



Graduation Rates and Property Value

Potential Impact of Additional Investments in Education

King County, Washington

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[LinkedIn](#), [Github](#)

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Agenda



- Objective
- Background
- Assumptions
- Method of Analysis
- Findings & Recommendations
- Questions & Next Steps

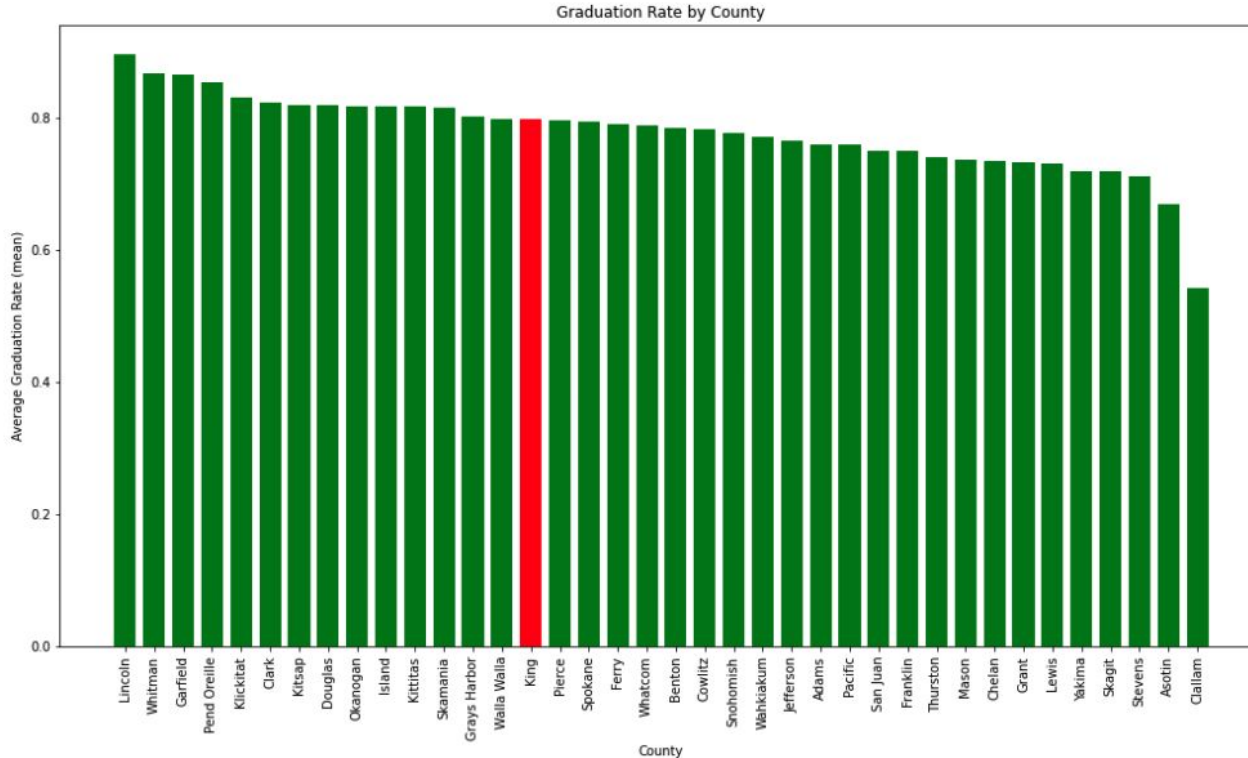
Project Overview



- **Stakeholder:** Washington State Board of Education - <https://www.sbe.wa.gov/our-work/education-system-health>
- **Situation:** Variability in graduation rates across school districts in King County demonstrate a need for additional school resources to reach and engage all students.
- **Problem:** There are limited funds available to increase resources in King County.
- **Objective:** The goal is to identify if an increase in property taxes can be justified by associating graduation rate with home sales price.

Background

Data obtained from [King County's Data Portal](#)



