Interactive Kendall Square Urban Renewal Development Map

Data Collection, Analysis and Visualization Process

May 7th, 2018

Overview

The Interactive KSURP Map was created to illustrate the growth and evolution of Kendall Square since 1980, when the development of the Kendall Square Urban Renewal Area restarted under MXD zoning. The map created in collaboration with Sasaki Associates focuses on three areas: growth by year, the development of mixed land uses and the addition of open space. The visualization makes buildings visible on the map when they are constructed, and invisible when they are demolished. Selecting a building on the map opens a tooltip tab showing the building's land use, total building area by parcel, its address and the year the building was built. The bar chart on the right of the screen totals the square footage of the buildings or open space aggregated in the selected year.

A number of decisions were made regarding the map's scope, scale and content. The timeframe of the map starting in 1980 was determined based on the approval of MXD zoning in 1977. The Kendall Square boundary was also deliberated and factors including land-use typology, parcel size, transit connectivity, economic correlations and ownership were considered. The selected geographic scope thus represents and area with land typologies that are largely centered around commercial and research enterprises, contain parcels that are larger in size and building massing, has economic correlation to the Innovation Economy and has transit connectivity (ex: pedestrian, cycling, bus) that connects to the Kendall Square Red Line. The land-use typology aggregation process is explained in *Table 1: Land-Use Aggregation Process* below.

This map is a working version and should be used as a tool to learn about past, current and future development in the area. It is intended for graphical and learning purposes only and it is not an official data record. For any errors, omissions, questions or comments regarding the map please contact Alexandra Levering at alevering@cambridgeredevelopment.org.

Data Layers and Aggregation Methods

1. Basemap

Background basemap provided by Leaflet and OpenStreetMap.

2. Land Use: Joining Building and Parcel Data

Most building polygons originated from the Cambridge GIS 2015 CDD_Buildings layer and were processed according to the following steps to assign appropriate data to each building shape. The building layer was generated by the Cambridge Community Development Department, and the buildings polygons were last edited in 2015.

Step 1. Join building attribute data to spatial parcel layer

Join the building attribute data in the Assessing Building Information FY2015 dataset to the Cambridge GIS CDD_Land Use layer using the unique ID "ML". This results in the parcel area spatial data containing assessing building information for FY2015.

Step 2. Sum Living Area

When joining by attribute in the step above, select sum for the Living Area data column, which sums the building area of each parcel. This is necessary to get an accurate Living Area value for each parcel in cases where there are multiple buildings on a single parcel. *Note footprint area was used for Open Spaces, and Gross Area was used for Parking & Transportation, as Living Area is not applicable for these land uses.*

Step 3. Spatial Join Parcel Data to Building Polygons

Spatially join the new Parcel Layer with Assessors Data to the 2015 Building Shapefile layer using the intersect feature – with the condition that should a building intersect 2 parcels, the building polygon will be given the data from the parcel that it intersects with the most.

These three steps result in a combined shapefile that represents buildings in the study area as polygons, with data associated to them pulling from the parcels that they exist on.

3. Open Space: Visualizing Separately from Built Structures

Open spaces were initially identified in the visualization though the Cambridge land-use shapefile. Several more polygons were added manually based on anecdotal information and Google Earth aerial images. For manually drawn polygons, the footprint was calculated using the Carto software system. The Cambridge assessors and property database was then referenced to determine if the parcels were privately owned public space, or publically owned.

4. Data Clean-Up and Simplification (for purposes of this visualization)

Consolidating Land-Use Categories

There were 45 total land-use categories in the original assessors' data for the Kendall Square study area. To simplify the visualization, land uses were grouped into parent categories. The parent category is listed in the visualization, not the sub-category.

Table 1: Land-Use Aggregation

PARENT CATEGORY Rolled into groups for easier visualization	SUB-CATEGORY Original land use designation from Cambridge database
Charitable/Religious	
	Religious
Commercial/Retail	
	AUTO-REPAIR BANK CHILD-CARE EATING-ESTBL GAS-STATION HOTEL RETAIL-STORE SH-CNTR/MALL THEATRE MULTIUSE-COM
Government Operations	

Category	Sub-category
	Government Operations
Higher Education	
	Other Educ & Research Org
	Private College
Industrial	
	CLEAN-MANUF
	MANUFACTURNG
	RESRCH IND CND
	WAREHOUSE
	MULTIUSE-IND
Residential / Retail	
	MXD >8-UNIT-APT
	MXD 4-8-UNIT-AP
	MXD SNGL-FAM-RE
	MXD TWO-FAM-RES
	MULTIUSE-RES
	Private College Res Units
	>8-UNIT-APT
	4-8-UNIT-APT
	SNGL-FAM-RES
	THREE-FM-RES
	TWO-FAM-RES
	RES-LAND-IMP
Office/R&D	
	GEN-OFFICE
	INV-OFFICE
	RETAIL-OFFIC
	HIGH-TECH
	RES-&-DEV-FC
Open Space	
	Private Open Space
Parking & Transportation	
	PARKING-GAR
	PARKING-LOT
	MBTA/Railroad
Utility	
	PUB UTIL REG
	ELEC GEN PLANT
	GAS-CONTROL
	TELE-EXCH-STA
Vacant Land	
	COM-DEV-LAND
12 TOTAL CATEGORIES	45 TOTAL SUB-CATEGORIES

Refining Data

Once the data was processed and aggregated at the building polygon level using the steps above, attention was given to refine or review the data and edit information that was either missing, or in some instances incorrect. Specifically, parcels under redevelopment, or those owned by tax-exempt entities, such as private colleges like MIT, the MBTA, and the City of Cambridge, which tend to be updated less frequently, were reviewed closely.

