Development Process of San Francisco’s GI Typical Details

SCVURPPP GI Workshop – April 19, 2017
Outline

How to develop GI details that work for my jurisdictional codes and standards?

- City of SF overview
- Development process
- Detail format and framework
- Lessons learned
City of SF Overview
City of SF: Stormwater Management

In **separate sewer system areas**, stormwater transports pollutants to receiving waters.

- **Primary Goal:** Protect water quality by treating stormwater

In **combined sewer system areas**, stormwater contributes to localized flooding and combined sewer discharges.

- **Primary Goal:** slow the rate and reduce the volume of stormwater

Collection System Types
SFPUC Green Infrastructure Implementation

- **Stormwater Management Ordinance**
  - Legally binding stormwater management requirements for development or redevelopment projects ≥ 5,000 sf of creation or replacement of impervious surface

- **Demonstration Projects**
  - Examples: Cesar Chavez, Newcomb Avenue, Leland Avenue, Sunset Circle, Mint Plaza

- **Early Implementation Projects (EIPs)**
  - 8 capital right-of-way projects in each of San Francisco’s Watersheds

- **Watershed Stewardship Grants**
  - SFPUC partnership with the Community Challenge Grant Program to fund green infrastructure projects in the public realm
SMO Project Status – 7 Years of Implementation

305 projects reviewed (149 Final Approved)

- Managing 218 acres of drainage area in the MS4
- Managing over 105 million gallons per year of stormwater from 325 acres of drainage area in the CSS
  - Roughly 4.5% of parcel area subject to SMO
- Encouraging a diverse array of GI in SF
Development Process

Le Conte Affordable Housing
Key Goals

- **TYPICAL**, rather than **STANDARD** details
- Flexible & context-sensitive framework
  - Core details (plans, sections, and profiles)
  - Components (kit-of-parts)
  - Allow for design innovation
- Details and specifications that are:
  - Functional
  - Constructible*
  - Maintainable*
  - Accessible (ADA)
  - Durable
  - Aesthetic
- Simple & clear communication
Performance Goals

- Conform to Phase II MS4 permit
  - MS4 Areas: Treatment

- Combined sewer system compatible
  - CSS Areas: Rate and Volume reduction
Objectives

- **Formalize City requirements**
  - City of SF Stormwater Management Requirements (2010, updated 2016)

- **Address San Francisco site-specific conditions**
  - Extreme density
  - Narrow, steep streets, etc.

- **Inform City Codes and Regulations**
  - Negotiate rigorous ADA requirements
  - Help to resolve City codes & conflicts

- **Applicable to Parcel and ROW**
  - Private & public parcels
  - ROW Improvements
Process

- Interdisciplinary City Team
  - Planning
  - Engineering
  - Landscape architecture
  - Construction management

- Hired nationally versed consultants
- Reviewed nation’s ‘best’ GI details
- Inter-agency coordination
- Multiple reviews & iterations
Inter-Agency Coordination

- Kick-off meeting to City-family
- Sent out Questionnaire
- Workshops to resolve critical “sticking points”
  - Public Works
    - ADA issues
    - Permeable Paving (loading, setbacks, and edge restraints)
    - Curbs, curb walls, and sidewalk connections (structural, and curb height)
  - SFPUC Collection System Division
    - Underdrain and lateral connections
    - Overflow structure vs. catch basin
- Peer review process of DRAFT details
Feedback Loops

... repeat and rinse

- Refined scope and deliverable expectations
- Refined format and CAD standards
- Applied lessons learned from implementing SMR
  - Several years of local “in-city” projects (now at 300+ projects)
- Applied inter-agency workshop findings
- Final Deliverable: City QA/QC prior to release
Notable Challenges

- Resolving ‘edge conditions’
  - Point where multi-agency codes & policies overlap/conflict
    - Curbs / Walls
    - Lateral / Structure connections

- Permeable Paving regarded as **not** ADA friendly

- Green Infrastructure not fully understood
  - Agency education
  - Agency negotiations
  - Agency compromise

- Created ‘finishing details’ for improved constructability

- Need for monitoring
Efforts & Phased Release

- **Phase I:** July 2014
  - 18 months

- **Specifications:** April 2016
  - 18 months (overall)

- **Phase II:** September 2016
  - 12 months (overall)