Overall Mean Graduation Rate
= **78%**

King County Mean Graduation
Rate = **79%**

King County Accounts for **24%**
of All Graduates

Background

30 largest School Districts	Claimed Cohort	Actual Cohort	2014 Grads	Reported 2014 Grad Rate	Actual 2014 Grad Rate	Drop
Kennewick	1167	1196	900	77	75	-2
Snohomish	853	856	720	84	84	0
Vancouver	1670	1674	1228	74	73	-1
S Kitsap	791	808	570	72	71	-1
Marysville	858	878	639	75	73	-2
Bellingham	900	923	707	79	77	-2
Northshore	1478	1513	1335	90	88	-2
Auburn	1159	1193	908	78	76	-2
Bellevue	1487	1525	1362	92	89	-3
Mukilteo	1098	1147	869	79	76	-3
Issaquah	1281	1340	1178	92	88	-3
Edmonds	1559	1625	1287	83	79	-4
Puyallup	1653	1721	1399	85	81	-4
Fed Way	1697	1791	1293	76	72	-4
Central Valley	876	937	778	89	83	-6
Lake WA	1592	1711	1436	90	84	-6
Spokane	1935	2077	1606	83	77	-6
Mead	809	878	715	88	81	-7
Evergreen	2056	2229	1646	80	74	-6
N Thurston	1024	1129	811	79	72	-7
Bethel	1197	1327	923	77	70	-7
Everett	1247	1380	1113	89	81	-8
C Kitsap	880	1025	782	89	76	-13
Battlegrd	984	1168	743	76	64	-12
Yakima	1133	1346	717	63	53	-10
Seattle	3348	4024	2527	76	63	-13
Renton	1066	1361	820	77	60	-17
Kent	1886	2443	1482	78	61	-17
Highline	1446	1915	909	63	47	-15
Tacoma	1870	2690	1464	78	54	-24

Seattle has a lower reported average (76%) than the rest of King County (79%)

Source:

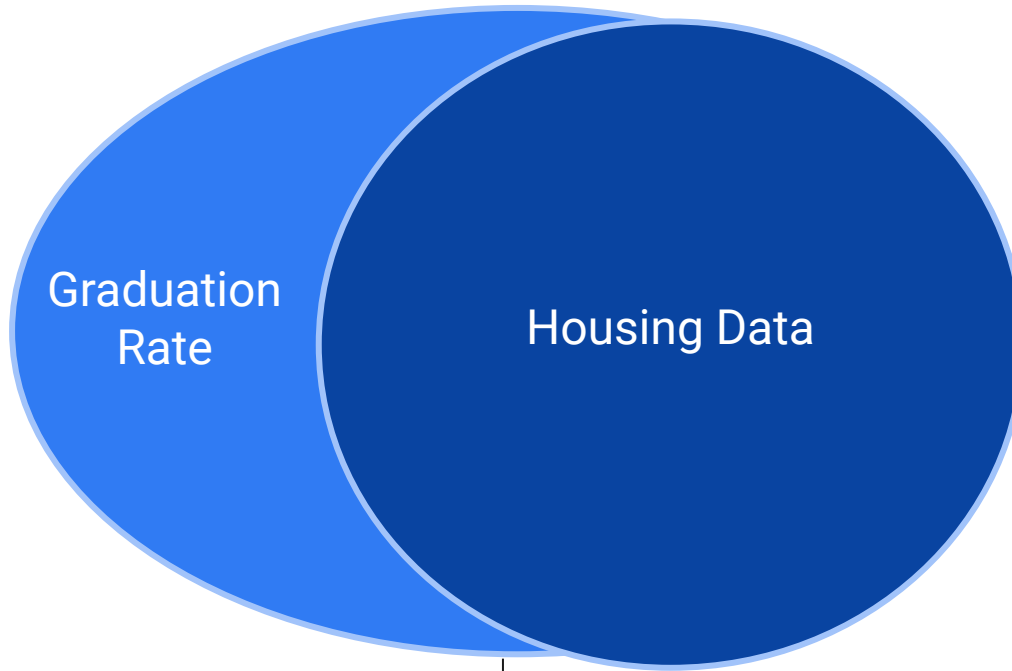
<https://springforbetterschools.org/8-increase-the-graduation-rate/raising-the-graduation-rates-starts-by-counting-every-student>

Assumptions and Considerations



- Years of Analysis
 - 2014 Home Sales based on King County Dataset
 - 2014/15 Academic Year
- Graduation Rate based on:
 - 4 year completion of high school
 - Public schools in King County

