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DRAFT Memorandum

Date:	25 August 2016
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Subject:	Urban Greening Bay Area Project – Design Charrette GIS Intersection Frequency Analysis

INTRODUCTION AND GOAL

The Urban Greening Bay Area Project includes a Design Charrette to develop cost-effective green infrastructure designs for typical roadway intersections. The Charrette includes the development of conceptual designs for BMPs that could be implemented in these intersections, as well as an assessment of how frequently typical roadway intersections occur in the Bay Area region.

Geosyntec conducted a GIS analysis to identify the frequency that intersections characterized as typical roadway intersections occur in the Bay Area region. This memorandum serves to summarize the analysis conducted and the frequency results.

METHODOLOGY

Overview

The GIS methodology employed for this analysis entailed screening and analysis of shapefiles provided by the City of San Mateo to identify typical roadway intersections where generic BMP designs could be implemented. As BMPs would typically be implemented at one or more corners in any given intersection, corners were identified as the unit which would be analyzed for frequency of occurrence.

Based on discussions with the BASMAA team and the Project team, the characteristics associated with corners located in typical roadway intersections that would be feasible for BMP implementation include the following:

1. Corner angle is approximately 90 degrees
2. Inlet that is connected to the storm main is present at corner

Parking configuration and underlying soil type were two other factors brought up by the team that were considered relevant to suitability of implementation of a generic BMP.

Analysis Steps

Data received for the analysis included the City of San Mateo street layer (a line layer) and the City of San Mateo storm drain layer (consisting of points and storm drain lines). A summary of the analysis steps are included below:

1. Using the street layer, all intersections and corners in the City were identified. To identify the "total corners", the following steps were conducted:
    a. Corners associated with highways or bridges were removed using visual assessment.
    b. Angles of corners were calculated based on the street layer linework.
    c. Corners with angles greater than 175 degrees were removed (these were found to represent street ends through visual assessment).
2. Once the total corners were estimated, those corners adjacent to an inlet connected to a storm main were identified using the following steps:
    a. Storm main lines were extracted from the storm drain layer.
    b. Inlet points connected to the storm main lines were identified.
    c. Corners within 30 feet of an inlet connected to a storm main were identified using a buffer analysis.
3. Corners adjacent to an inlet connected to a storm main that were approximately 90 degrees were then identified.
    a. Corners with angles ranging from 87.5 degrees to 92.5 degrees were assumed to be approximately 90 degrees. This range was found to adequately represent an average of 90 degree corners based on a visual assessment of the corners in different angle ranges (85 to 95, 87.5 to 92.5, 89.5 to 90.5, and 89.95 to 90.05).
4. These corners were analyzed for underlying soil type using the NRCS SSURGO dataset available through Web Soil Survey (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm).

To examine parking configuration for the identified corners, a visual assessment was conducted on half of the corners identified. These corners were identified using a random selection tool available in ArcGIS. The first 100 feet of curb of the corners were examined in Google Earth to characterize parking on both parking legs.

RESULTS

The analysis yielded a total of 1,560 intersections in the city, and a total of 4,010 corners with less than a 175 degree angle. Twenty-eight percent of those corners were within 30 feet of an inlet connected to a storm main. Of those, approximately 65% (18% of total corners) were found to be approximately 90 degrees (i.e. with an angle within the 87.5 to 92.5 degree range). When examining how many total intersections contained at least one of these corners, it was found that approximately one quarter of City intersections contained a corner with the identified characteristics. A summary of the corner analysis is provided in Table X below:

Table 1: Summary of Intersections and Corners

Feature	Number	Percent of Total
Total Intersections[1]	1,560	100%
Total Corners[1,2]	4,010	100%
Corners Adjacent to Inlet Connected to Storm Main[1,2]	1,116	28%
Corners Approximately 90 degrees, Adjacent to Inlet Connected to Storm Main[1,3]	737	18%
Intersections with at least one Corner Approximately 90 degrees, Adjacent to Inlet Connected to Storm Main[1,3]	399	26%

1 Does not include highway or bridge adjacent intersections or corners.
2 Includes corners with angle of 175 degrees or less.
3 Includes corners with angle between 87.5 and 92.5 degrees.

