



Sri Lanka Institute of Information Technology

# **Data Warehousing and Business Intelligence**

Assignment 2

2021

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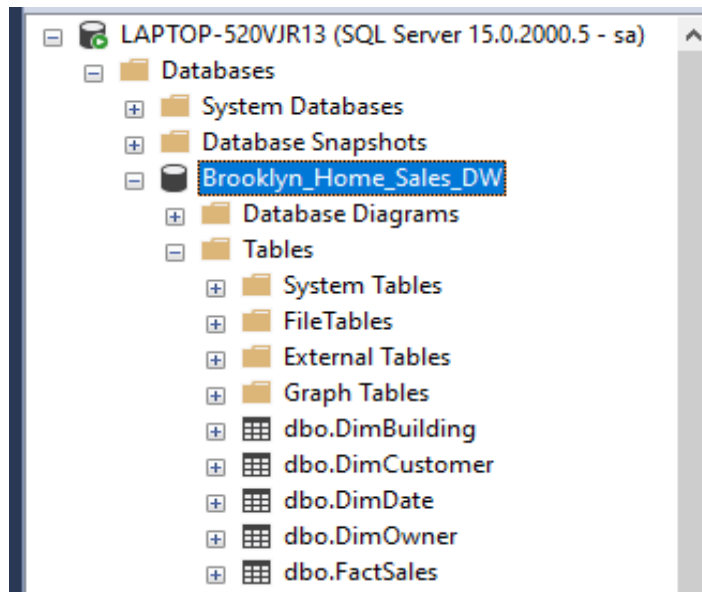
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## 1. Data Warehouse Introduction

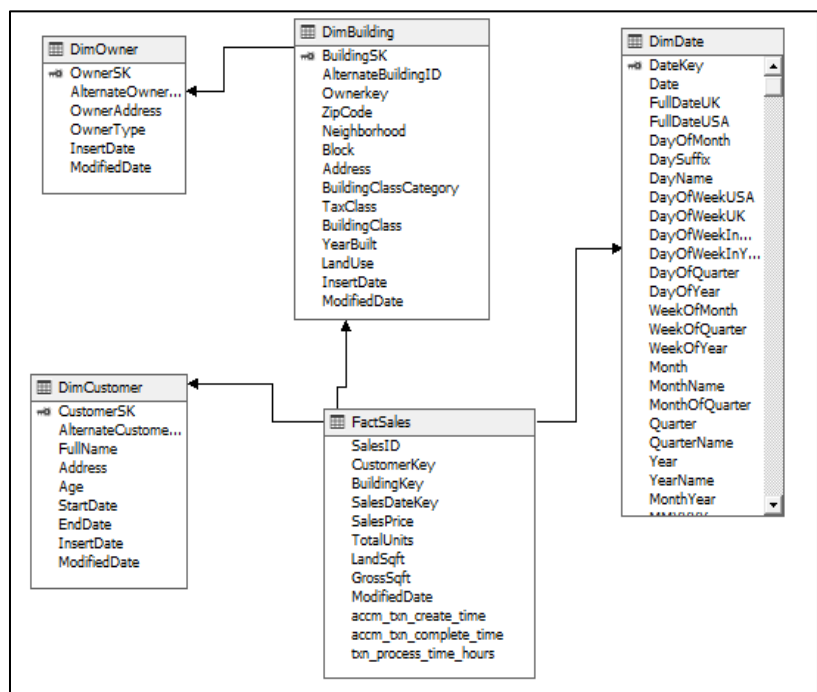
The data source used here is the ‘**Brooklyn Home Sales**’ which is the database which was created as the data warehouse earlier. The data warehouse was created using the Brooklyn Home Sales Dataset which consists of home sales prices of the Brooklyn from 2003 to 2017. This dataset has over 20k of data which through sales fact table and through dimension tables which are Customer, Building, Owner, and Date.

This data source is used for analysis for reporting services and to implement dashboards.



DataSource: Brooklyn Home Sales database

Snowflake schema used.



## 2. Cube Implementation

A multidimension data cube is a structure, that contains information for analytical purposes. The main constituents of a cube are dimensions and measures. Mainly this contains two facts,

- Dimensions: Define the structure of the cube that you use to slice and dice over.
- Measures: Provide aggregated numerical values of interest to the end user.

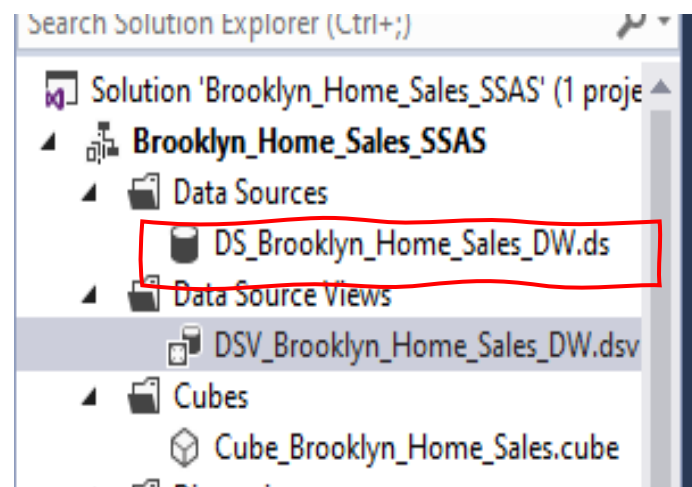
For this process SQL Server Data Tools was used.

### 2.1 Procedure for cube Implementation

#### 2.1.1 Step 1: Creating Data Source

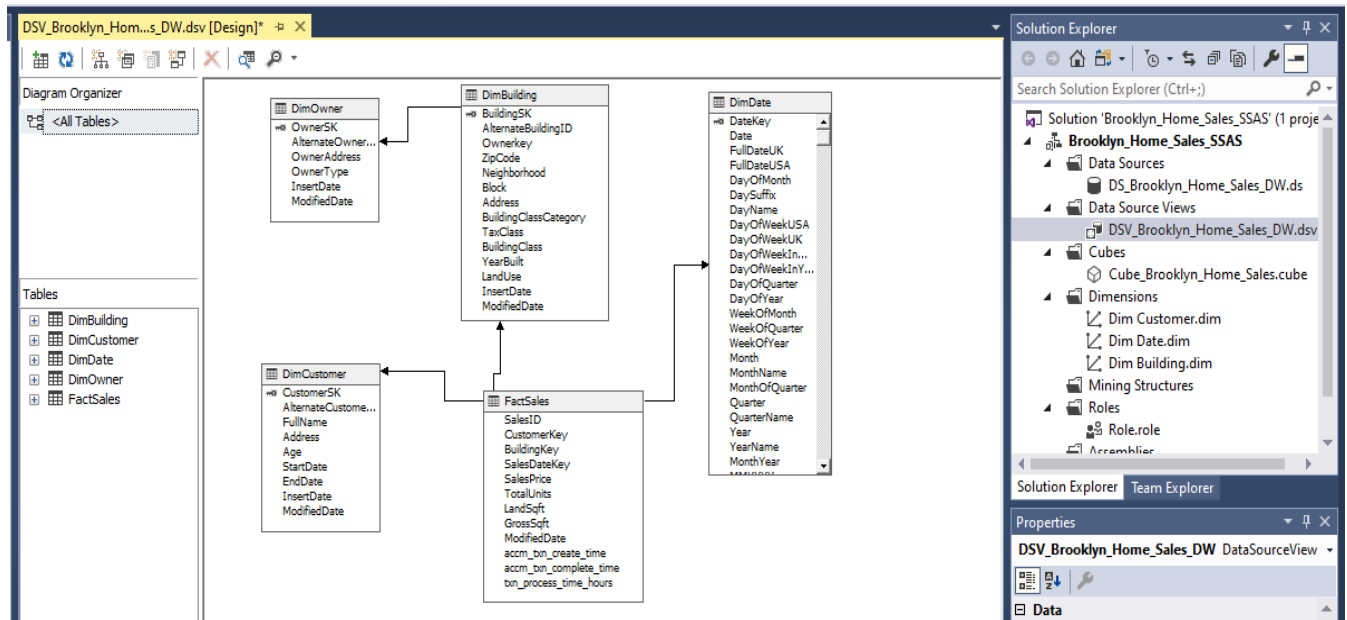
The Data source was created by connecting to the '**Brooklyn Home Sales DW**' database through SQL server management studio. Specific windows username and password was used to connect to the SQL Server management studio

