

# DHCD FINAL REPORT

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### 1. INTRODUCTION

Talking about affordable housing is a complex and sensitive issue that present many question and challenges: how does a public agency provide a safe environment for those families with a housing voucher or living in social housing? How does the system help those families to get out of the public housing policies? Many of the opportunities are closely related to the location and environment of where the families live and develop.

One of the public housing programs is the housing voucher, where an agency sets a rent cap over apartments and voucher holders pay up to 30% of their income on rent. Across the Commonwealth of Massachusetts, there are several public housing agencies<sup>1</sup> providing a different kind of vouchers, and each one of them has different criteria to define the voucher size. The most common criterion is the number of bedrooms. Yet, there is a large difference in the value of voucher for the same number of bedrooms. For example, if a family receives a voucher for a 2-bedroom apartment and wants to live in the Fenway (Boston), their rent cap would be \$1914 if the agency is the Boston Housing Authority (BHA). But, if they receive their voucher from the Department of Housing and Community Development (DHCD), the amount is \$1691. This difference might determine that they could end up living in two completely different neighborhoods and having two completely different experiences.

The DHCD is considering increasing their payment standards in high opportunity areas. For that, they asked The American City Coalition to analyze the rental housing market and advice on where to implement the pilot program. The current paper is organized in the following way: first, a brief description of the data used. Then, a review of the methodology and finally the results.

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<sup>1</sup> For a list of all public housing agencies follow this link: <https://www.hud.gov/states/massachusetts/renting/hawebsites>

## 2. DATA

### 2.1 DESCRIPTION

For this project, we used the following resources of data:

- **DHCD data:** The DHCD administrative dataset included deidentified information on 15,494 households currently holding a Mobility-to-Work (MTW) voucher in Massachusetts. Key indicators used for the analysis included household addresses, voucher size, unit size, and contract rent.
- **AFFH data:** The Affirmatively Furthering Fair Housing (AFFH) provides data on several indicators across the country at census tract level. This data was used to classify high, moderate and low opportunity areas across the state.
- **Online listings data:** The analysis presented here uses a unique dataset of online rental listings compiled from Craigslist regional websites in Massachusetts. TACC developed this methodology to produce a more accurate picture of the affordability of the rental market for MTW recipients in a wide range of communities. During October 2017 a total of 27,119 "unique" rental housing listings were collected, geocoded and linked with census tract and zip code level data, current DHCD Payment Standards for HCVs, and the Department of Housing and Urban Development's (HUD) Small Area Fair Market Rent (SAFMR) payment standards.
- **Child Opportunity Index:** To have a comprehensive neighborhood opportunity index, the Diversitydatakids.org – Kirwan Institute Child Opportunity Index (COI) was selected. It is a population-level surveillance tool that describes community-level resources and includes 19 indicators that measure opportunity across three core areas known to be critical for healthy child development and positive life outcomes: quality educational settings, health and environment, and social and economic environments.

### 2.2 CHALLENGES

Working with several datasets and different geographic units (address, census tracts, zip codes and DHCD regions), there were several challenges that were necessary to solve:

- The first data challenge was to geocode all the addresses to identify the latitude and longitude, which is necessary to identify what are the census tracts that they belong to.
- The second challenge was to assign to each observation to the census tract.
- The third challenge was to create a shapefile for the DHCD regions based on a Municipal dataset and shapefile provided by MassGIS and then assign each observation to each DHCD region.
- The fourth challenge was to merge the Payment Standard with all the datasets. Since the Payment Standard are based on zip codes, a reverse geocoding process was needed for those observations that did not have zip code information.

### 3. METHODOLOGY

Analysis and mapping for this project was conducted with R and ArcGIS software. The methodology for solving each one of the challenges detailed above are the following:

For the first challenge, the DHCD Active Units dataset contains the address of each unit, so it was required to geocode those addresses. For that purpose, R (“placement” package<sup>2</sup>) and the Google Maps API geocoder was used to obtain Latitude and Longitude. The reason to use R and not ArcMap in the geocoding process was due to the high volume of cases (more than 15,000) and the flexibility across the process given by coding each step of the process.

