



# Parking Meter Data Guide

October 25, 2013

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## 1 Introduction

This document describes how parking meter event data is collected from the SFMTA's parking meters and processed for analysis in the SFpark data warehouse, particularly for the purpose of analyzing revenue. Additionally, the document describes the decisions made when compiling the data from two different sources.

### 1.1 Timeline

Smart meters installation commenced within the SFpark pilot areas in December 2010 and was substantially complete during the first quarter of 2011. Due to logistics of installing thousands of meters the data parking meter revenue data feed came online incrementally during those months. Legacy meter revenue data was, and continues to be collected via the methods described in Section 2 below.

### 1.2 Availability of Data

This data guide supports the use of parking meter revenue data extracted in the following ways:

#### TRANSACTIONAL REVENUE DATA

Transactional revenue data (smart meters only) between March 2011 and April 2013 can be found in SFpark\_MeterData\_PaymentTransactions\_Smart\_20112013.csv. Revenue summaries by collection date (legacy meters only) can be found in SFpark\_MeterData\_PaymentTransactions\_Legacy\_20112013.csv.

#### DAILY REVENUE BY PMD

Smart and legacy meter daily revenue data between March 2011 and April 2013 can be found in SFpark\_MeterData\_ParkingRevenue\_Smart\_20112013.csv and SFpark\_MeterData\_ParkingRevenue\_Legacy\_20112013.csv respectively.

A data dictionary for each of the files below can be found in section 5 of this document.

For all data requests and related inquiries, please contact [info@sfpark.org](mailto:info@sfpark.org) and put "SFpark evaluation data request" in the subject line.

Parking meter data file names, formats and sizes are as follows:

- File name: SFpark\_MeterData\_PaymentTransactions\_Smart\_20112013.csv

- Microsoft Excel Comma Separated Values File (.csv)
- File size: XXX KB
  
- File name: SFpark\_MeterData\_PaymentTransactions\_Legacy\_20112013.csv
- Microsoft Excel Comma Separated Values File (.csv)
- File size: XXX KB
  
- File name: SFpark\_MeterData\_ParkingRevenue\_Smart\_20112013.csv
- Microsoft Excel Comma Separated Values File (.csv)
- File size: XXX KB
  
- File name: SFpark\_MeterData\_ParkingRevenue\_Legacy\_20112013.csv
- Microsoft Excel Comma Separated Values File (.csv)
- File size: XXX MB

## 2 Parking meter equipment overview

Prior to the inception of *SFpark* the SFMTA operated what are now referred to as legacy parking meters. Legacy meters lack much of the additional functionality that smart meters provide, particularly the ability to communicate remotely with meter management systems and the *SFpark* data warehouse.

Figure 1. Smart meter locations



The SFMTA currently manages parking meters from four different manufacturers within the city. These meters can be reduced into one of two categories mentioned above: smart meters or legacy meters. To the customer, the most obvious difference between the two is that legacy meters lack the ability to accept credit cards and don't have large displays with parking information. All parking meters, both smart and legacy, are equipped with smart lock technology. During the coin collection process the revenue data for each meter is associated with each unique digital lock. The information is then downloaded via a smart key when the meter is unlocked for collection. This revenue information is then used to reconcile coin collections on a monthly basis in the San Francisco Parking Meter (SFPM) database maintained by the meter shop.

## 2.1 Smart Meters

Meter Type	Manufacturer	Model
Single space	IPS	M3 147
Multi-space	Duncan	VM



(Left) An IPS single space meter. (Right) A Duncan multi-space meter

Each smart meter is equipped with a cellular radio and SIM-card to communicate with the SFpark data warehouse as well as the vendor meter management system. To support the policies of the SFpark program and analyze various data feeds (parking meters, parking sensors, roadway sensors, etc.) a specialized database known as the SFpark data warehouse was developed. The data warehouse stores all events that are triggered by the parking meter, such as payments, and interfaces with the meter management systems of the vendors to push configuration changes wirelessly to the meters.

## 2.2 Legacy Meters

Meter Type	Manufacturer	Model
Single space	MacKay	Guardian
Multi-space	Duncan	RSV2
Multi-space	Duncan	RSV3
Multi-space	Parkeon	Strada



*(Left) A MacKay single space meter. (Center) A Duncan RSV2/3 (Right) A Parkeon multi-space meter*

Legacy meters, lacking any way to communicate remotely, require a Parking Meter Repair Technician (PMR) or coin collector to physically touch the meter in order to upload or download information. Meter revenue is collected through smart lock method described in Section 2 above, used for reconciliation, and then downloaded into the legacy SFPM system at the Meter Shop.