Data Source and Impersonation information



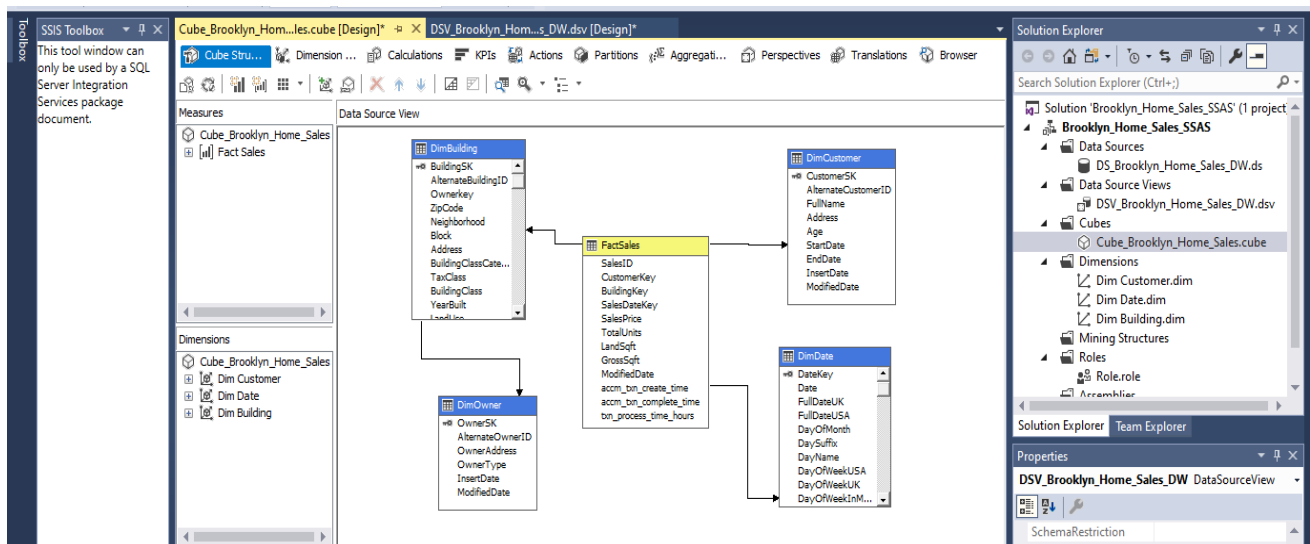
### 2.1.2 Step 2: Creating Data View

This step includes getting the relations and views of our dataset since the analysis service only has access to the relations that are present in this data source view. Therefore, using the data source that was created in the step 1 the data source view is created.



### 2.1.3 Step 3: Creating the Cube

This step includes creation of the cube using our data source view. We will mention the fact sales relation as the fact table as it contains all our measures required for the analysis process.