Once that all the datasets that have points in the map (DHCD and Online listings datasets), the second challenge was to assign them the “Census Tract” (a geographical unit established by the Bureau of Census) that they belong to and that it a complicated process. Again, the methodology to overcome this challenge involved using R the

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<sup>2</sup> The R function is specified at the Appendix as “Geocoding Function”

“Federal Communications Commission” API, where each request required latitude and longitude. The result was that each observation in each dataset had its Census Tract ID<sup>3</sup>.

The DHCD Regions are defined in their webpage, but they do not provide a shapefile. The first step was to create a DHCD regions shapefile. This was solved using a Municipal dataset and shapefile provided by MassGIS for the State of Massachusetts and ArcMap’s Dissolve function. The second step was to join each Census Tract ID with each of the DHCD regions. This was done using ArcMap’s Spatial Join function.

For the fourth challenge was joining the DHCD payment standards with the rental information from the DHCD dataset and the Online listings dataset. Since the payment standards differ based on zip code, both datasets had to had zip code information to make the joint possible. A reverse geocoding process was required for the Online Listings dataset. This process was done again using R (“ggmap” package) and the Google Maps API geocoder.

After all the datasets used in this project had variables that made the joint possible, all datasets were combined to make the analysis in ArcMap easier. The merges and joints were done using R due to the volume of the information of each dataset.

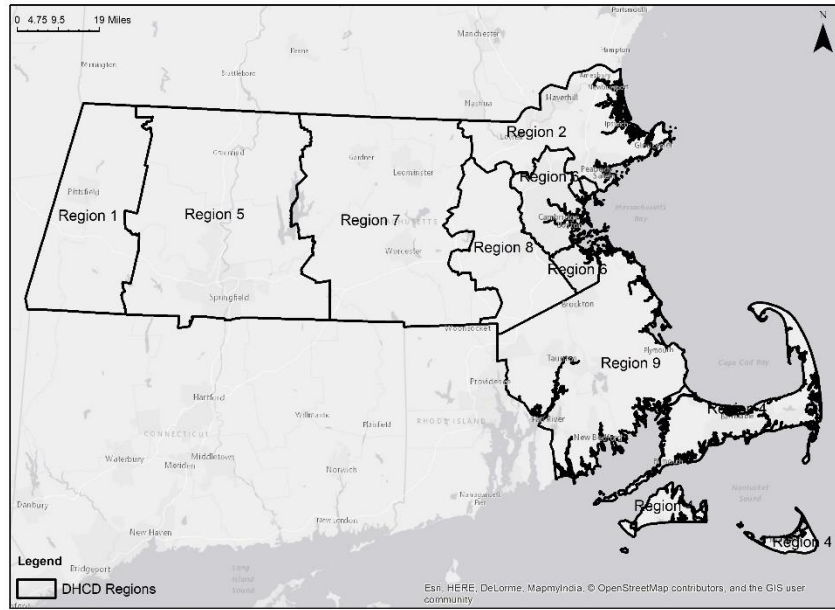
## 4. RESULTS

Map 1 shows the result of the third challenge: building a shapefile for the DHCD regions in the State of Massachusetts. As it can be appreciated it, there is no Region 3, and that is due to internal procedures of the DHCD organization.