As the information available from legacy meters is summarized at each date the meter was touched, balances fluctuate due to how many collection days were in the period. This presents a challenge for analyses at the daily, weekly and monthly level.

### 2.3 Smart Meters vs. Legacy Meters

As compared to legacy meters, smart meters allow the SFMTA to employ:

- Increased payment methods
- Remote reprogramming of meter rates
- Complex scheduling for special events, multiple time limits in the same day, variable rates, etc.
- Detailed meter revenue data collection
- Real time maintenance information
- Visual verification of payment by phone

Legacy meters require a parking meter repair technician (PMR) to reprogram each meter individually whenever there is a change to meter functionality. To achieve the policy goals of the SFpark pilot project, large scale changes to parking meters needed to be rolled out simultaneously across the pilot districts. In particular, remotely programming variable meter rates – the critical technological requirement for

implementing the *SFpark* pilot project – would not have been possible without smart meters. Smart meter installation commenced in December 2010 and continued through April of 2011.

## 2.4 Equipment Inventory

The SFMTA's 25,870 parking meters manage over 29,000 individual parking spaces throughout the city. Single space meters are more commonly used, though multi-space meters are frequently used to manage motorcycles parking spaces or automobile spaces where the sidewalks pose challenges for multiple single space meters. The following table shows breakdown by meter and area:

Area Type	Smart Meters		Legacy Meters			Total
	IPS M3 147	Duncan VM	Duncan RSV2/3	MacKay Guardian	Parkeon Strada	
Pilot	6,002	152	161	3,519	39	<b>9,873</b>
Control	-	-	-	1,435	-	<b>1,435</b>
Other	669	43	109	13,722	19	<b>14,562</b>
<b>Total</b>	<b>6,671</b>	<b>195</b>	<b>270</b>	<b>18,676</b>	<b>58</b>	<b>25,870</b>

These meters, the spaces that they cover, the regulations, schedules, and rates are all stored in the *SFpark* data warehouse.

## 3 Business processes

The two parking meter technologies communicate revenue information to the SFMTA in different ways.

### 3.1 Legacy meters

As mentioned in Section 2.2, legacy meters do provide revenue information for analysis, albeit much less frequently and at a higher level. Once this information is retrieved from the meter during the coin collection process, it is uploaded to the SFPM database.

### 3.2 Smart meters

Because of their ability to communicate wirelessly, smart meters are able to provide transaction level detail in real-time to the *SFpark* data warehouse. This provides a very rich dataset which includes time-stamped transactions, payment type (credit card, coin, smart card, pay by phone) and transaction amount. In addition to the live data feed, SFMTA staff have the ability to reprogram meters remotely



through the SFpark data warehouse, which communicates with the vendors' meter management system via xml. With the creation of the SFpark data warehouse, the SFMTA has established a meter XML to ensure that regardless of the vendor or model of smart meter all meter communications will be compatible with the data warehouse. The specifications of the XML file are spelled out in Appendix A.

## 4 Known Issues

### 4.1 Different minimum temporal units

As discussed above, due to the fact that legacy and pilot meters have different minimal temporal units in which they can report revenue, data sets are provided as separate files.

## 5 Data Dictionary

### 5.1 Smart Meter Revenue (in SFpark Pilot Areas)

FIELD NAME	DEFINITION
Parking Management District	Name of parking management district
Date	Date revenue was collected at that Post ID
Street and Block	Street and block number
Post ID	Unique ID assigned to each metered space
Payment Type	Differentiates between cash, credit card, pre-paid parking car, or pay by phone
Net Amount Paid	Amount paid minus transaction fees paid by the customer (PBP only)
Session Start Date	Start of time purchased at meter
Session End Date	End of time purchased at meter

### 5.2 Legacy Meter Revenue (SFpark Pilot and Control Areas)

FIELD NAME	DEFINITION
Parking Management District	Name of parking management district
Date	Date revenue was collected at that Post ID
Street and Block	Street and block number
Post ID	Unique ID assigned to each metered space
Coin Revenue	Coin Revenue per SFPM
Smart Card Revenue	Smart Card Revenue per SFPM
Pay By Phone Revenue	Pay by Phone Revenue per OBIEE
Total Revenue	Total Revenue (the sum of the three revenue columns)

### 5.3 Smart Meter Daily Revenue (in SFpark Pilot Areas)

FIELD NAME	DEFINITION
Parking Management District	Name of parking management district
Date	Date
Payment Type	Differentiates between cash, credit card, pre-paid parking card, or pay by phone
Revenue	Revenue for each payment type on a given day

### 5.4 Legacy Meter Daily Revenue (SFpark Pilot and Control Areas)

FIELD NAME	DEFINITION
Parking Management District	Name of parking management district
Date	Date
Coin Revenue	Differentiates between cash, credit card, pre-paid parking card, or pay by phone
Smart Card Revenue	Revenue for each type of Payment type on a given day
Pay By Phone Revenue	Pay by Phone Revenue per OBIEE
Total Revenue	Total Revenue (the sum of the three revenue columns)

## 6 Appendix A: Meter Payment XML Spec 4.0

Description: The following XML is the format in which the Proposer will deliver real-time parking transaction data.

