

# Aro Homes at Stanford dy/dx

*Converted Presentation with Notes & Images – July 2023*

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We presented the following material to Stanford University’s dy/dx Executive Program in July 2023. This document is a significantly reduced version of that talk, with selected images and tables inserted for clarity.

Central to Aro Homes’ strategy is finding the right properties and understanding what can be built there. To this end we developed our own Property Intelligence system to guide site selection, including the home you’re about to visit.

This talk hopes to answer how did we ended up building our first house at 694 Pettis Avenue in Mountain View.

Aro Homes purchases small, energy-inefficient houses on the public market and replaces them with larger, energy and water efficient homes designed by an award-winning architecture firm. When we founded Aro, we wanted to start building in a region with room to grow. In other words, we wanted a region with a large number of house listings. California has a housing shortage. It also has the most active single family home market in the United States, as Table 1.1 shows.

State	Current Listings	Adjusted Listings	SAM
California	5069	31453	\$70,769,576,250
Florida	1969	12218	\$27,489,701,250
New York	905	5616	\$12,634,931,250
Washington	628	3897	\$8,767,665,000
Texas	496	3078	\$6,924,780,000
Colorado	383	2377	\$5,347,158,750
Massachusetts	358	2221	\$4,998,127,500
Hawaii	353	2190	\$4,928,321,250
Arizona	328	2035	\$4,579,290,000
Connecticut	264	1638	\$3,685,770,000
South Carolina	249	1545	\$3,476,351,250

Table 1.1: Top States by Listings & SAM - 2022 Data

Our state-wide anlysis suggests California as a natural starting location for Aro. We further broke our analysis down by counties, shown in Table 1.2

Los Angeles and Santa Clara Counties stand out, both from the number of listings, as well as price per square foot.

In order to achieve our high-performance, high-quality, and low cost, Aro Homes performs minimal configuration of each home. This means we can’t

County Name	Median Listing Time	Current Listings	Adjusted Listings
Los Angeles County	51	3562	25493
Santa Clara County	41	1174	10451
Orange County	48	1222	9292
San Diego County	45	960	7787
San Mateo County	45	562	4558
Riverside County	45	451	3658
Alameda County	38	364	3496
Sonoma County	45	322	2612
Ventura County	45	281	2279
Marin County	45	274	2222
Monterey County	45	198	1606

Table 1.2: Top CA Counties by Listing Time & Adjusted Listings

adjust our floorplan, roofline, eaves, or other aesthetics if requested by local municipal Design Review (also known as Planning Permit or Architectural Review). So for now, Aro has to build in cities with no design review, outlined in Table 1.3.

City	Has Design Review
Campbell	No <sup>*</sup>
Cupertino	No <sup>*</sup>
Los Altos	Yes
Mountain View	No
Palo Alto	Yes
San Jose	No <sup>*</sup>
Santa Clara	Yes
Saratoga	Yes
Sunnyvale	Yes
Los Gatos	Yes

<sup>\*</sup>*Does not require design review / planning permit for our design, depending on zoning and FAR requirements, depending on municipality*

Table 1.3: Design Review Requirements for Bay Area Counties

Each municipality has different requirements for first and second floor setbacks from a property line. For a given home design, this implies a minimum lot size for each municipality. For instance, in Figure 1.1 you can see that the same home built requires a 60 ft. wide lot in Mountain View, but only requires a 55 ft. 7 in wide lot in San Jose.

When creating a home design, one goal is to maximize the number of potential lots we can develop in a given city. This goal is not one-dimensional, as we are making a home that is sustainable, great to live in, and easy to assembly.