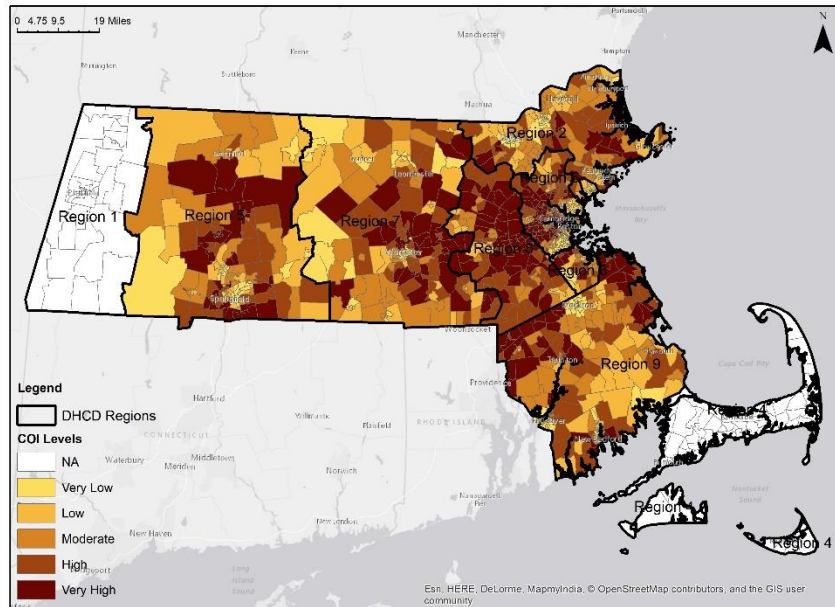
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<sup>3</sup> The R function is specified at the Appendix as “Census Tract Function”

**Map 1: Regional Administrative Areas**



**Map 2: Regional Administrative Areas by COI**



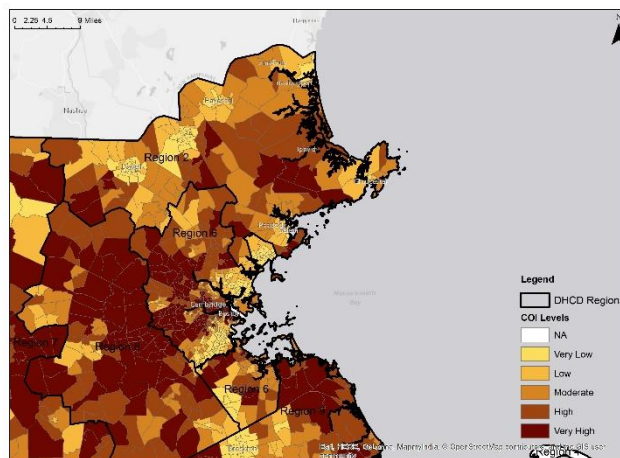
Map 2 shows the results of mapping the COI index in the Map 1. As it can be seen, the COI index only cover 1,368 (93%) of the 1,475 census tracts in the Massachusetts. The 107 census tracts that fall outside of the metropolitan

areas are in Region 1 (Berkshire County) and Region 4 (Cape Cod & the Islands). Table 1 shows a breakdown of the COI index for the census tracts of each region. From that table, it can be inferred that Region 8 has 68% of its census tracts in high/very high COI and Region 6, 45% of its census tracts in high/very high COI.

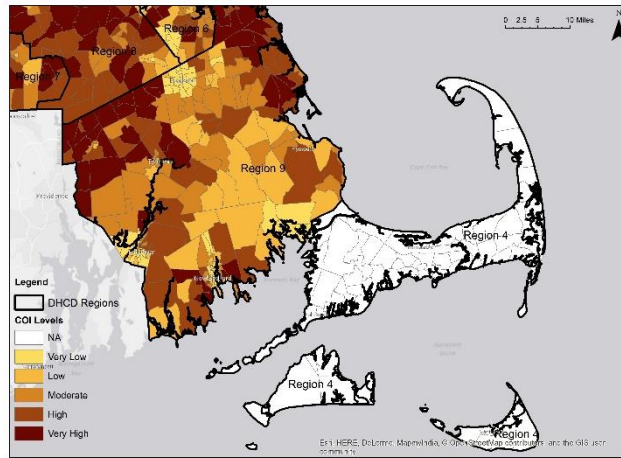
Regional Area	Neighborhood Opportunity (COI)						Total Number of Census Tracts
	Very Low	Low	Moderate	High	Very High	NA	
Region 1	-	-	-	-	-	35	35
Region 2	60	53	51	47	20	0	231
Region 4	-	-	-	-	-	69	69
Region 5	37	33	34	31	33	4	172
Region 6	93	63	72	75	112	1	416
Region 7	29	31	34	35	29	0	158
Region 8	7	21	22	43	63	0	156
Region 9	58	44	52	43	40	1	238
<b>Total</b>	<b>284</b>	<b>245</b>	<b>265</b>	<b>274</b>	<b>297</b>	<b>110</b>	<b>1475</b>

Map 3 is showing a breakdown of Map 2 but focusing in each region. Results from Table 1 can be appreciated with more details.