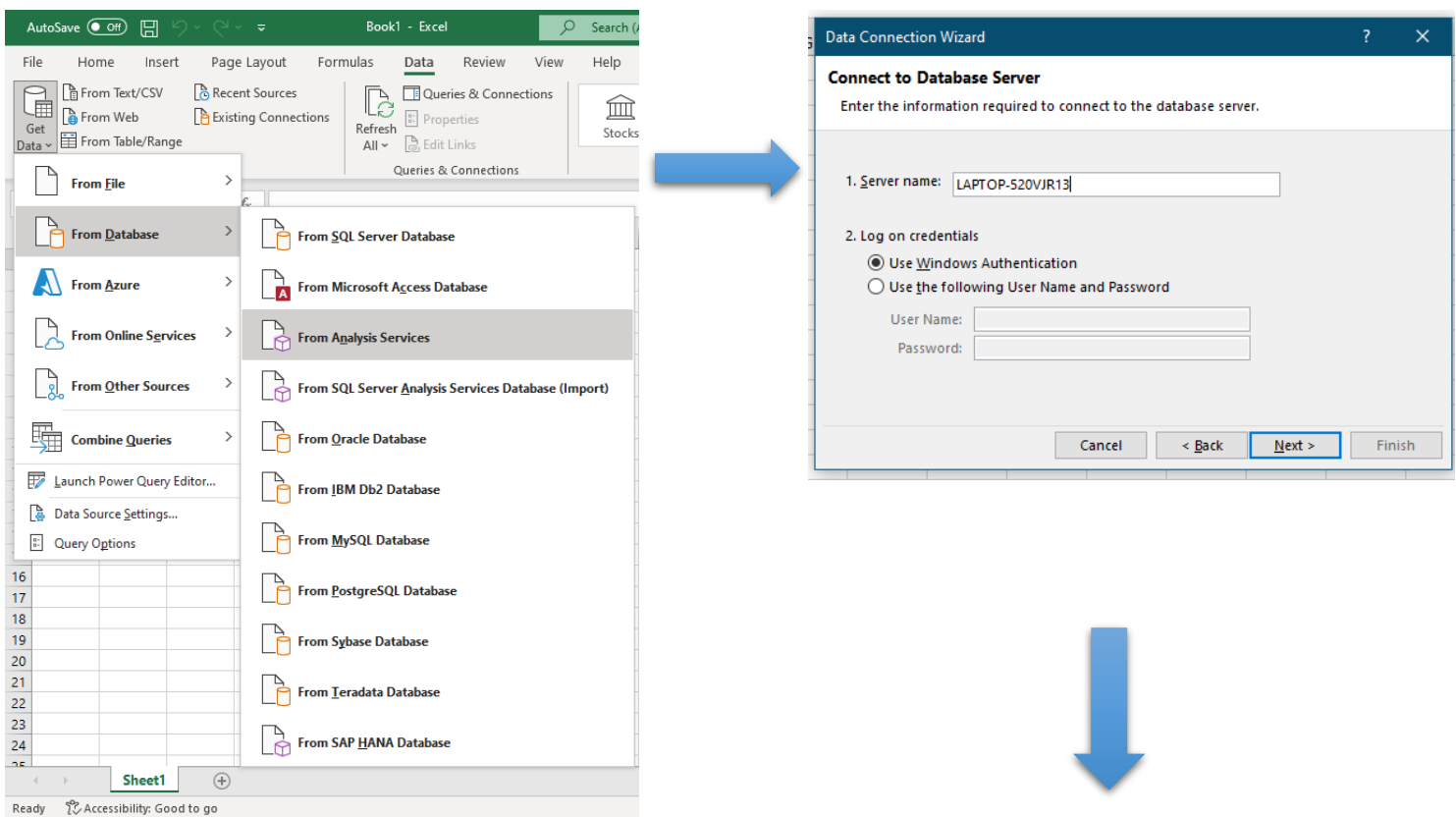


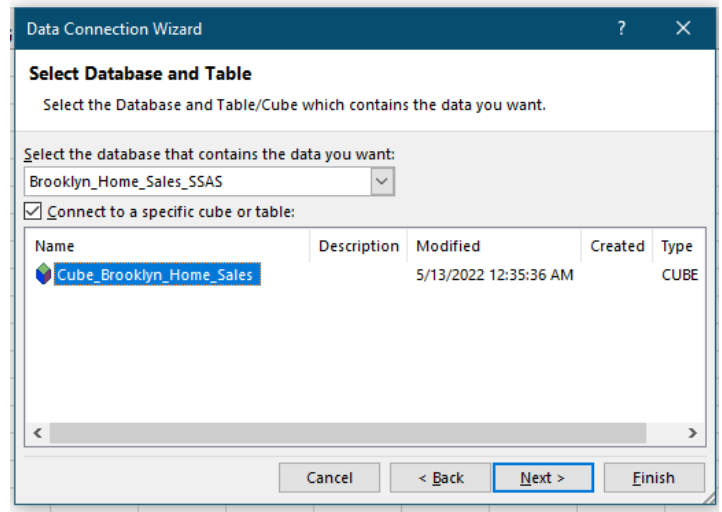
### 3. Demonstration of OLAP Operations

**OLAP** stands for **Online Analytical Processing** Server. It is a software technology that allows users to analyze information from multiple database systems at the same time. It is based on multidimensional data model and allows the user to query on multi-dimensional data. An effective OLAP solution solves problems for both business users and IT departments. This is an important part of Business Intelligence, providing powerful capabilities for data mining and trend analysis. OLAP helps to analyze big data amounts from different perspectives rapidly. For the Demonstration, to connect the excel workbooks and to get the data to the semantic layer we can use MDX query. We can build up the MDX query through SSAS project by browsing data.

In my scenario I have not used MDX query instead I have used the data tab in the ribbon to get data from my SSAS Cube.

#### 3.1 Connection to the SSAS Cube





## 3.2 Excel Report for OLAP Operations Demonstrations

### 3.2.1 Drill down and rollup demonstration

- The **Role Up** operation performs, aggregation on a multidimensional data cube either by climbing up the hierarchy or by dimension reduction. Roll-up is like zooming out on the data cubes
- The **Drill Down** operation is carried out either by descending a concept hierarchy for a dimension or by adding a new dimension. This lets a user deploy highly detailed data from a data cube. The drill-down operation is the reverse operation of roll-up. Drill-down is like zooming-in on the data cube

## Roll up - Total Sales Price by Neighborhood Group

Neighborhood	Sales Price
+ BATH BEACH	416,609,242
+ BAY RIDGE	1,224,584,968
+ BEDFORD STUYVESANT	3,394,437,885
+ BENSONHURST	794,158,862
+ BERGEN BEACH	108,545,390
+ BOERUM HILL	1,686,931,900
+ BOROUGH PARK	2,044,824,883
+ BRIGHTON BEACH	554,987,202
+ BROOKLYN HEIGHTS	4,955,976,671
+ BROOKLYN-UNKNOWN	131,532,135
+ BROWNSVILLE	526,976,687
+ BUSH TERMINAL	639,257,989
+ BUSHWICK	1,625,718,858
+ CANARSIE	433,927,149
+ CARROLL GARDENS	1,546,204,761
+ CLINTON HILL	1,733,478,181
+ COBBLE HILL	1,272,825,725
+ COBBLE HILL-WEST	325,476,262
+ CONEY ISLAND	723,552,105
+ CROWN HEIGHTS	3,037,015,452
+ CYPRESS HILLS	217,177,675



## Drill down

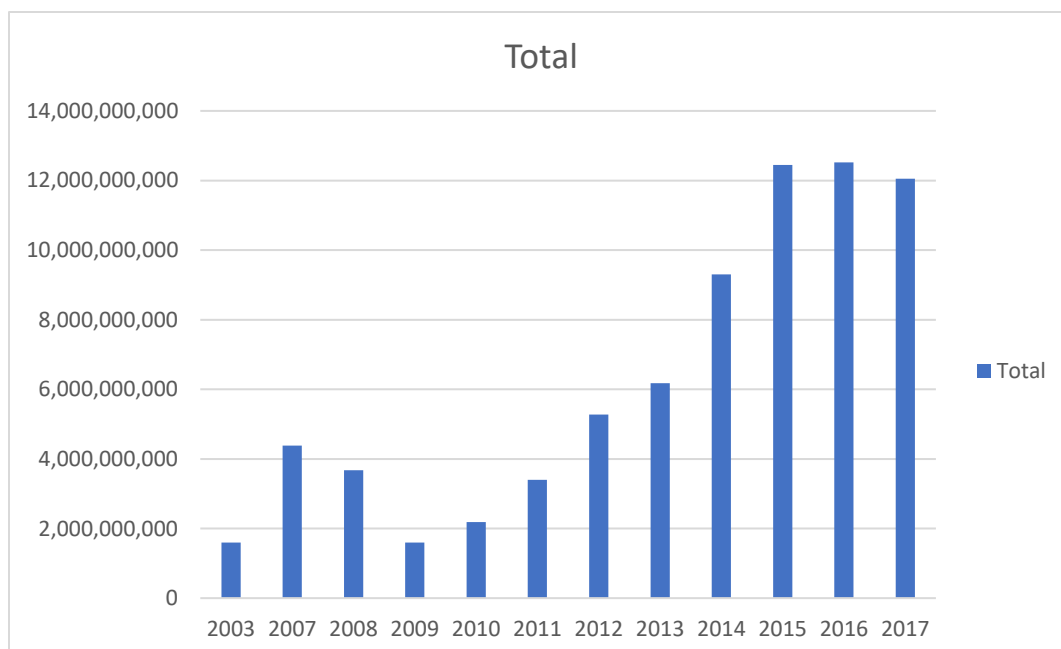
Neighborhood	Sales Price
[-] BATH BEACH	
[-] 6357	
8643 14TH AVENUE	1,388,000
[-] 6358	
1448 86TH STREET	1,640,000
[-] 6359	
1476 86TH STREET	2,500,000
[-] 6360	
1510 86TH STREET	1,400,000
1514 86TH STREET	2,000,000
1518 86 STREET	1,350,000
[-] 6363	
1616 86TH STREET	2,525,000
[-] 6365	
1698 86TH STREET	1,350,000
55 BAY 14TH STREET	1,760,000
[-] 6366	
1718 86TH STREET	4,680,000
[-] 6367	
58 BAY 17TH STREET	1,350,000
64 BAY 17TH STREET	1,480,000

### 3.2.2 Slice Demonstration

A **slice** is a subset of the cubes corresponding to a single value for one or more members of the dimension.