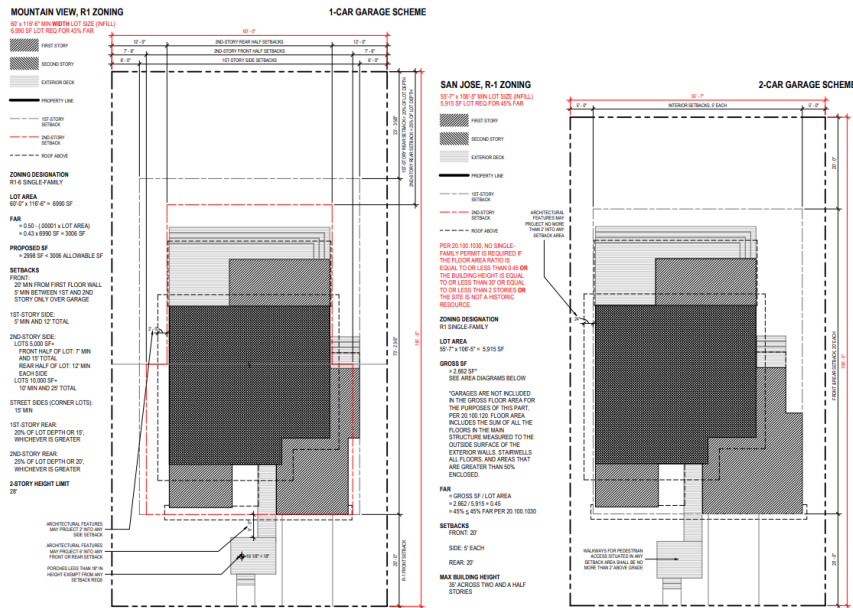


Figure 1.1: Comparison of Mountain View and San Jose zoning setbacks for the same home design.

Each city has a different set of setback requirements for a home. We mapped the required lot width and depth of all the available lots in Mountain View. If you make the home too large, you reduce the potential number of houses; too small, and you miss arbitrage opportunities. We settled on a home size that would fit 16% of the properties in Mountain View for our “version 1”. Figure 1.2 shows the current design in the context of all lots in Mountain View, requiring a 60 by 117 ft lot, boxed in dark black. Figures like this highlight tradeoffs in the design process. For instance, if we were to reduce the current depth of the home by 12 ft, we could target 54% (1090) more lots.

16% might sound like a small percentage of Mountain View, but it’s important to note the neighborhoods we target. The heat map in Figure 1.3 shows property prices in Mountain View, and we focused on neighborhoods along the south of the city, where home prices are higher per square foot, and transitional “pockets” in the center of the city. Mountain View home prices are highest in the south of the city, gradually lowering as you move north.

Of course, our house won’t fit on all these properties, so this map shows all the lots that could fit our target home size. Figure 1.4 shows only the homes in Mountain View where a version 1 home can fit on. In the target neighborhood we’re focusing on, we have very good coverage.

So where should we target in this neighborhood? Floor to Area Ratio captures what percentage of a lot is covered with structure. Typical suburbs only allow a maximum of 40-50% of lot to be covered, allowing for front, back, and