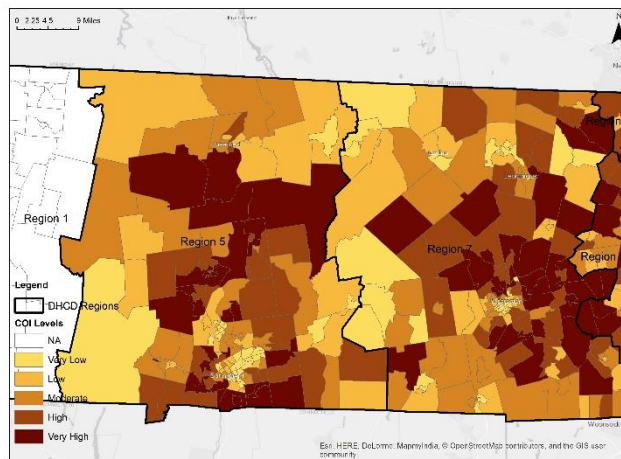
**Map 3: Regional Administrative Areas by COI, each Region separately  
(a) Region 2, 6 and 8**



**(b) Region 4 and 9**

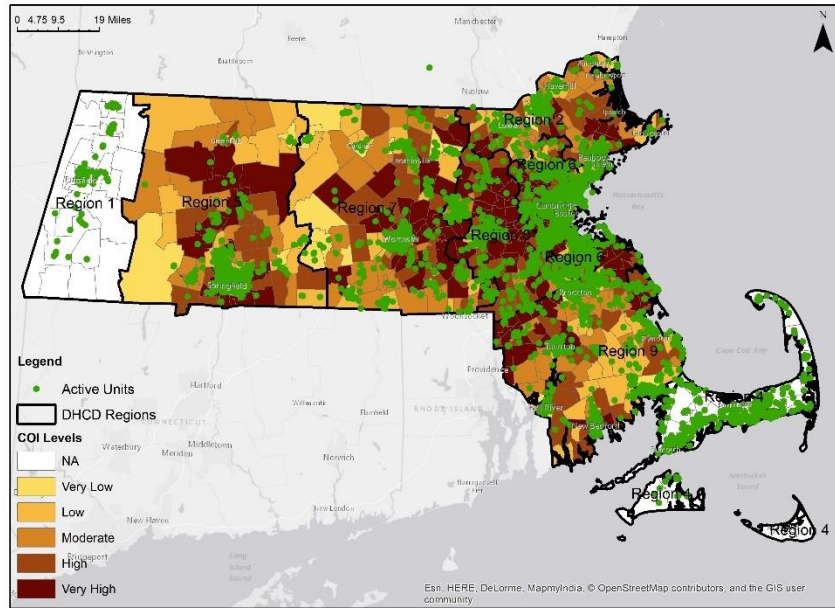


**(e) Region 8**



Map 4 represents the location of each household holding a housing voucher. The breakdown of the numbers than be seen in Table 2. It can be inferred that 90% of HCVs in Region 2 are living in Very Low/Low COI, while that number goes down to 84% when we look at Region 5 and Region 6.