- Overall contract fees: $400,000
Framework

- User Guide: “How to use...”
- Navigation Bar
- Purpose
- Designer Notes & Guidelines
- Layout Requirements
- Designer Checklist
- BMP Plans
- BMP Sections and Profiles
- Construction Notes
- Components
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**Not for Construction - Refer to User Guide**

**Green Infrastructure Typical Details**

San Francisco Public Utilities Commission

**Sheet Index**

(Additional information is present but not transcribed here.)
USER GUIDE: HOW TO USE THESE GI TYPICAL DETAILS

These typical details and specifications were developed to be revised and customized for each individual project by design professionals. They show typical configurations, rather than a required City standard configuration. This distinction is deliberate. We recognize that to create GI projects that are functional, contextual, and aesthetic, design professionals must use their professional judgment and creative thinking to be responsive to each site-specific condition.

Acad drawings of these typical details are provided such that the design professionals must modify the plan, sections, call-outs, and/or construction notes to address the projects site-specific conditions.

Content

These typical details are formatted, organized, and developed with the necessary informational tools to guide the design professional through the proper selection, layout, and design of GI best management practices (BMPs) and the selection of appropriate site-specific BMP component details (i.e. inlets, outlets, and edge treatments, etc.). These typical details provide the following organization:

Purpose: Summary of each facility's intended performance and function.

Designer Notes & Guidelines: Technical design requirements and/or sizing criteria guidelines are provided such that each facility is designed and appropriately customized by the design professional.

Layout Requirements: Technical information, design requirements, and reference to related City requirements.

Designer Checklist: Technical design information that must be determined and shown in the construction documents to ensure proper design and constructability.

BMP Plans: Typical plan view with general configuration for proper function. Dimensional layout and edging materials should be adjusted based on proposed site design and programming. [Adjust Acad Detail Call-Outs and References for Use in CDs]

BMP Sections and Profiles: A typical section and/or profile with general configuration for proper function. Dimensional layout and edging materials should be adjusted based on proposed site design and programming. [Adjust Acad Details Call-Outs and References for Use in CDs]

Construction Notes: Construction related notes for use by the contractor. [Adjust Acad Notes for Use in CDs]

Navigation

The typical details have been developed with a navigation system and key bar to assist the design professionals with linking the specific BMP to relevant design notes and possible detail components. Example key bar:

<table>
<thead>
<tr>
<th>Edge Treatments</th>
<th>Subsurface Check Dams</th>
<th>Subsurface Outlets</th>
<th>Edge Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
<td>Key</td>
<td>Notes</td>
<td>Key</td>
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<td>PC 1</td>
<td>PC 2</td>
<td>PC 3</td>
<td>PC 4</td>
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<tr>
<td>PC 5</td>
<td>PC 6</td>
<td>PC 7</td>
<td>PC 8</td>
</tr>
</tbody>
</table>

Use on Construction Documents

Design professionals using the AutoCAD drawings must review and adjust the details and construction notes to address their site-specific conditions. To allow for site-specific design adjustments the typical details are developed as "not for construction" drawings. Title blocks are provided for document organization and reference only.

- Do not include the non-adjusted detail with title block within the construction documents.
- Do not include non-adjusted detail plans, sections, or construction notes within the construction documents.
- Do not reference the GI typical detail sheet name and/or number (i.e., BP 2.1) as a standard detail call-out within the CDs.
- Do not expect contractors to conduct calculations or be responsible for missing design information.
PURPOSE

BIORETENTION PLANTERS CONTROL PEAK FLOWS AND VOLUMES OF STORMWATER RUNOFF BY PROVIDING SURFACE, SUBSURFACE STORAGE AND INFILTRATION INTO NATIVE SOIL. WATER IS ALSO TREATED AS IT FILTERS THROUGH THE BIORETENTION SOIL.