#### Slice - Total Sales by Year

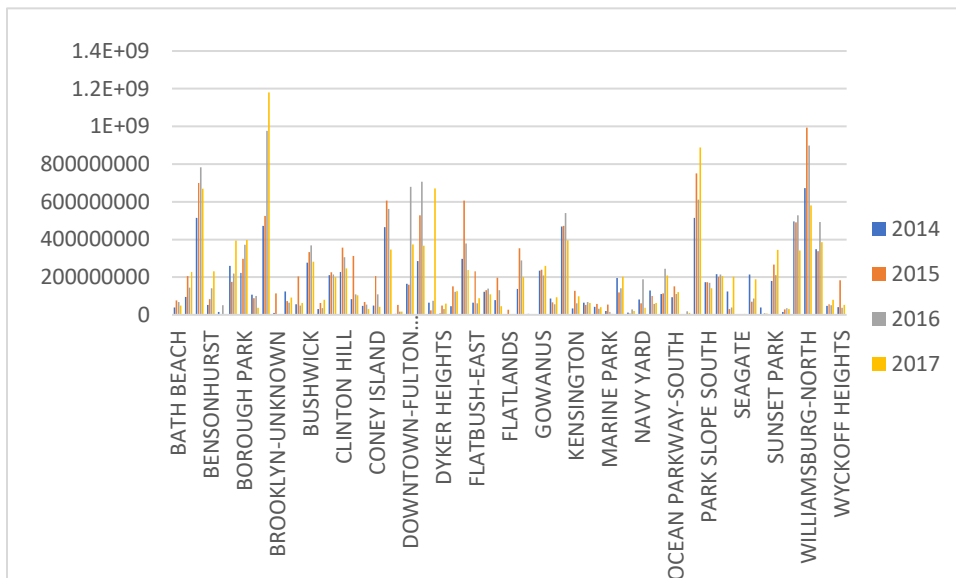
	A	B	C	D	E	F
1	Year	Sales Price				
2	2003	1,601,046,099				
3	2007	4,387,046,128				
4	2008	3,678,651,429				
5	2009	1,599,793,982				
6	2010	2,182,272,856				
7	2011	3,394,832,118				
8	2012	5,276,261,861				
9	2013	6,172,247,502				
10	2014	9,300,967,452				
11	2015	12,442,497,635				
12	2016	12,519,486,107				
13	2017	12,047,649,019				
14	Grand Total	74,602,752,188				
15						



### 3.2.3 Dice Demonstration

**Dice** operation is similar to a slice. The difference in dice is you select 2 or more dimensions that result in the creation of a sub-cube. Dicing on the other hand, is more of a zoom feature that selects a subset over all the dimensions, but for specific values of the dimension.

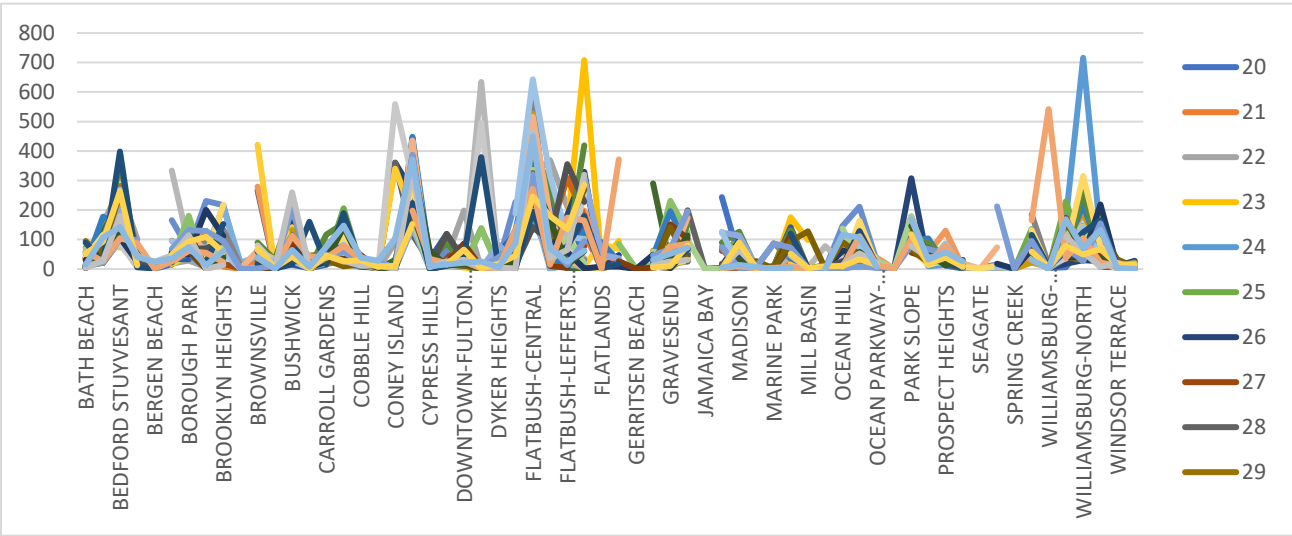
	A	B	C	D	E	F	G	H	I
1	Sales Price	Year							
2	Neighborhood	2014	2015	2016	2017	Grand Total			
3	BATH BEACH	39883728	76278000	67704597	49296059	233162384			
4	BAY RIDGE	95456652	205810723	144929500	227639212	673836087			
5	BEDFORD STUYVESANT	515432380	700226184	782306552	669319032	2667284148			
6	BENSONHURST	52594888	83565148	140830126	231466884	508457046			
7	BERGEN BEACH	15162088	3900000	51550000	1580000	72192088			
8	BOERUM HILL	259717661	174346955	219046016	394458373	1047569005			
9	BOROUGH PARK	223420897	297723297	372321021	396674176	1290139391			
10	BRIGHTON BEACH	106344230	88841878	100395450	37099712	332681270			
11	BROOKLYN HEIGHTS	471582678	525603256	975660498	1179536250	3152382682			
12	BROOKLYN-UNKNOWN	10251250	114030885			124282135			
13	BROWNSVILLE	123693752	73180053	64493562	91699100	353066467			
14	BUSH TERMINAL	56710000	204130305	49165010	62330000	372335315			
15	BUSHWICK	276315347	333630925	369058234	282258152	1261262658			
16	CANARSIE	29964000	63569270	35937372	79565000	209035642			
17	CARROLL GARDENS	210486256	226797184	214500636	200877888	852661964			
18	CLINTON HILL	228486185	356861078	306608087	245628638	1137583988			
19	COBBLE HILL	83119135	311963634	109154466	104200000	608437235			
20	COBBLE HILL-WEST	47715556	67750323	55100517	30315000	200881396			
21	CONEY ISLAND	49780453	205357373	108573234	42575224	406286284			
22	CROWN HEIGHTS	465383044	606125697	561713609	346910008	1980132358			
23	CYPRESS HILLS	4700000	52570000	17705175	17400000	92375175			
24	DOWNTOWN-FULTON FERRY	165608603	159977401	679623269	372971614	1378180887			
25	DOWNTOWN-FULTON MANHATTAN	385043800	530040953	707374610	366705337	1888073700			