	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175
50	11622	11308	11179	10293	9843	7572	6728	4918	4166	3336	2414	1556	1289	1075	961	671	580	507	468	414	375	348	319	271	254	211	204	187	178	163
55	10833	10575	10448	10102	9709	7524	6684	4898	4146	3320	2398	1541	1277	1066	955	667	577	504	465	411	372	345	316	268	251	210	203	186	177	162
60	10537	10310	10211	9928	9547	7363	6654	4892	4140	3314	2392	1535	1272	1063	952	664	575	503	464	410	371	344	315	267	250	210	203	186	177	162
65	10350	10124	10025	9789	9408	7255	6573	4867	4119	3298	2377	1521	1261	1052	942	659	571	499	461	407	368	341	312	266	249	209	203	186	177	162
70	10239	10038	9939	9704	9346	7197	6538	4843	4097	3277	2358	1504	1252	1044	934	657	569	497	459	405	366	340	311	265	248	209	203	186	177	162
75	10028	9832	9757	9528	9246	7104	6493	4806	4069	3257	2338	1487	1235	1029	922	648	561	492	456	403	364	338	310	264	247	208	202	185	176	161
80	9852	9657	9602	9379	9119	6985	6431	4750	4021	3215	2310	1460	1209	1003	898	634	552	484	448	396	360	334	306	261	244	207	201	184	175	160
85	9649	9540	9487	9267	9012	6884	6338	4670	3953	3159	2269	1427	1177	980	879	621	541	473	437	387	351	326	299	256	239	204	198	181	172	157
90	9395	9287	9236	9019	8774	6663	6133	4569	3891	3109	2231	1397	1152	958	860	610	531	465	431	382	346	322	295	252	235	200	194	177	169	154
95	8374	8284	8233	8017	7840	5870	5472	4089	3643	2979	2124	1331	1104	934	843	598	519	455	421	372	338	314	288	246	229	195	189	172	164	150
100	7608	7520	7469	7351	7185	5356	5020	3820	3419	2821	2007	1271	1064	908	824	587	511	448	414	366	332	308	283	242	225	191	185	168	160	146
105	4717	4684	4645	4579	4466	3545	3328	2782	2546	2176	1579	1153	987	856	793	571	497	437	405	359	327	305	280	240	223	189	183	166	158	144
110	3810	3783	3747	3681	3585	2772	2596	2131	1959	1669	1332	1051	907	800	747	551	481	425	395	350	318	296	272	234	217	185	179	163	155	141
115	3205	3186	3154	3096	3012	2297	2155	1801	1676	1486	1197	963	843	749	706	531	463	414	384	340	311	290	266	228	211	181	175	160	152	138
120	2855	2839	2822	2770	2698	2037	1927	1630	1525	1371	1113	905	810	724	686	515	452	407	377	335	307	287	263	226	209	179	173	158	150	137
125	2522	2510	2497	2450	2391	1811	1716	1467	1384	1253	1024	839	759	685	657	500	442	400	374	332	304	284	261	224	207	177	171	156	148	135
130	2195	2185	2174	2129	2076	1537	1458	1262	1189	1070	886	768	704	650	628	479	426	387	362	321	294	274	254	218	201	171	165	150	142	129
135	1939	1934	1925	1886	1841	1358	1289	1123	1060	965	802	718	674	630	612	466	418	382	357	316	290	270	250	214	197	167	161	146	138	125
140	1772	1768	1759	1724	1680	1238	1171	1015	959	886	745	679	644	608	593	452	406	372	349	308	283	264	245	209	196	166	160	145	137	124
145	1531	1530	1526	1497	1461	1096	1036	921	871	806	707	647	612	577	563	433	390	359	338	299	274	257	238	202	190	161	155	141	133	121
150	1427	1426	1423	1397	1362	1012	954	865	823	768	679	625	593	560	546	423	380	350	330	292	267	251	232	196	185	157	151	137	129	117
155	1036	1035	1034	1022	1002	878	826	750	716	665	616	570	542	516	503	391	353	326	307	272	248	234	215	179	169	146	141	127	120	109
160	990	989	988	977	959	846	797	726	695	649	603	558	533	508	495	386	349	322	303	268	245	232	213	177	167	144	139	126	119	108
165	917	916	915	904	888	789	746	690	661	624	580	543	518	494	481	378	341	315	298	263	241	228	209	173	163	141	136	123	116	105
170	872	871	870	859	843	752	714	662	635	600	562	527	503	481	468	368	332	307	291	258	236	224	205	169	159	137	132	120	113	102
175	820	820	819	808	792	708	677	629	603	571	534	502	479	457	445	352	318	297	281	248	226	215	197	162	154	132	128	116	109	99
180	773	773	772	762	747	674	645	599	574	544	510	482	461	439	427	337	303	284	268	237	216	206	189	156	148	127	124	113	106	96
185	707	707	706	696	681	619	614	576	552	525	492	465	445	423	411	327	295	276	261	232	211	201	185	152	145	125	122	111	104	94
190	679	679	678	668	655	597	592	557	534	507	476	449	429	407	395	320	289	271	256	227	206	196	180	147	141	121	118	107	100	90
195	641	641	641	631	618	566	561	529	506	481	450	428	408	388	376	309	278	260	245	217	197	187	172	141	135	116	113	102	95	86
200	605	605	605	595	583	533	528	503	482	459	430	411	391	373	361	296	265	248	234	207	189	179	164	134	128	110	107	96	89	82
205	547	547	547	537	530	495	492	470	454	431	405	389	370	352	341	278	250	234	221	197	180	171	156	126	121	103	100	91	84	77
210	517	517	517	508	502	473	470	451	436	415	389	373	355	337	328	266	239	225	212	188	171	162	149	120	116	98	97	89	82	75
215	493	493	493	484	478	449	446	427	413	392	366	352	334	316	308	249	228	214	201	177	160	151	139	117	113	95	94	86	80	73
220	471	471	471	462	456	429	426	408	396	376	352	338	322	304	296	243	222	209	197	173	156	147	137	115	113	95	94	86	80	73
225	431	431	431	422	416	391	388	372	361	342	319	307	293	275	267	217	196	185	173	149	133	124	115	98	96	81	80	73	69	63
230	415	415	415	406	400	377	374	360	349	330	308	296	282	265	257	210	189	178	166	143	127	118	109	93	91	76	75	68	65	59
235	378	378	378	370	364	346	343	330	321	303	285	274	262	249	241	195	174	163	151	128	114	105	96	83	81	72	71	65	63	57
240	358	358	358	353	347	331	328	315	306	289	276	265	256	246	238	193	172	161	149	126	112	103	94	81	79	70	69	64	62	56
245	337	337	337	335	331	318	315	303	294	279	266	256	247	238	230	186	165	155	144	122	108	99	93	80	78	70	69	64	62	56
250	321	321	321	319	315	304	301	294	285	272	259	249	240	231	223	180	159	150	139	117	103	94	88	76	75	67	66	61	60	54
255	299	299	299	298	294	283	280	273	265	253	240	232	223	215	208	168	147	139	128	107	93	85	79	68	67	60	59	56	55	51
260	291	291	291	290	286	275	272	265	257	248	236	228	219	211	204	164	143	135	124	103	90	84	78	67	66	59	58	55	54	50
265	285	285	285	284	280	269	266	259	252	243	231	225	216	208	201	162	141	133	122	101	88	83	77	66	65	58	57	55	54	50
270	278	278	278	277	273	263	260	253	246	238	227	221	212	204	197	159	138	130	119	98	85	80	74	63	62	55	54	52	51	49
275	271	271	271	270	266	256	253	246	239	234	223	217	208	200	193	157	136	128	117	96	83	78	74	63	62	55	54	52	51	49