Of the 737 identified corners that are approximately 90 degrees, and are adjacent to an inlet connected to a storm main, one half of the corners (rounded to 369 corners) were randomly selected and were visually assessed for parking configuration (Angled, Parallel, or No Parking Allowed). The findings of that assessment are presented in Table 2. In addition to the three parking configurations examined, four (about 1%) of the 369 corners visually assessed consisted either of points that were not actually corners (i.e. a driveway or alleyway was represented instead of a street) or the parking configuration was not able to be determined.

The majority of corners assessed include parallel parking on both parking legs (85%). Only about 2 percent (9 total corners) included parallel parking on one leg and angled parking on the other leg.

Table 2: Summary of Visual Assessment of Parking Configuration

Parking Leg I	Parking Leg II	Number of Corners Assessed	Percent of Corners Assessed[1]
Angled	Angled	1	0.3%
Angled	Parallel	9	2%
Angled	No Parking Allowed	4	1%
Parallel	Parallel	312	85%
Parallel	No Parking Allowed	32	9%
No Parking Allowed	No Parking Allowed	7	2%
N/A or Unable to Determine	N/A or Unable to Determine	4	1%
Total		369	100%

[1] Does not sum to 100% due to rounding.

The vast majority of soil underlying the identified corners was identified by NRCS as cut and fill or urban land. No hydrologic soil group is identified by NRCS for these soil types, but they are typically assumed to be poorly drained soils. Less than one percent of these corners (5 corners) were underlain by hydrologic soil group C soils.

Figure 1 displays the results of this analysis graphically.

Application to Greater Bay Area

A detailed analysis was not conducted to examine the representativeness of San Mateo as compared to the greater Bay Area. Land use was approximately identified during the visual assessment conducted to examine parking configuration for the identified corners. Based on that assessment, approximately 85% of the corners were located in residential land use areas. The majority of the remaining corners were located in commercial land use areas, with very few located in industrial, mixed use, and open space land use areas. Whether the high proportion of residential land use is representative of City of San Mateo or if this is a function of the identified corner characteristics (or both) was not examined as part of the scope of this work.

Land use does appear to affect parking configuration based on the visual assessment conducted. Per the assessment, no angled parking was observed in residential areas, whereas at least one leg of angled parking was observed for approximately 25% of corners located in commercial land use areas.