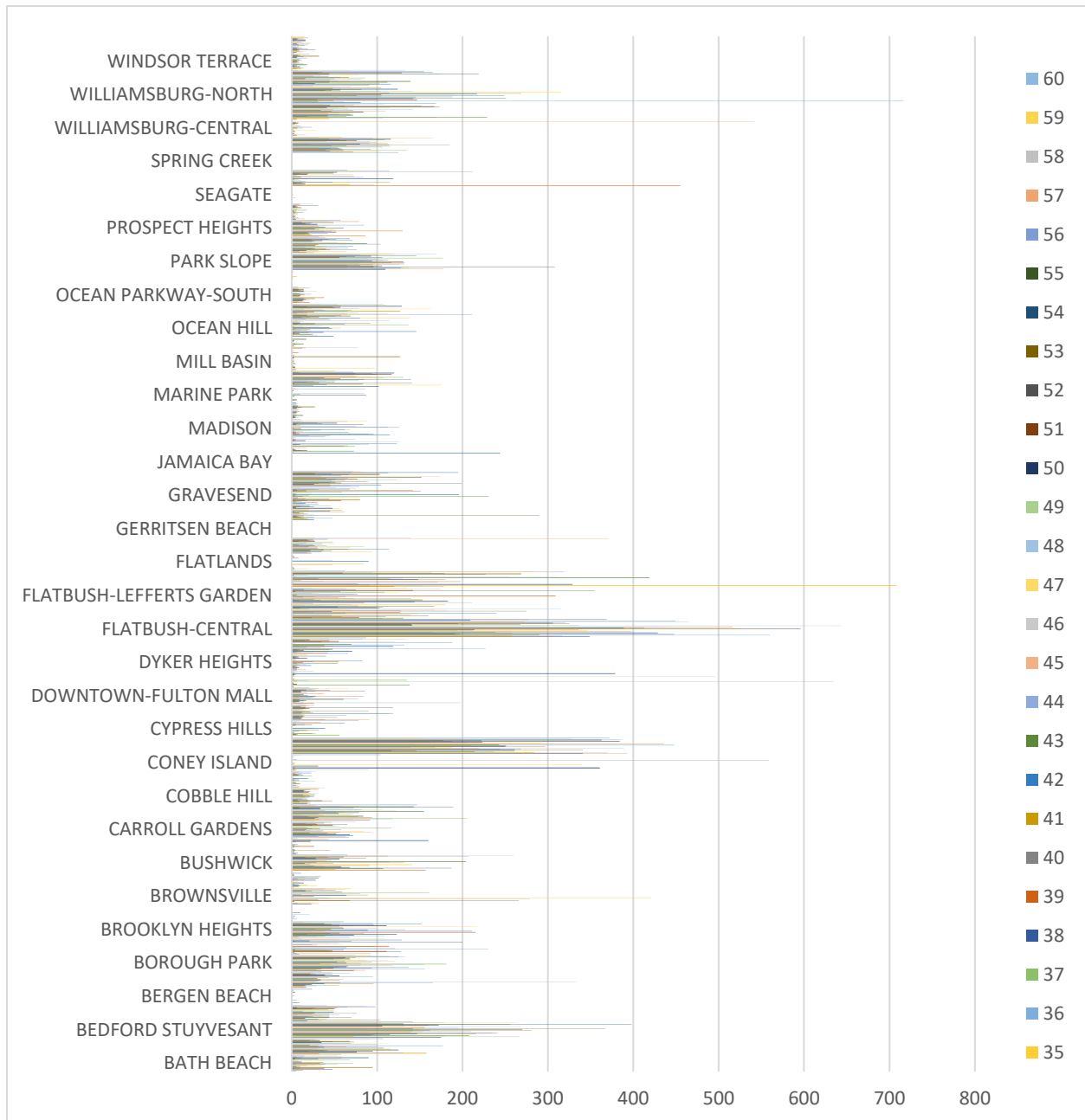


3.2.4 Pivot Chart

Pivot Chart – Total Units Sold in Neighborhood by Age

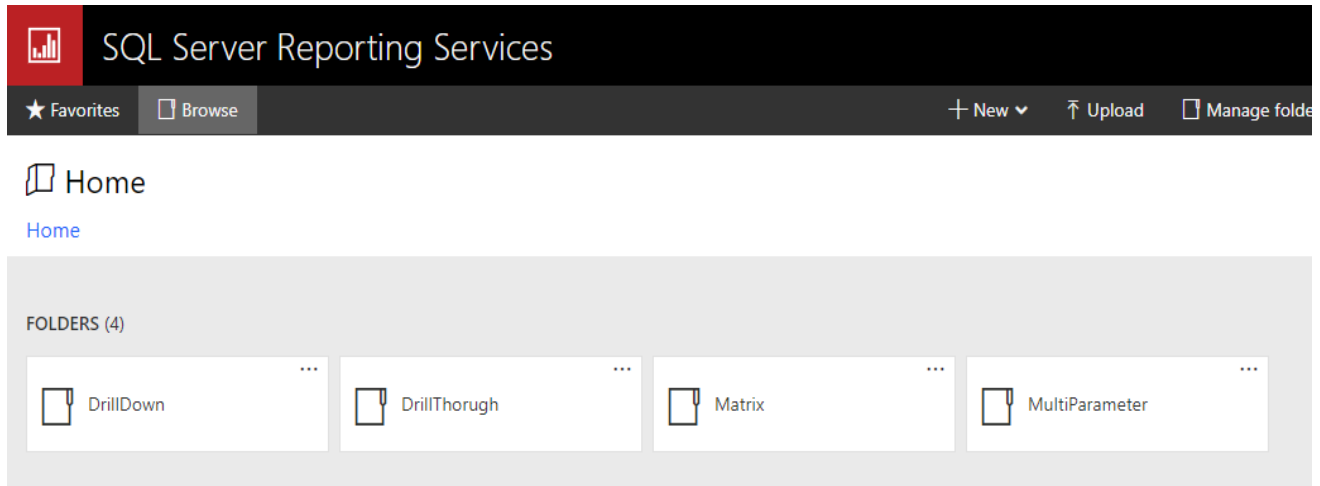
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	
1	Total Units	Age																																
2	Neighborhood	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
3	BATH BEACH	5	8	13	39	48	10	3	38	10	95	5	6	10	35	18	28	5	54	39	33	72	37	12	9	12	8	7	38	55	68	31		
4	BAY RIDGE	58	32	158	158	131	40	76	20	95	37	42	125	31	116	28	107	108	33	38	64	99	31	177	21	36	33	100	114	69	22	35	7	
5	BEDFORD STUYVESANT	175	173	267	73	179	208	93	97	115	216	147	241	235	139	91	154	210	142	162	281	270	149	142	367	196	156	82	155	268	132	106	16	
6	BENSONHURST	18	35	103	81	31	41	16	15	70	44	25	20	44	36	6	7	56	44	24	27	76	25	49	27	13	50	15	49	34	43	24	5	
7	BERGEN BEACH	1				9						6			1			0		1			3			2		1						
8	BOERUM HILL	16	17	18	14	29	55	16	22	24	96	38	57	165	27	333	17	29	31	34	56	34	61	25	30	30	43	42	31	95	20	56	3	
9	BOROUGH PARK	73	86	29	76	156	35	94	49	137	55	64	64	66	118	80	46	155	181	33	81	64	63	53	94	62	121	112	87	55	69	49	6	
10	BRIGHTON BEACH	9	92	6	4	3	48	128	111	43	48	61	4	230	39	121	10	64	3		114	98		1	30	24	60	1	44	55	1	200		
11	BROOKLYN HEIGHTS	68	8	29	39	109	48	73	18	123	85	45	56	216	215	24	36	211	39	89	48	133	46	28	61	99	60	47	217	56	72	111	5	
12	BROOKLYN-UNKNOWN	1	1			6				3					4			21				10					1			1				
13	BROWNSVILLE	23	32	7	25	1	0	2	3	266	68		31		279	101	421	43	1	2	26			64	89	11	62	80	2	5	161	59		
14	BUSH TERMINAL	3	8		30	10	18	8	1	3			14	2	9		7	2			28	15	3		7	31	32	33	16	1	34	1		
15	BUSHWICK	22	157	41	51	108	107	187	58	68	38	58	25	27	91	36	141	22	21	15	49	29	132	114	204	64	41	47	46	29	27	56	8	
16	CANARSIE	5	2	7	2	1	3	3		2	45	4	2	1	2		1		3	3	26	9	1	2	4	7	3		1	1		5		
17	CARROLL GARDENS	67	63	31	49	72	27	68	40	52	52	42	21	57	95	34	85	37	22	15	17	58	33	24	117	19	30	16	31	56	51	24	4	
18	CLINTON HILL	26	92	72	32	118	205	27	94	31	78	20	84	17	37	11	69	32	73	55	29	79	62	52	155	43	39	122	106	82	25	34	3	