Figure 1.2: Number of lots we can target in Mountain View for a given home design width and depth.

Mountain View Heat Map

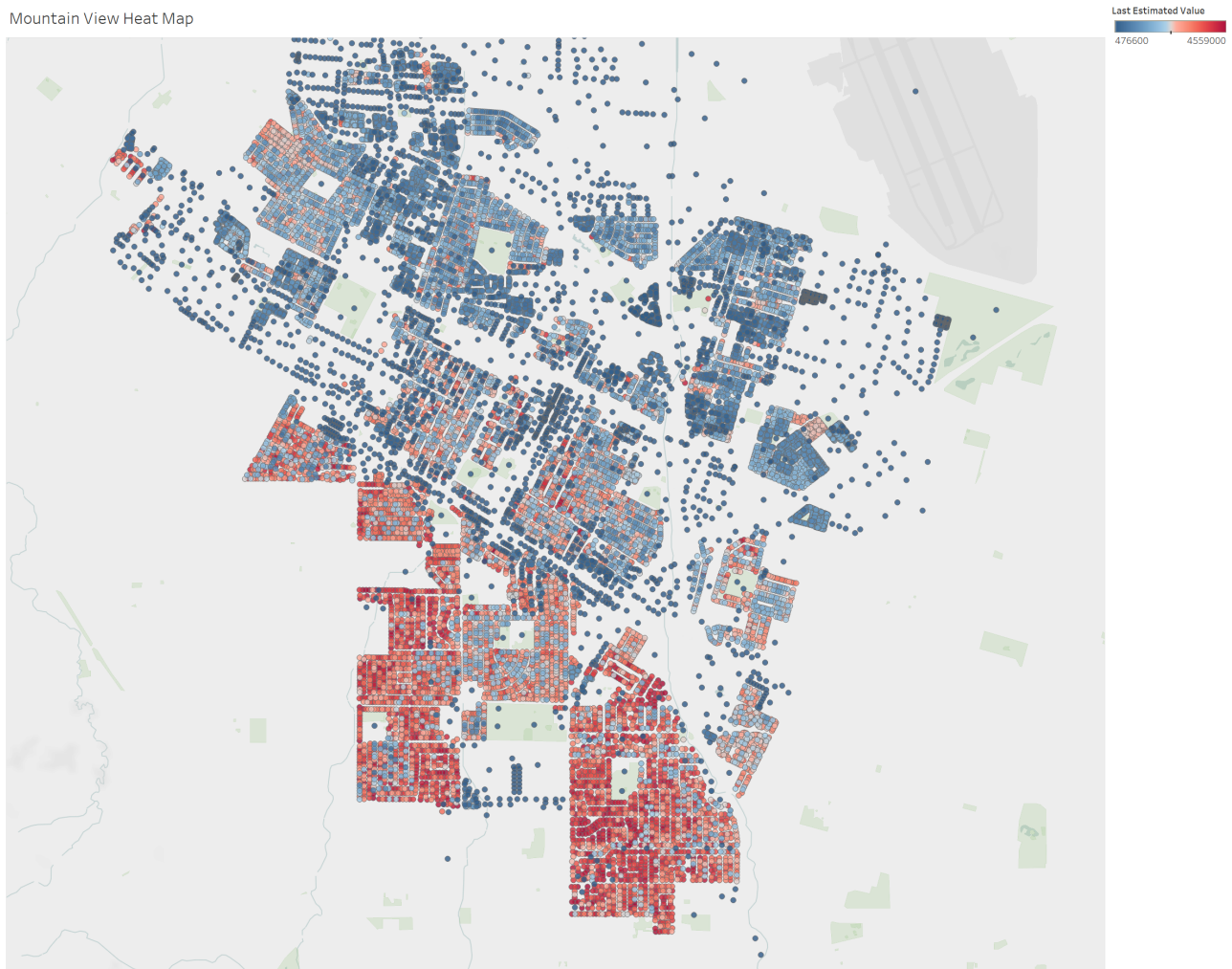


Figure 1.3: Property value heat map of Mountain View. Each dot represents a single family home.