Revision History		
Date	Version	Description
20 June 2012	1.0	First DRAFT for review (Mariana R. Parreiras)
28 June 2012	2.0	Revised per discussion with Randy (Mariana R. Parreiras)
29 May 2013	3.0	Revised per discussion with Randy (Alexiy S)
10 Oct 2013	4.0	Added PAYMENT_TIME tag.

## &lt;PAYMENT&gt;

<VENDOR\_ID>**ID number assigned to each Proposer by SFMTA**</VENDOR\_ID><TRANSMISSION\_ID>**Transaction number generated by Proposer for this message**</TRANSMISSION\_ID><TRANSMISSION\_DATETIME>**Date and time of transmission from Proposer in UTC**</TRANSMISSION\_DATETIME><METER\_TYPE>**MS,SS**</METER\_TYPE><PARKING\_SPACE\_ID>**Internal numeric ID assigned to meter space by SFMTA**  
</PARKING\_SPACE\_ID><POST\_ID>**999-99999 (SS only)**</POST\_ID><MS\_ID>**999-99999 (MS only)**</MS\_ID><SPACE\_NUM>**99 (MS only)**</SPACE\_NUM><EVENT\_TYPE>**NS,AT** </EVENT\_TYPE>

&lt;NEW\_SESSION&gt;

<SESSION\_ID>**unique ID number**</SESSION\_ID><AMOUNT\_PAID\_BY\_DRIVER>**price in dollars and cents**</AMOUNT\_PAID\_BY\_DRIVER><AMOUNT\_RECEIVED\_BY\_SFMTA>**price in dollars and cents**</AMOUNT\_RECEIVED\_BY\_SFMTA ><PAYMENT\_TYPE>**CREDIT CARD, CASH, SMART CARD, TOKEN, PAY BY CELL, TECH CREDIT**</PAYMENT\_TYPE>

&lt;/NEW\_SESSION&gt;

&lt;ADD\_TIME&gt;

<SESSION\_ID>**unique ID number**</SESSION\_ID><AMOUNT\_PAID\_BY\_DRIVER>**price in dollars and cents**</AMOUNT\_PAID\_BY\_DRIVER><AMOUNT\_RECEIVED\_BY\_SFMTA>**price in dollars and cents**</AMOUNT\_RECEIVED\_BY\_SFMTA >

**<PAYMENT\_TYPE>CREDIT CARD, CASH, SMART CARD, TOKEN, PAY BY CELL, TECH CREDIT</PAYMENT\_TYPE>**

**</ADD\_TIME>**

**<PAYMENT\_TIME> time in standard Oracle format to the second in UTC</PAYMENT\_TIME>**

**<START\_TIME>time in standard Oracle format to the second in UTC</START\_TIME>**

**<END\_TIME>time in standard Oracle format to the second in UTC</END\_TIME>**

**</PAYMENT>**

*Descriptions:*

<i>XML Code:</i>	<i>Shall Be:</i>
<i>VENDOR_ID</i>	<i>Assigned by SFMTA to each pay by cell company, parking meter company, etc.</i>
<i>TRANSMISSION_ID</i>	<i>Unique and generated by Proposer</i>
<i>TRANSMISSION_DATETIME</i>	<i>Given by Proposer, in standard Oracle format to the second in UTC time zone</i>
<i>METER_TYPE</i>	<i>MS: multi-space meter SS: single space meter</i>
<i>PARKING_SPACE_ID</i>	<i>Unique identifier for the metered parking space assigned by SFMTA; applies to either SS or MS metered space</i>
<i>POST_ID</i>	<i>Unique identifier assigned by SFMTA; used primarily to identify single space metered spaces on the street</i>
<i>MS_ID</i>	<i>Unique identifier assigned by SFMTA; applies to multi-space pay stations only</i>