19	COBBLE HILL	18	22	22	19	19	9	22	47	36	19	7	12	18	14	12	18	15	21	26	15	21	26	13	27	27	19	30	22	14	13	20	2	
20	COBBLE HILL-WEST	8	10	1	1	5	7	1	1	1	10	5	1	5	3		6	27	3	9	2	8	4	19	3	1	1	2	9	6	24	13		
21	CONEY ISLAND	4	6	90	4	3	0	361	4	360	1	1	31	1	1	2	340	3	1		4	0			1		1	1	559	5	6		0	
22	CROWN HEIGHTS	341	393	369	284	237	214	261	146	117	341	261	244	269	219	389	188	139	168	250	297	251	211	448	243	146	436	307	292	206	162	223	18	
23	CYPRESS HILLS		2	1	1	2	56	7	5	24	28	0	2	3	1	8	20	9	18	32	1			39	26	1	1		1		4	15	2	
24	DOWNTOWN-FULTON FERRY	78	91	39	14	11	11	12	53	13	9	15	13	64	13	14	16	11	114	119	12	25	22	15	90	12	16	8	17	13	17	16	2	
25	DOWNTOWN-FULTON FERRY	13	35	100	5	14	0	0	14	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0





## 4. SQL Server Reporting Service (SSRS) Reports

**SQL Server Reporting Service (SSRS)** is a reporting software that allows you to produce formatted reports with tables in the form of data, images, graphs, and charts. These reports are hosted on a server that can be executed any time using parameters defined by the users. The web portal of a Reporting Services report server is a web-based experience. In the portal, you can view reports, mobile reports, KPIs, and navigate through the elements in your report server instance. You can also use the web portal to administer a single report server instance.



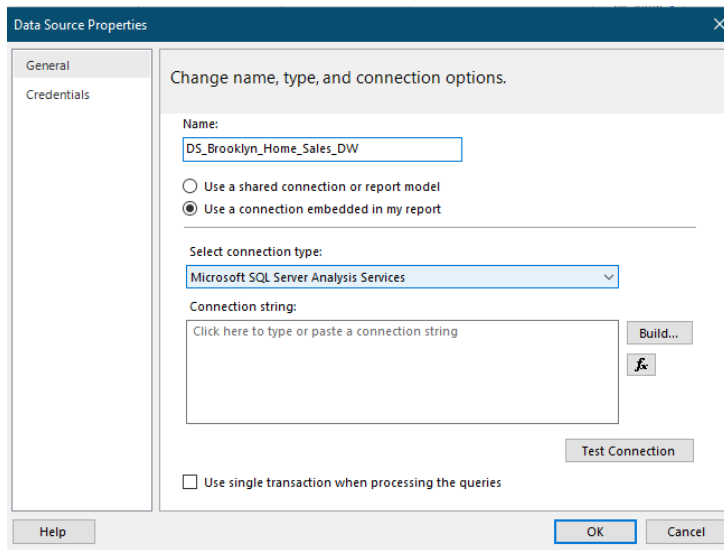
To generate this “**Report Builder**” application was used.

**Report Builder** is a stand-alone app, installed on your computer by you or an administrator. You can install it from the Microsoft Download Center, from a SQL Server 2016 **Reporting Services** or later (SSRS) **report** server, or from a SharePoint site integrated with **Reporting Services**.

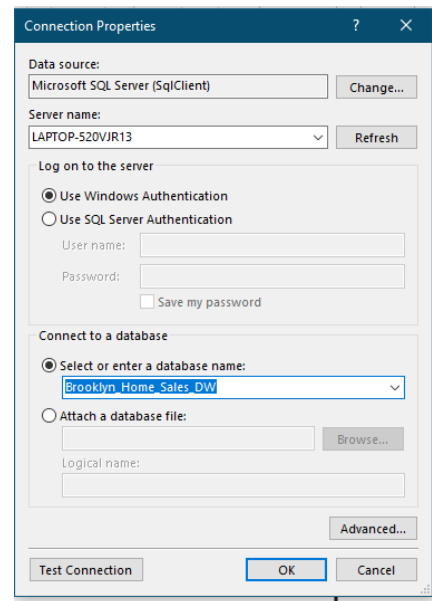
### 4.1 Basic steps of Report builder

#### 4.1.1 Step 1: Creating Data source

In this step we will be connecting to our data source ‘Brooklyn Home Sales’ which is the data warehouse created earlier.