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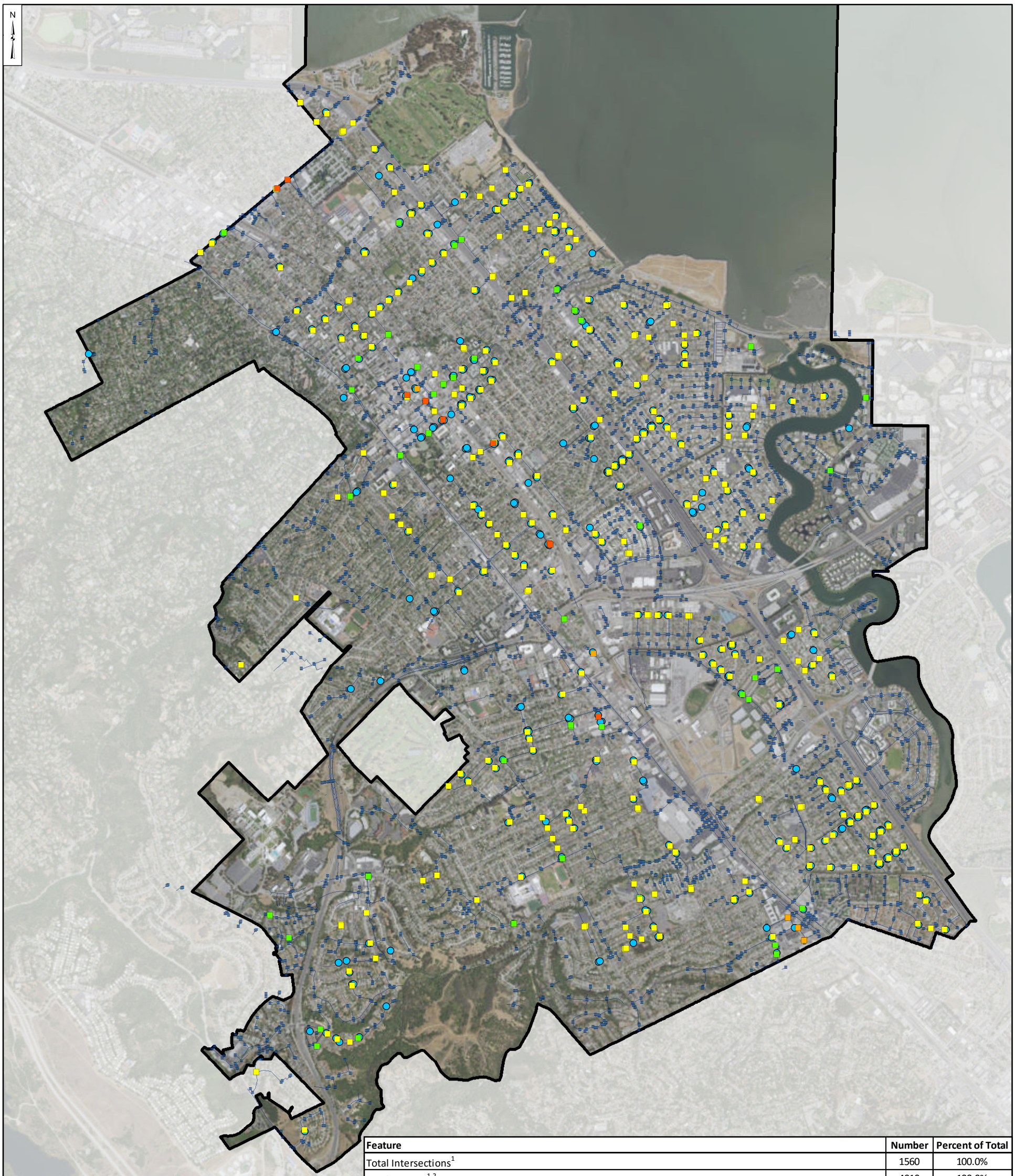

Feature	Number	Percent of Total
Total Intersections[1]	1560	100.0%
Total Corners[1,2]	4010	100.0%
Corners Adjacent to Inlet Connected to Storm Main[1,2]	1116	27.8%
Corners Approximately 90 degrees, Adjacent to Inlet Connected to Storm Main[1,3]	737	18.4%
Intersections with at least one Corner Approximately 90 degrees, Adjacent to Inlet Connected to Storm Main[1,3]	399	25.6%

[1] Does not include highway or bridge adjacent intersections or corners.

[2] Includes corners with angle of 175 degrees or less.

[3] Includes corners with angle between 87.5 and 92.5 degrees.

Parking Configuration	Total Corners	Percent Corners Analyzed
One leg angled and one leg parallel	9	2.4%
At least one leg angled (not including one leg parallel)	5	1.4%
Both legs parallel	312	84.6%
Other configurations[4]	43	11.7%

Soil Type	Total Corners	Percent Underlain by
HSG C	5	0.7%
Cut and Fill and Urban Land	732	99.3%

Legend

Corners Assessed for Parking Configuration (369)

- One leg angled and one leg parallel
- At least one leg angled (not including one leg parallel)
- Both Legs Parallel
- Other configurations[4]

- Corners Meeting Criteria but Not Assessed for Parking Configuration (368)
- Storm Inlet connected to Storm Main
- Storm Main
- San Mateo City Limit

[4]Other configurations include combinations of parallel, no parking or unable to determine/ not available.

Urban Greening Corner Analysis

San Mateo, CA

Geosyntec consultants

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Figure 1

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