**Map 4: Regional Administrative Areas by COI and Active Voucher Holders**



**Table 2: Number of voucher holders by COI and RAA**

Regional Area	Neighborhood Opportunity (COI)						Total Number of Current HCVs
	Very Low	Low	Moderate	High	Very High	NA	
<b>Region 1</b>	-	-	-	-	-	409	409
<b>Region 2</b>	1118	260	136	62	18	7	1601
<b>Region 4</b>	5	-	-	-	-	728	733
<b>Region 5</b>	1563	815	397	164	112	2	3053
<b>Region 6</b>	3016	888	678	324	269	10	5185
<b>Region 7</b>	803	433	237	147	124	13	1757
<b>Region 8</b>	47	356	256	279	110	5	1053
<b>Region 9</b>	781	291	335	162	123	11	1703
<b>Total</b>	7333	3043	2039	1138	756	1185	15494

Table 3 shows the distribution of the Online listings across the DHCD Regions. It can be appreciated that Region 6 (Metropolitan Boston area), had the biggest percentage of total online listings, with a 62% of them. However, to have a better understanding of the affordable online listings, Table 4 should be looked at. While the 62% of the total online listings are in Region 6, only 4% of those are affordable in High and Very High census tracts and 5% if



Moderate areas are included. A comparable situation arises in Region 2 (Northeast Massachusetts) where only 9% of the online listings are affordable at High and Very High and 11% if Moderate areas are included. In the other is Region 8 where 30% of the online listings are in Moderate, High or Very High areas.

**Table 3: Number of online unit listings across opportunity areas by RAAs**

Regional Area	COI						Total Online Listings
	Very Low	Low	Moderate	High	Very High	NA	
Region 1	-	-	-	-	-	333	333
Region 2	1201	768	1357	654	155	0	4135
Region 4	-	-	-	-	-	404	404
Region 5	88	186	178	366	464	9	1291
Region 6	2105	2179	2911	3845	5922	1	16963
Region 7	248	502	265	204	451	0	1670
Region 8	2	313	153	341	384	0	1193
Region 9	294	159	223	322	131	1	1130
<b>Total</b>	3938	4107	5087	5732	7507	748	27119

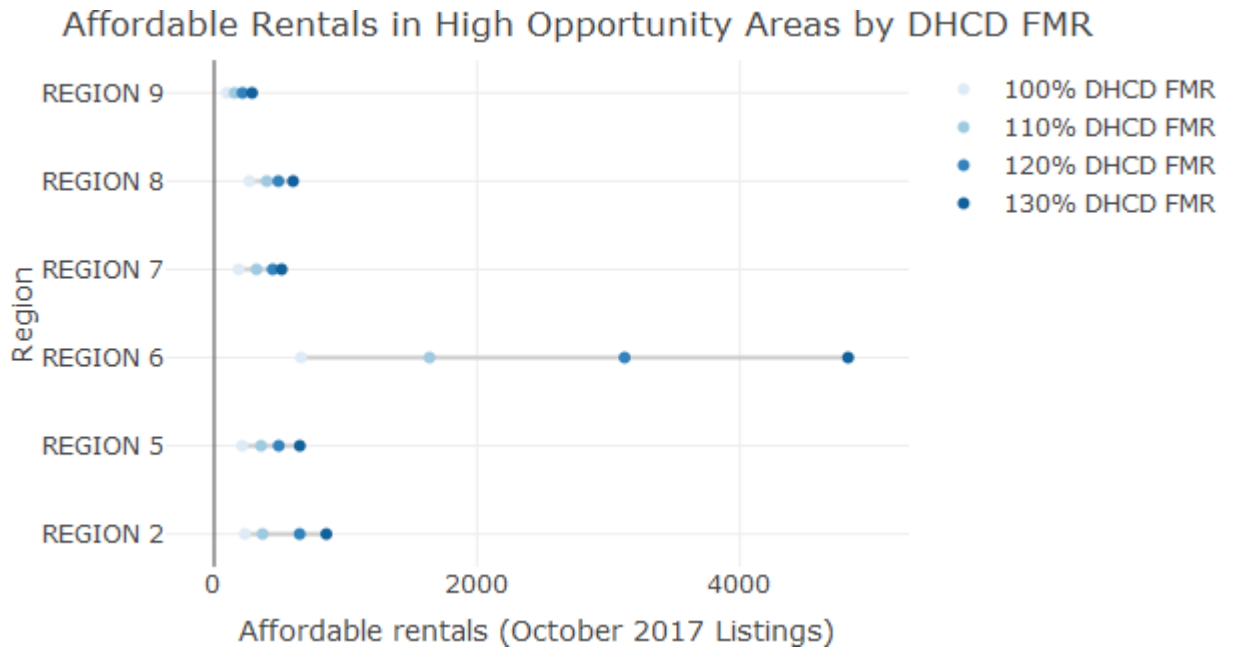
**Table 4: Total online unit rentals for October 2017 listed within payment standard (PaySt)**