<i>SPACE_NUM</i>	<i>Identifier of specific parking space managed by MS pay station, assigned by SFMTA. The combination MS_ID + SPACE_NUM is always unique</i>
<i>EVENT_TYPE</i>	<i>Given by Proposer</i>  <i>NS: New Session - A customer initiates a new session</i>  <i>AT: Add Time - A customer adds time to an existing session</i>
<i>NEW_SESSION</i>	
<i>SESSION_ID</i>	<i>Generated by Proposer. A new session_ID shall be generated for each new NEW_SESSION event. If a customer adds time to a session the existing session_ID will be sent along with any ADD_TIME event(s).</i>
<i>AMOUNT_PAID_BY_DRIVER</i>	<i>The total amount paid by the customer including any fees.</i>
<i>AMOUNT_RECEIVED_BY_SFMTA</i>	<i>The total amount owed the SFMTA.</i>
<i>PAYMENT_TYPE</i>	<i>CREDIT CARD</i>  <i>CASH</i>  <i>SMART CARD</i>  <i>TOKEN</i>  <i>PAY BY CELL (used only by pay-by-cell service provider)</i>  <i>TECH CREDIT</i>
<i>ADD_TIME</i>	

<p>SESSION_ID</p>	<p>Generated by Proposer. A new session_ID shall be generated for each new NEW_SESSION event. If a customer adds time to a session the existing session_ID will be sent along with any ADD_TIME event(s).</p>
<p>AMOUNT_PAID_BY_DRIVER</p>	<p>The total amount paid by the customer including any fees.</p>
<p>AMOUNT_RECEIVED_BY_SFMTA</p>	<p>The total amount owed the SFMTA.</p>
<p>PAYMENT_TYPE</p>	<p>CREDIT CARD            CASH            SMART CARD            TOKEN            PAY BY CELL (used only by pay-by-cell service provider)            TECH CREDIT</p>
<p>PAYMENT_TIME</p>	<p>Given by Proposer in UTC time zone. Actual time payment is made to meter or pay by phone.</p>
<p>START_TIME</p>	<p>Given by Proposer in UTC time zone. For the NEW_SESSION event, the initial start time for the parking session. <b><u>In the case of prepayment this is not the same as payment time. For the ADD_TIME event, the extension start time for the parking session. This is likely not ever the same as the payment time.</u></b></p>

<p>END_TIME</p>	<p>Given by Proposer in UTC time zone. For a NEW_SESSION event, the initial end time for the parking session. For the ADD_TIME event, the new end time for the parking session.</p>
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Sample XML:

```

<PAYMENT>
  <VENDOR_ID>999</VENDOR_ID>
  <TRANSMISSION_ID>12345678</TRANSMISSION_ID>
  <TRANSMISSION_DATETIME>2010-07-10 15:30:02</TRANSMISSION_DATETIME>
  <METER_TYPE>SS</METER_TYPE>
  <PARKING_SPACE_ID>123456</PARKING_SPACE_ID>
  <POST_ID>111-12340</POST_ID>
  <EVENT_TYPE>NS</EVENT_TYPE>
    <NEW_SESSION>
      <SESSION_ID>123456</SESSION_ID>
      <AMOUNT_PAID_BY_DRIVER>7.00</AMOUNT_PAID_BY_DRIVER>
      <AMOUNT_RECEIVED_BY_SFMTA>7.00</AMOUNT_RECEIVED_BY_SFMTA
    >
      <PAYMENT_TYPE>CASH</PAYMENT_TYPE>
    </NEW_SESSION>
  <PAYMENT_TIME>2010-07-10 15:29:30</PAYMENT_TIME><START_TIME>2010-07-10
  15:29:30</START_TIME>
  <END_TIME>2010-07-10 17:29:30</END_TIME>
</PAYMENT>

```

<PAYMENT>

<VENDOR\_ID>**999**</VENDOR\_ID>

<TRANSMISSION\_ID>**12345679**</TRANSMISSION\_ID>

<TRANSMISSION\_DATETIME>**2010-07-10 17:20:45**</TRANSMISSION\_DATETIME>

<METER\_TYPE>**SS**</METER\_TYPE>

<PARKING\_SPACE\_ID>123456</PARKING\_SPACE\_ID>

<POST\_ID>**111-12340**</POST\_ID>

<EVENT\_TYPE>**AT**</EVENT\_TYPE>

<ADD\_TIME>

<SESSION\_ID>**123456**</SESSION\_ID>

<AMOUNT\_PAID\_BY\_DRIVER>**3.50**</AMOUNT\_PAID\_BY\_DRIVER>

<AMOUNT\_RECEIVED\_BY\_SFMTA>**3.50**</AMOUNT\_RECEIVED\_BY\_SFMTA  
>

<PAYMENT\_TYPE>**CREDIT CARD**</PAYMENT\_TYPE>

</ADD\_TIME>

<PAYMENT\_TIME>**2010-07-10 15:29:30**</PAYMENT\_TIME>

<START\_TIME>**2010-07-10 17:20:45**</START\_TIME>

<END\_TIME>**2010-07-10 18:20:45**</END\_TIME>

</PAYMENT>