DESIGNER NOTES & GUIDELINES:

1. THE DESIGNER MUST ADAPT PLAN AND SECTION DRAWINGS TO ADDRESS SITE-SPECIFIC CONDITIONS.
2. PLANTER AREA, PONDING DEPTH, BIORETENTION SOIL DEPTH, AND AGGREGATE STORAGE DEPTH MUST BE SIZED TO MEET PROJECT HYDROLOGIC PERFORMANCE GOALS.
3. PONDING AND BIORETENTION SOIL DRAWDOWN TIME (I.E., TIME FOR MAXIMUM SURFACE PONDING TO DRAIN THROUGH THE BIORETENTION SOIL AFTER THE END OF A STORM) RECOMMENDATIONS:
   - 3 - 12 HOUR PONDING AND BIORETENTION SOIL DRAWDOWN (TYPICAL)
   - 24 HOUR MAXIMUM PONDING AND BIORETENTION SOIL DRAWDOWN
4. FACILITY DRAWDOWN TIME (I.E., TIME FOR SURFACE PONDING TO DRAIN THROUGH THE ENTIRE SECTION INCLUDING AGGREGATE STORAGE AFTER THE END OF A STORM) REQUIREMENTS:
   - 48 HOUR MAXIMUM FACILITY DRAWDOWN (I.E., ORIFICE CONTROLLED SYSTEM OR EXTENDED STORAGE DEPTH WITHIN INFILTRATION SYSTEM)
5. AN AGGREGATE COURSE IS REQUIRED UNDER THE BIORETENTION SOIL FOR BIORETENTION IN SEPARATE SEWER SYSTEM AREAS TO PROVIDE ADDITIONAL TREATMENT. THIS AGGREGATE COURSE IS OPTIONAL FOR FACILITIES IN COMBINED SEWER SYSTEM AREAS. SEE GUIDANCE ON BC 4.1.
6. THE PLANTER WALL SLOPE IS TYPICALLY DESIGNED TO MATCH THE LONGITUDINAL SLOPE OF THE ADJACENT ROADWAY/SIDewALK. THE FACILITY SUBGRADE, HOWEVER, SHOULD BE FLAT. CHECK DAMS MAY BE USED TO TERRACE FACILITIES TO PROVIDE SUFFICIENT PONDING FOR HIGHER-SLOPED INSTALLATIONS. DESIGNER MUST SPECIFY CHECK DAM HEIGHT AND SPACING. REFER TO BC 6.1 AND BC 6.2 FOR GUIDANCE ON CHECK DAM DESIGN.
7. DEPENDING ON THE HEIGHT OF THE PROPOSED PLANTER WALL, ADDITIONAL STRUCTURAL CONSIDERATIONS MAY BE REQUIRED TO ADDRESS WALL LOADING. REFER TO BC 1.1 THROUGH BC 1.7 FOR GUIDANCE ON EDGE TREATMENTS.
8. WHEN FACILITY CONSTRUCTION IMPACTS EXISTING SIDEWALKS, ALL SAW CUTS MUST ADHERE TO SFPC REQUIREMENTS. SAW CUTS SHOULD BE ALONG SCORE LINES AND ANY DISTURBED SIDEWALK FLAGS SHOULD BE REPLACED IN THEIR ENTIRETY.
9. PLANTERS IN PUBLIC RIGHT OF WAY SHALL BE DESIGNED WITH EMERGENCY OVERFLOW TO THE STREET IN THE EVENT THE PLANTER OUTLET IS OBLITERATED OR CLOSED.
10. UP TO TWO PLANTERS MAY BE CONNECTED IN SERIES, IN LIEU OF MULTIPLE INLETS, PROVIDED THE CONNECTION IS A TRENCH DRAIN OR EQUAL SURFACE CONVEYANCE AND IS ADEQUATELY SIZED TO CONVEY FLOWS.
11. PLANTER VEGETATION MUST BE SPECIFIED BY DESIGN PROFESSIONAL PER SFPC VEGETATION Pallet
12. THE DESIGNER MUST EVALUATE UTILITY SURVEYS FOR POTENTIAL UTILITY CROSSINGS OR CONFLICTS. REFER TO GC 2.1 - GC 2.12 FOR UTILITY CROSSING DETAILS AND GC 4.4 - GC 4.4 FOR UTILITY CROSSING CONFLICT DETAILS.
13. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SFPC ASSET PROTECTION STANDARDS AND OTHER UTILITY PROVIDER REQUIREMENTS.