Mountain View Aro-Sized Lots

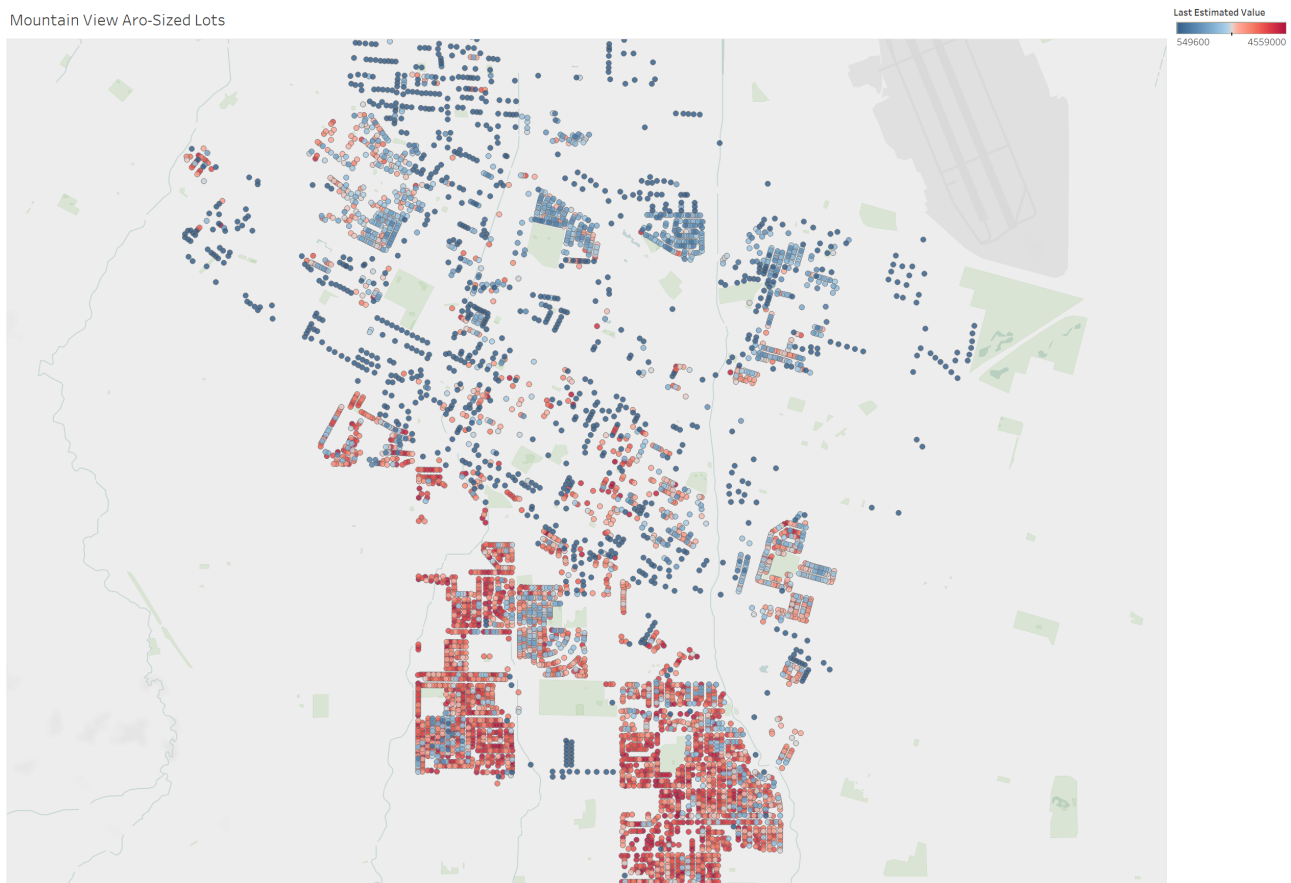


Figure 1.4: Property value heat map of Mountain View, showing only lots where a Version 1 Aro Home can fit.