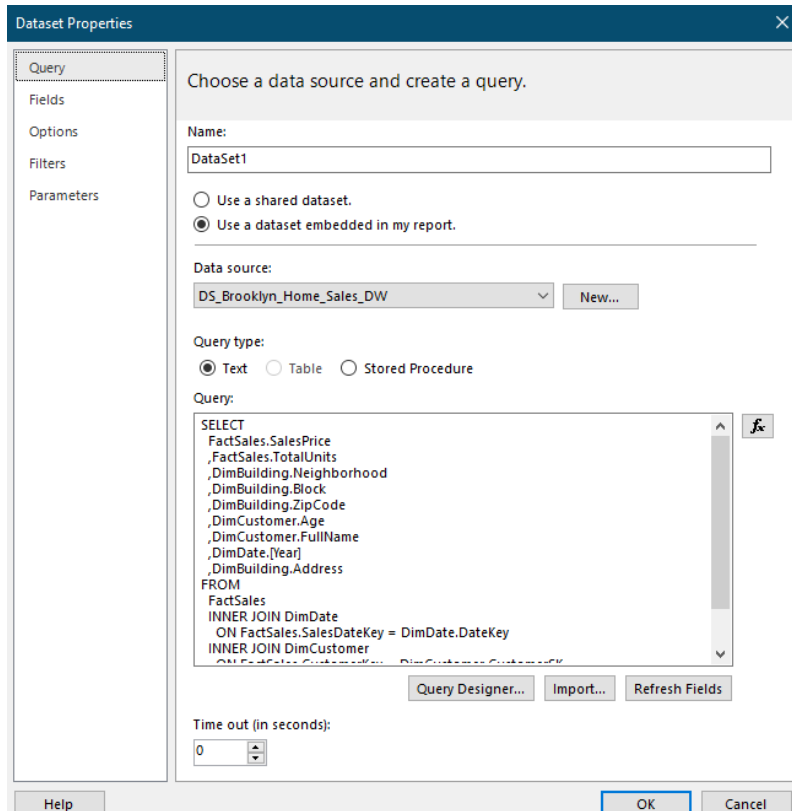


4.1.2



#### 4.1.2 Step 2: Creating a dataset

In this step a necessary dataset will be imported to our report builder using a query which will assigned manually according to the requirements



### 4.1.3 Step 3: Creating a Matrix or a Table

Using the imported dataset, we will create a matrix or a table according to our requirements

New Table or Matrix

Arrange fields

Arrange fields to group data in rows, columns, or both, and choose values to display. Data expands across the page in column groups and down the page in row groups. Use functions such as Sum, Avg, and Count on the fields in the Values box.

Available fields

- Neighborhood
- Block
- Address
- SalesPrice
- TotalUnits
- AlternateBuildingID
- OwnerAddress
- OwnerType
- Year

Column groups

- Year

Row groups

- AlternateBuildingID
- Neighborhood
- Block
- Address
- OwnerAddress
- OwnerType

Σ Values

- Sum(SalesPrice)
- Sum(TotalUnits)

Help < Back Next > Cancel

### 4.1.4 Step 4: Report Demonstration

#### 4.1.4.1 Matrix – Total Sales by Neighborhood Report



In SSRS Matrix is very similar to a table, but it is configured to show data grouped by columns and rows, with aggregate data at the intersection. This is like using a pivot table in a spreadsheet.

							2015	
Alternate Building ID	Neighborhood	Block	Address	Owner Address	Owner Type	Sales Price	Total	
2	DOWNTOWN-FULTON FERRY	54	85 JAY STREET	85 JAY STREET BROOKLY	P			
3	BROOKLYN HEIGHTS	204	29 COLUMBIA HEIGHTS	25-30 COLUMBIA HEIGHT	NA			
5	BROOKLYN HEIGHTS	230	21 CLARK STREET	WATCHTOWER C/O REAL P	X			
7	BROOKLYN HEIGHTS	250	16 COURT STREET	16 COURT STREET OWNER	P			
8	WILLIAMSBURG-NORTH	2307	250 N 10 STREET	BRKLYN NY 250 N 10TH	P	169000000		
9	WILLIAMSBURG-SOUTH	2128	418 KENT AVENUE	420 KENT AVENUE LLC	NA	165000000		
10	NAVY YARD	1876	9-47 HALL ST	RXR 9-47 HALL STREET	P			
11	WILLIAMSBURG-NORTH	2287	20 NORTH 12 STREET	10TH STREET LLC	P			
12	FORT GREENE	2094	625 FULTON	625 FULTON A LLC	P			
13	DOWNTOWN-FULTON MALL	165	236 LIVINGSTON STREET	NA	NA			
14	DOWNTOWN-METROTECH	63	55 PROSPECT STREET	55 PROSPECT OWNER LLC	NA			
16	DOWNTOWN-METROTECH	87	90 SANDS STREET	WATCHTOWER C/O REAL P	P			
17	WILLIAMSBURG-NORTH	2282	19 KENT AVENUE	19 KENT ACQUISITION L	NA	132400000		
18	WILLIAMSBURG-NORTH	2322	246 NORTH 8TH STREET	GS 247 N7TH WILLIAMSB	NA			
20	DOWNTOWN-METROTECH	77	77 SANDS STREET	77 SANDS OWNER LLC	NA			
22	DOWNTOWN-FULTON MALL	156	422 FULTON STREET	NA	NA			
25	BROOKLYN HEIGHTS	208	122 COLUMBIA HEIGHTS	EASTERN DIVISION LLC	NA			
26	GREENPOINT	2522	110 GREEN STREET	WWG GREEN LLC	NA			
27	DOWNTOWN-METROTECH	87	175 PEARL STREET	175 PEARL OWNER LLC	NA			
28	DOWNTOWN-METROTECH	75	117 ADAMS STREET	117 ADAMS OWNER LLC	NA			

#### 4.1.4.2 Multi-Parameters – Total Sales by neighborhood and Block

In SSRS using Multiparameter-values allows us to pass either one or more than the input value to the report. Also, it offers a “Select All” option that helps to select all parameter values.