RELATED COMPONENTS

EDGE TREATMENTS:

INLETS:

OUTLETS:

AGGREGATE STORAGE:

UNDERDRAINS:

CHECK DAMS:

LINERS:

UTILITY CROSSINGS:

OBSERVATION PORTS:

UTILITY CONFLICTS:

CLEANOUTS:

RELATED SPECIFICATIONS

BIORETENTION:
- BIORETENTION SOIL MIX
- AGGREGATE STORAGE
- MULCH
- STREAMBED COBBLES

GREEN INFRASTRUCTURE
TYPICAL DETAILS
SAN FRANCISCO PUBLIC UTILITIES COMMISSION
LAYOUT REQUIREMENTS:

1. ALL PERMEABLE PAVEMENT APPLICATIONS SHALL CONFORM TO THE CURRENT CITY OF SAN FRANCISCO PUBLIC WORKS PERMEABLE PAVEMENT DIRECTORS ORDER (PENDING COMPLETION). THE DESIGN MUST COMPLY WITH SAN FRANCISCO PUBLIC WORKS STANDARD ACCESSIBILITY REQUIREMENTS.

2. THE PREFERRED AND ALLOWED CATCHMENT AREA CONTRIBUTING RUN-ON TO A PERMEABLE PAVEMENT FACILITY IS PROVIDED IN THE FOLLOWING TABLE:

<table>
<thead>
<tr>
<th>WEARING COURSE</th>
<th>PREFERRED RUN-ON RATIO</th>
<th>MAXIMUM RUN-ON RATIO** (AREA CONTRIBUTING RUN-ON TO PERMEABLE PAVEMENT AREA)</th>
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</thead>
<tbody>
<tr>
<td>Permeable Unit Pavers (2 1/2&quot; Gaps)</td>
<td>0.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Permeable Unit Pavers (2 2/8&quot; Gaps)</td>
<td>0.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Permeable Unit Pavers (2 1/4&quot; Gaps)</td>
<td>0.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Porous Pavers</td>
<td>0.1</td>
<td>0.1 (NO RUN-ON)</td>
</tr>
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** Pavers with 3/8 inch or 1/2 inch gaps shall be permeable interlocking concrete pavers with integrated precast interlocking spacer.

** The designer and owner should consider the increased maintenance requirements associated with higher run-on ratios when designing the facility.

3. WHEN DESIGNED TO ACCEPT RUN-ON FROM OTHER CATCHMENT AREAS, PERMEABLE PAVEMENT AREAS MUST BE PROTECTED FROM SEDIMENTATION WHICH CAN CAUSE CLOGGING AND DIMINISHED FACILITY PERFORMANCE. THE FOLLOWING REQUIREMENTS APPLY FOR RUN-ON CONTRIBUTIONS:

- Run-on from lawn, landscape or other erosible surfaces is discouraged. If minor run-on from lawn or landscape areas is unavoidable, those erosible areas must be fully stabilized.
- Concentrated run-on (e.g., direct discharge from a downspout) should be dispersed prior to discharge to a permeable pavement facility. Acceptable methods include sheet flow or subsurface delivery to the storage reservoir. If subsurface delivery is used, primary settling is required (e.g., via sand trap) followed by distribution to storage reservoir (e.g., via perforated pipe).

4. WEARING COURSE SHALL BE SET FLUSH (± 3/16 INCH) WITH ADJACENT WALKING SURFACES.

5. WEARING COURSE SHALL HAVE A MINIMUM SURFACE SLOPE OF 0.5% TO ALLOW FOR SURFACE OVERFLOW AND A MAXIMUM SURFACE SLOPE AS LISTED BELOW:
   a. Porous Asphalt Surface: = 5 PERCENT SLOPE
   b. Pervious Concrete Surface: = 10 PERCENT SLOPE
   c. Permeable Unit Pavers: = 12 PERCENT SLOPE (PER MANUFACTURER’S RECOMMENDATION)

6. WHILE THERE IS NO MAXIMUM SLOPE FOR THE SUBGRADE UNDER THE PERMEABLE PAVEMENT COURSES, THERE MAY BE ENGINEERING CHALLENGES ASSOCIATED WITH SUBSURFACE CHECK DAM REQUIREMENTS ON SUBGRADE SLOPES EXCEEDING 9%. SEE SUBSURFACE CHECK DAMS (PC 2.1 AND PC 2.2).