Close attention was also paid to buildings that overlap/exist on two parcels of land. In instances where that occurred, polygons were reviewed to ensure Living Area, Addresses, Year Built and Land Uses were appropriately assigned.

Refining Parcel Area for Building Equation

In the visualization, each building polygon when selected shows the amount of building area that exists on the parcel, using the original data source from the Cambridge assessors' database. Separately, the bar chart on the right-hand side of the visualization calculates the amount of building area in square feet that exists in each parent land-use category by year. To accurately estimate building footprint areas (in square feet) all building polygons within the same parcel were aggregated together, summing them using the unique parcel ID "ml". The overall parcel square footage was then divided by individual building footprints from the total to get percentages representing each building's share of the parcel's total built square footage. The parcel area was then re-distributed to each building using those percentages. An example is written out below.

*Ex. Overall living area of Parcel ABC is 2000 sqft and there are 3 buildings on that parcel. Building 1 has 200 sqft of footprint area, Building 2 has 1000 sqft of footprint area and Building 3 has 500 sqft of footprint area. In total, there is 1700 sqft of footprint area covering the parcel. To calculate percentages: Building 1 (200/1700) = 11.7%. Building 2 (1000/1700) = 58.8% and Building 3 (500/1700) = 29.4%. To redistribute parcel living area using the percentages calculated: Building 1 (2000 * 11.7%) = 354 sqft, Building 2 (2000 * 58.8%) = 1176 sqft, and Building 3 (2000 * 29.4%) = 588 sqft.*

5. Future Data (post-2015)

Future building polygons and data were initially added using a CAD data file maintained internally by Sasaki, compiled of planned buildings known through prior work with the CRA and other clients in the Kendall Square area. This data file was supplemented with additional information supplied by the CRA and research of recent building permits and site plans.

6. Historic Data

For historic data dating between 2000-2015, historic satellite images from Google Maps and Google Earth were reviewed to determine buildings that were either externally renovated or demolished. Those building polygons were then drawn using CAD software systems, and imported into the visualization.

For historic data dating between 1980-2000, research was done using the historic resources listed below, with most data being found using Sanborn Fire Insurance Maps. Once buildings were identified to have been renovated or demolished, additional research was conducted for that parcel.

Research was further conducted on a polygon-by-polygon basis, to gather land-use, parcel area, address and year-built information for each historic building polygon. The resources used to collect this information include historic publications, websites and assessors' data files. Those resources are listed below. At times, initial year built and building area information could not be found. That data is listed as unknown.

Historic Resources

Maps

Call Number: G3760.3769 - Rotch Library of Architecture and Planning, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 7-238, Cambridge MA 02139

"Cambridge Map with Illustrations: Including Maps of Harvard, Radcliffe, MIT, complete Street Index" Cambridge, MA: Cities, Inc. (1975)

"Cambridge Tourist Guide and Map," Cambridge Chamber of Commerce, Turnbull & Co. 1982

"Cambridge Map & Street Guide and complete campus maps of Harvard, MIT, Radcliffe," Bridgewater, MA: Arrow Map, Inc. 1993

"How to Get Around in Cambridge," Cambridge, MA: The City of Cambridge Community Development Department. 1996

"Professor Pathfinder's Cambridge Street Map: Including parts of Somerville, Boston, Belmont and Arlington," Minneapolis, MN: Hedberg Maps, Inc. 1997

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1981. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1991. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1996. 1 - 48

Harvard Map Collection, Pusey Library - Harvard University Cambridge MA 02138

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1985. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1986. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1987. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1989. 1 - 48

Cambridge Historical Commission - 841 Massachusetts Avenue #2, Cambridge MA 02139

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1982. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1983. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1988. 1 - 48

Sanborn Fire Insurance Map from Cambridge, Middlesex County, Massachusetts. Map. Vol. 1. Pelham, NY: Sanborn Map Company Inc, 1997. 1 - 48

Publications

"East Cambridge Development Review Process and Guidelines," Cambridge Community Development Department, Cambridge MA ,1985
https://www.cambridgema.gov/CDD/planud/neighplan/neighs/~/media/B01CA38B19884886AB8640EB2F6E1B38.ashx

"East Cambridge Neighborhood Study," Cambridge Community Development Department, Cambridge MA ,1989
https://www.cambridgema.gov/~/media/Files/CDD/Planning/Neighborhoods/1/eastcamb_ns_1989.pdf

"East Cambridge Riverfront Plan," Cambridge Community Development Department, Cambridge MA, 1978
https://www.cambridgema.gov/~/media/Files/CDD/Planning/Studies/EastCambridge/ecambridge_riverfront_plan_1978.pdf?la=en

Websites

"History of Kendall Square Urban Renewal Project." Cambridge Redevelopment Authority.
http://www.cambridgeredevelopment.org/history/