SQL Server Reporting

★ Favorites □ Browse

Home > MultiParameter > multi parameter

Neighborhood CANARSIE,BATH BEACH

- ☐ (Select All)
- ☒ CANARSIE
- ☐ CYPRESS HILLS
- ☐ CARROLL GARDENS
- ☐ SHEEPSHEAD BAY
- ☐ BROOKLYN HEIGHTS
- ☐ FORT GREENE
- ☐ BROWNSVILLE
- ☐ WILLIAMSBURG-SOUTH
- ☐ BENSONHURST
- ☒ BATH BEACH
- ☐ GERRITSEN BEACH
- ☐ FULTON-NORTH

*Selecting Neighborhoods*

SQL Server Reporting Services

★ Favorites □ Browse

Home > MultiParameter > multi parameter

Neighborhood CANARSIE,BATH BEACH

Block

- ☐ (Select All)
- ☒ 6438
- ☒ 6435
- ☐ 8131
- ☐ 8224
- ☐ 6468
- ☐ 6379
- ☐ 6372
- ☐ 6435

*Selecting Blocks according to the selected Neighborhood*

SQL Server Reporting Services			
★ Favorites Browse			
Home > MultiParameter > multi parameter			
Neighborhood	CANARSIE,BATH BEACH	Block	6438,8131
< < 1 of 1 > >  <input type="button" value="Refresh"/> <input type="button" value="Back"/> 100% <input type="button" value="Save"/> <input type="button" value="Print"/> <input type="text"/> Find   Next			
Neighborhood Wise Sales by Year Report (Brooklyn Home Sales)			
Neighborhood	Block	2015	2016
BATH BEACH	6438		1500000
CANARSIE	8131	2250000	1550000

- Here we have created two parameter and three data sets as following.
- DataSet1: This data set contains the Sales Price data which will be displayed in the report through the matrix.

Query: SELECT  
 DimDate.[Year]  
 ,DimBuilding.Neighborhood  
 ,DimBuilding.Block  
 ,DimBuilding.Address  
 ,FactSales.SalesPrice  
 ,FactSales.TotalUnits  
 ,DimCustomer.Age  
 FROM  
 FactSales  
 INNER JOIN DimDate  
 ON FactSales.SalesDateKey = DimDate.DateKey  
 INNER JOIN DimCustomer  
 ON FactSales.CustomerKey = DimCustomer.CustomerSK  
 INNER JOIN DimBuilding  
 ON FactSales.BuildingKey = DimBuilding.BuildingSK  
  
 where DimBuilding.Block IN (@Block)

- Neighborhood list: This data set contains the required Neighborhood names which is needed to be shown for  
  
 selection as the 1st parameter.

**Query:** select distinct Neighborhood  
from DimBuilding

- **Block\_list:** This contains the Blocks which are in the selected Neighborhood.  
When the Neighborhood names are selected, they will be passed as a parameter to this query and the relevant data will be retrieved from the database.

**Query:** select Neighborhood, Block  
from DimBuilding  
where Neighborhood IN (@Neighborhood)

#### 4.1.4.3 Drill down – Total Sales by Neighborhood Group

In SSRS using Drill Down means allowing users to show or hide the column data by providing plus and minus symbols on a textbox (In short, providing interactivity to the user.).

#### Neighborhood Wise Sales by Year Report (Brooklyn Home Sales)

Neighborhood	2015	2016	2017	Total
+ BATH BEACH	76,278,000	67,704,597	49,296,059	193,278,656
+ BAY RIDGE	205,810,723	144,929,500	227,639,212	578,379,435
+ BEDFORD STUYVESANT	700,226,184	782,306,552	669,319,032	2,151,851,768
+ BENSONHURST	83,565,148	140,830,126	231,466,884	455,862,158
+ BERGEN BEACH	3,900,000	51,550,000	1,580,000	57,030,000
+ BOERUM HILL	174,346,955	219,046,016	394,458,373	787,851,344
+ BOROUGH PARK	297,723,297	372,321,021	396,674,176	1,066,718,494
+ BRIGHTON BEACH	88,841,878	100,395,450	37,099,712	226,337,040
+ BROOKLYN HEIGHTS	525,603,256	975,660,498	1,179,536,250	2,680,800,004

*When you click on the plus mark in front of the Neighborhood names, it will display the details of Blocks in that Neighborhood*

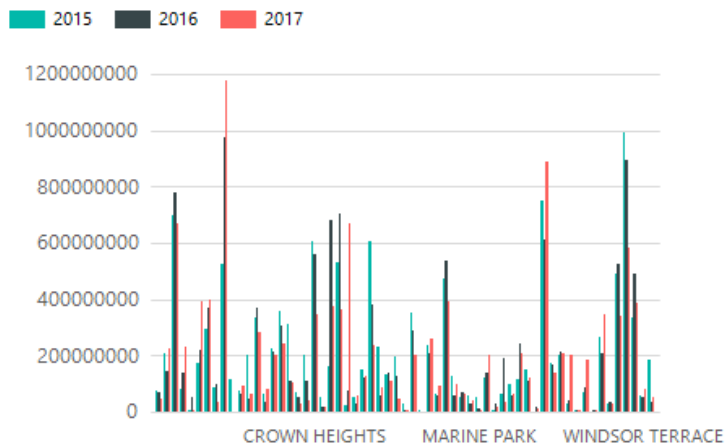
### Neighborhood Wise Sales by Year Report (Brooklyn Home Sales)

Neighborhood	2015	2016	2017	Total
BATH BEACH	76,278,000	67,704,597	49,296,059	193,278,656
6357			1,388,000	1,388,000
6360			1,350,000	1,350,000
6365		1,760,000		1,760,000
6366			4,680,000	4,680,000
6367		2,830,000		2,830,000
6368		1,900,000	2,000,000	3,900,000
6370	2,000,000	17,100,000		19,100,000
6371		1,900,000		1,900,000
6372	1,365,000	6,363,000	3,450,000	11,178,000
6373		1,400,000	6,882,500	8,282,500
6374	7,395,000			7,395,000
6375	3,950,000			3,950,000
6377	3,448,000	10,000,000		13,448,000
6378	1,830,000			1,830,000
6379	5,040,000	3,213,597		8,253,597
6380	1,580,000			1,580,000
6392	1,500,000			1,500,000
6394		1,400,000	2,930,000	4,330,000
6395		1,400,000		1,400,000

#### 4.1.4.4 Drill through – Total Earnings by Neighborhood Group

### Neighborhood Wise Sales by Year Report (Brooklyn Home Sales)

Chart Title

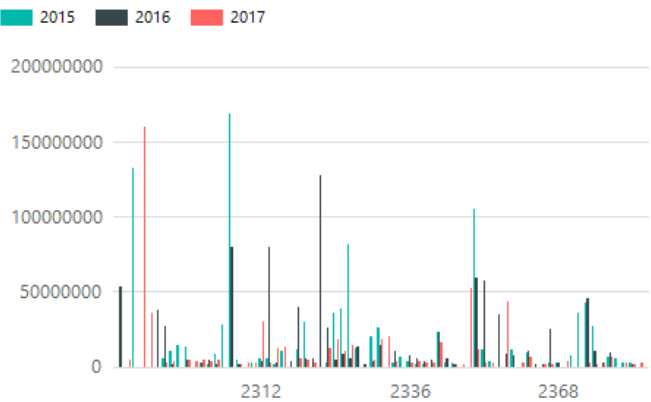


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**Neighborhood Wise Sales by Year Report (Brooklyn Home Sales)**

Chart Title



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