DESIGNER CHECKLIST (MUST SPECIFY, AS APPLICABLE):

- Permeable pavement specifications and/or paver type and gap width
- Permeable pavement width and length
- Elevations and control points at every corner or point of tangency
- Thickness of each layer in the pavement section
- Joint spacing and type
- Subgrade slope
- Subsurface check dam spacing, height, and type
- Elevations of each pipe inlet and outlet invert
- Type and design of permeable pavement components (e.g., edge treatments, outlets, underdrains, etc.)
CONSTRUCTION NOTES:
1. CHECK DAMS SHALL BE SPACED TO PROVIDE PONDING PER SITE SPECIFIC DESIGN.
2. SLOPE TOP OF PLANTER WALL TO MATCH LONGITUDINAL SLOPE OF ADJACENT SURFACE.
3. LAY OUT DRAINAGE NOTCHES TO PREVENT PONDING BEHIND PLANTER WALL WITH 6" MAXIMUM SPACING BETWEEN NOTCHES.
4. PROVIDE ONE CLEANOUT PER PLANTER (MIN) FOR FACILITIES WITH UNDERDRAINS.
5. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SFPUC ASSET PROTECTION STANDARDS. COORDINATE WITH ENGINEER IN THE EVENT OF UTILITY CROSSING AND UTILITY CONFLICTS.

GREEN INFRASTRUCTURE
TYPICAL DETAILS
SAN FRANCISCO PUBLIC UTILITIES COMMISSION

BIORETENTION PLANTER
ROADSIDE PLANTER WITH PARKING
PLAN

2016-SEPTEMBER

NOTE

BP 2.1

PARCEL APPLICATIONS

NOTES

WE/PARKING

PLAN SECTIONS

W/O PARKING

PLAN SECTIONS

ALT 1

ALT 2

ALT 3

ALT 4

ALT 5

ALT 6

PLANTER

1.1

1.2

2.1

2.2

3.1

3.2

4.1

4.2

4.3

4.4

4.5

4.6

5.1

5.2

5.3

5.4

5.5

5.6

6.1

6.2

6.3

6.4

6.5

6.6
CONSTRUCTION NOTES:

1. AVOID COMPACTATION OF EXISTING SUBGRADE BELOW PLANTER DURING CONSTRUCTION.

2. SCARIFY SUBGRADE TO A DEPTH OF 3 INCHES (MIN) IMMEDIATELY PRIOR TO PLACEMENT OF AGGREGATE STORAGE AND BIORETENTION SOIL MATERIAL.

3. MAXIMUM DROP FROM TOP OF CURB TO TOP OF BIORETENTION SOIL SHALL INCLUDE CONSIDERATIONS FOR BIORETENTION SOIL SETTLEMENT.

TYPICAL DRAINAGE NOTCH DETAIL
Plan

Underdrains and others...

Outlets

Components

Inlets

Edge Treatments
Specifications and Guidelines

- Bioretention Soil Mix
- Pervious Concrete
- Permeable Unit Pavers
- Porous Asphalt
- Infiltration Test Guidelines
- Aggregate Guidelines
Context Sensitive Design

Mission Bay Traffic Circle  SF Zoo  Stevenson Alley
Edge Conditions – Permeable Paving

- Interface at adjacent surface types
Edge Conditions - Bioretention Walls

- Interface at adjacent surface types
- Wall options (based on structural calculations)
- Lateral bracing & check dams
Slopes

- Permeable pavement slopes
- Bioretention slopes
Existing Infrastructure

- Utility conflicts
- Interface with structures (e.g. pole, bike racks, etc.)
Design for Maintainability

- Sediment settling
- Cleanouts
Design for Monitoring

- Observation ports
- Outlets monitoring
- End of block monitoring
Lessons Learned
Lessons Learned – Development Process

- Longer efforts than expected due to inter-agency coordination
- Participation in inter-agency policy committees
- Revealed City-wide process gaps
- Necessary utility protection discussions
- Necessary intra-agency maintenance discussions
Lessons Learned – Phase II Improvements

- Need for ‘How To’ User Guide
- Simplified and easier usability
- Clarified format and organization
- Clarified and split note types
  - Designer Notes & Guidelines
  - Construction Notes
- Added note “Not for Construction”
Lessons Learned – Common Use Mistakes

- Project contracting gaps
  - Gaps between disciplines scope & deliverables

- Design process gaps
  - Not customized to site context
  - Unclear CD communication
  - Not designed as a ‘connected system’
  - Inconsistent inter-disciplinary coordination
  - Lack of QA/QC

- City design review oversight is essential

- Design Team construction oversight is essential
Contact and Info

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