Mountain View FAR

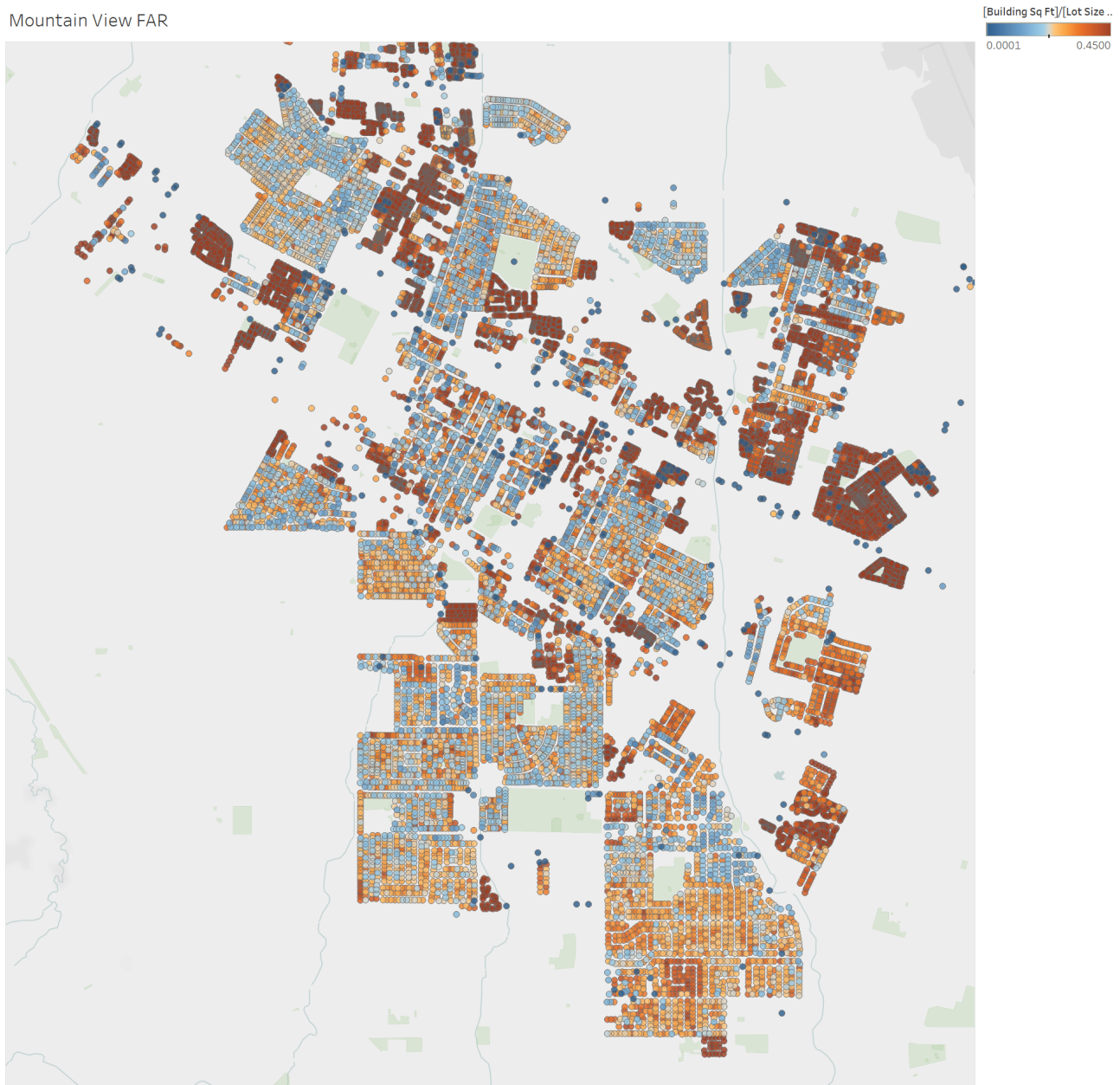


Figure 1.5: Current Floor to Area Ratios of Mountain View.

side yards. Given that Mountain View allows a FAR of 45%, Figure 1.5 shows lots that are a substantial number of under-utilized lots. In other words the streets and pockets that are darker the blue are the opportunities for Aro to build more home. As we've scaled, we're building a new database of parcels that considers even more factors guide our property search. And for each property, we are assigning a score based primarily on what we think we can sell our built home for minus what we think we can purchase it for.