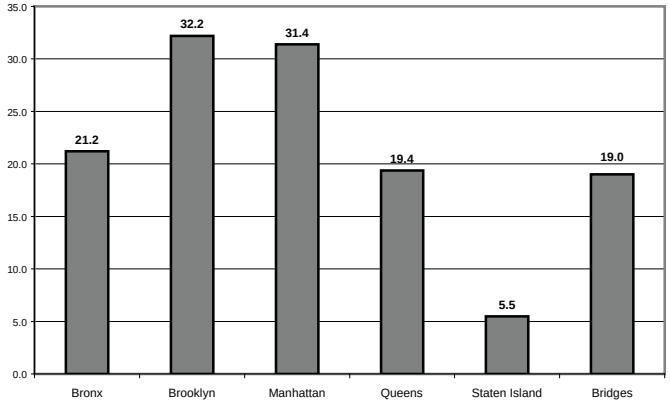


Chart 16
Off-Street Bicycle Paths (Class1)
Miles of Bicycle Paths by borough



It should be noted that on-street bicycle lanes with two lanes were measured twice (one for each direction of traffic). Also, those figures do not include proposed or unbuilt Class I and II facilities, nor do they include existing or proposed Class III bicycle facilities.

Conclusion

Based on the data collection and the results of the analysis, the following observations were made:

- The bridges had the highest percentage of signs in poor condition (33%). In general these signs were vandalized and/or covered with graffiti.

- Staten Island was the only borough to have all pavement in good condition (0% poor condition for both on-street and off-street facilities). However, it is also important to note that Staten Island has a relatively low number of on-street bicycle lanes (13.1 miles) and off-street bicycle paths (5.5 miles).

- The borough with the highest percentage of on-street bicycle lanes in the worst conditions was the Bronx with 27% of pavement and 57% of lane markings in poor condition. On the other hand, the Bronx had all signs in good condition for both Class 1 and Class 2 bicycle facilities (100% in good condition and 0% in poor condition).

- When boroughs were compared, Brooklyn had the highest mileage of both bicycle lanes and paths throughout the network with 66.3 miles of on-street bicycle lanes and 32.2 miles of off-street bicycle paths. The Bronx had the lowest mileage for on-street bicycle lanes (11.2 miles), and Staten Island had the lowest mileage for off-street paths (5.5 miles).

Recommendations

Below are DCP's recommendations to improve the bicycle network based on the results of this survey:

- Replace the signs in poor condition on the bridges with priority given to the Williamsburg and the Triborough Bridge where there is a concentration of signs that were vandalized (33 % of all signs on the bridges were in poor condition).

- Further assess pavement conditions along segments of the bicycle routes identified in this study in poor condition and repair the pavement of those locations as needed.

- Further analyze Class 1 and Class 2 bicycle facilities where there are no markings and install these markings as appropriate. In doing so, Class 1 bicycle routes should be a priority since 57% of the paths have been identified with no markings citywide. It appears as though many times the markings are missing not because they were not implemented but because of the wear and tear of the markings over the years.

- Further analyze the locations identified in this report along the Class 1 and Class 2 bicycle facilities with poor symbol markings and install appropriate symbols as necessary. Phasing out the diamond symbols should continue through normal maintenance practices along the Class 2 bicycle lanes due to the confusing nature of these symbols which are also used for High Occupancy Lanes (HOV) and bus lanes. These diamond symbols could be replaced with the "cyclist's silhouette" which are more appropriate for bicycle lanes. In addition, further survey work should be done along the bicycle lanes and paths to identify locations where there are no symbols and assess the need for implementation.

- Expand the bicycle network to increase the number of on-street bicycle lanes and off-street bicycle paths. The announcement by NYCDOT in September of 2006 to add 200 miles of bicycle lanes to the five boroughs over the next three years brings the city closer towards the implementation of the proposed Bicycle Master Plan by increasing the number of bicycle facilities. This will further promote cycling which is one of the most efficient and environmentally safe modes of transportation.