Region	Low/Very Low			Moderate			High/Very High			Total PaySt DHCD Online Listings
	DHCD PaySt	Total Low/Very Low listings	DHCD PaySt (%)	DHCD PaySt	Total Moderate listings	DHCD PaySt (%)	DHCD PaySt	Total High/Very High listings	DHCD PaySt (%)	
Region 2	323	1969	16%	159	1357	12%	75	809	9%	557
Region 5	173	274	63%	73	178	41%	139	830	17%	385
Region 6	579	4284	14%	223	2911	8%	438	9767	5%	1240
Region 7	254	750	34%	94	265	36%	92	655	14%	440
Region 8	84	315	27%	83	153	54%	184	725	25%	351
Region 9	216	453	48%	39	223	18%	57	453	13%	312
<b>Total</b>	1629	8045		671	5087		985	13239		3285

Based on the low percentages of online units that are in High or Very High census tracts, it is interesting to calculate what would be the impact of increasing the Payment Standard a 110%, a 120% and a 130%. The results are shown in Table 5 and in the Figure 1. Some numbers are shocking: if Region 6 increases its Payment Standard a 10%,

there are 248% increase in the number of units, at 20% the increase is 472% and at 30% the increase is 730%. The same case valid for Region 2: 157% at 10%, 278% at 20% and 365% at 30%.

**Figure 1: Affordable rental units in high & very high opportunity areas by current and higher payment standards**



**Table 5: Total online unit at Current Payment Standard an at 110%, 120% and 130%**

Region	Total	Current PaySt	110% Current PaySt	120% Current PaySt	130% Current PaySt
Region 2	2166	234	368	650	853
Region 5	1008	212	356	491	651
Region 6	12678	661	1638	3122	4822
Region 7	920	186	322	445	513
Region 8	878	267	400	488	600
Region 9	676	96	155	216	288

## 5. CONCLUSIONS

Based on the tables, maps and figures analyzed in the previous sections, if the DHCD is planning on piloting an initiative that consist in expanding the Payment Standards, it should perform a deeper analyze on the feasibility of the Region 6 and Region 2. These two areas present high percentages of census tracts with high or very high COI index and both regions present a low percentage of voucher holders in those census tracts.

## APPENDIX

### GEOCODING FUNTION

```
for(i in 1:nrow(dataset)){  
  address <- dataset $Full.Address[i]  
  data <- geocode_url(address, auth="standard_api", privkey= api_key,  
    clean=TRUE, add_date='today', verbose=TRUE)  
  dataset$X[i] <- data$lat  
  dataset$Y[i] <- data$lng  
  print(i)  
}
```

### CENSUS TRACT FUNCTION

```
url <- paste0(  
  "http://data.fcc.gov/api/block/find?latitude=", X,  
  "&longitude=", Y, "&showall=true")  
  
# Sys.sleep(0.2) # sleep a little bit to avoid being banned  
doc <- read_xml(url)  
  
fips <- doc %>%  
  xml_find_first("//d1:Block") %>%  
  xml_attr("FIPS") %>%  
  str_extract("[0-9]{11}")  
  # message(sprintf("%.5f, %.5f) -> %s", lat, long, fips))  
  fips  
}  
  
geocode.ct <- function(df){  
  df$fips <- rowwise(df) %>%  
    do(fips=geo_to_blk(.$X, .$Y)) %>% .$fips %>% as.numeric()  
  df  
}  
  
# Running the code  
support.file <- geocode.ct()
```