Method of Analysis



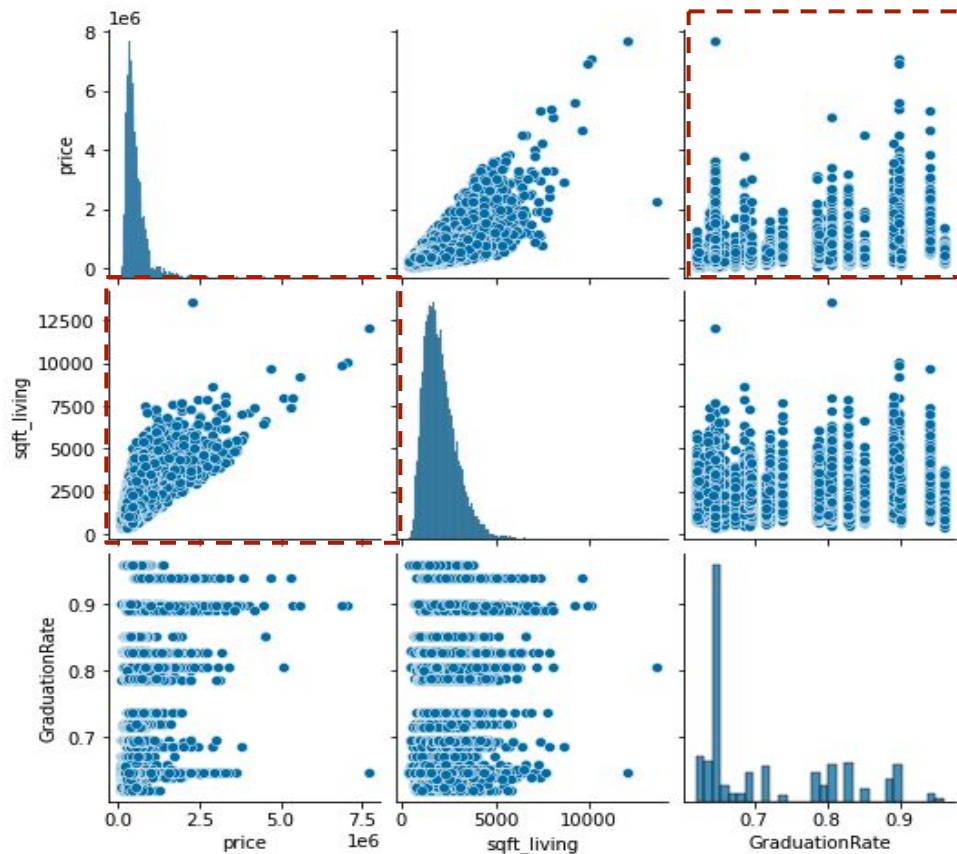
Zip Code to District Mapping

**Merged Data File
Joined on Zip Code
(*df_housing_wgrade*)
N=21,597**

Key Variables:

- Sales Price
- Date of Sale
- Property Size and Condition info
- Property Zipcode
- Graduation Rate (by Zipcode)

Interaction between Variables

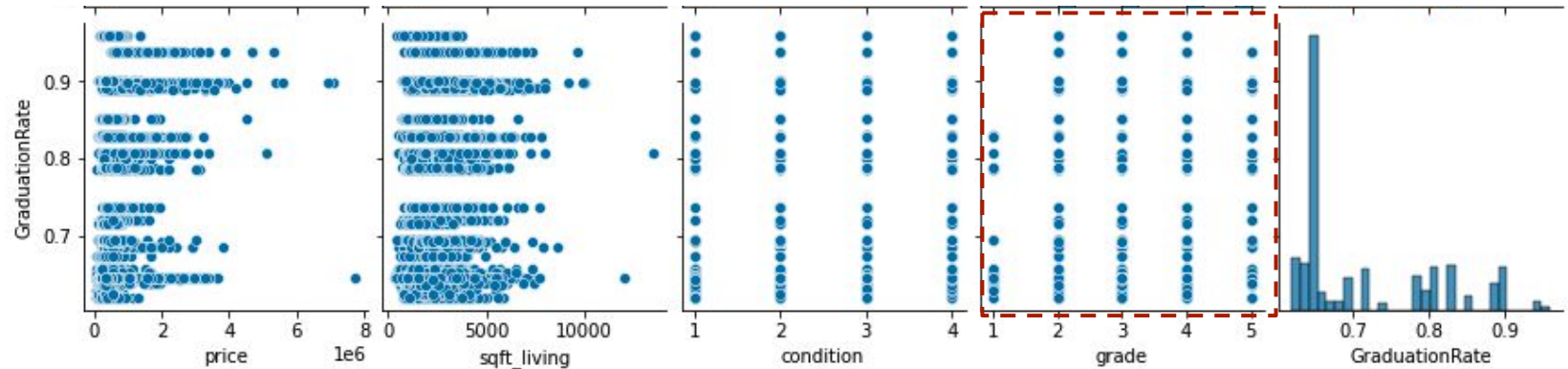


Observations:

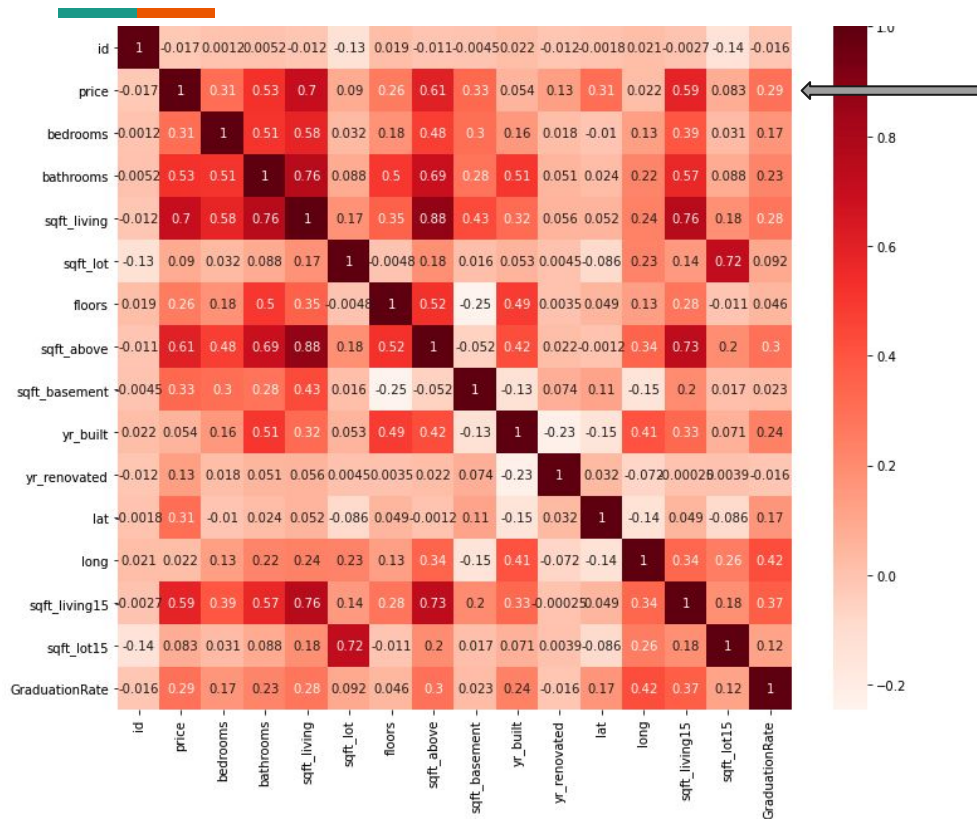
- **Property Size and Price** - *some correlation*
- **Graduation Rate and Price** - *range of graduation rate increases w/price*

Interaction between Variables

- **Graduation Rate and Building Grade** - Graduation Rates do not exceed 85% for properties w/lowest building grade compared with the population maximum rate of 95%



Interaction between Variables



Graduation rate does not have the highest coefficient to home sales price

But...

We will still proceed to run a regression model to assess it's prediction value

Prepare for Regression Model



1. Variables selected for analysis:

- Target
 - Sales Price
- Predictors
 - Graduation Rate
 - SQFT
 - Zipcode
 - Grade
 - Condition

2. Ordinal variables ranked:

- Grade
- Condition

3. Categorical variables encoded

- Zipcode

4. Numeric variables scaled

- SQFT

—

Output

Training Data Results:

R² = .86

OLS Regression Results

Dep. Variable:	price	R-squared:	0.857
Model:	OLS	Adj. R-squared:	0.856
Method:	Least Squares	F-statistic:	1339.
Date:	Fri, 24 Jun 2022	Prob (F-statistic):	0.00
Time:	12:52:54	Log-Likelihood:	3330.2
No. Observations:	17277	AIC:	-6504.
Df Residuals:	17199	BIC:	-5899.
Df Model:	77		

Graduation Rate has the highest coefficient!

	coef	std err	t	P> t	[0.025	0.975]
bedrooms	-0.0070	0.002	-3.237	0.001	-0.011	-0.003
GraduationRate	19.3741	0.034	571.267	0.000	19.308	19.441
condition	0.0464	0.002	18.824	0.000	0.042	0.051
grade	0.1561	0.004	41.448	0.000	0.149	0.163
view_EXCELLENT	0.3412	0.014	23.675	0.000	0.313	0.369
view_FAIR	0.0250	0.014	1.730	0.084	-0.003	0.053
view_GOOD	0.0895	0.012	7.245	0.000	0.065	0.114
view_NONE	-0.1266	0.007	-16.931	0.000	-0.141	-0.112
zipcode_98002	-0.5525	0.020	-26.954	0.000	-0.593	-0.512
zipcode_98003	0.1172	0.018	6.537	0.000	0.082	0.152
zipcode_98004	-4.1793	0.023	-185.716	0.000	-4.223	-4.135

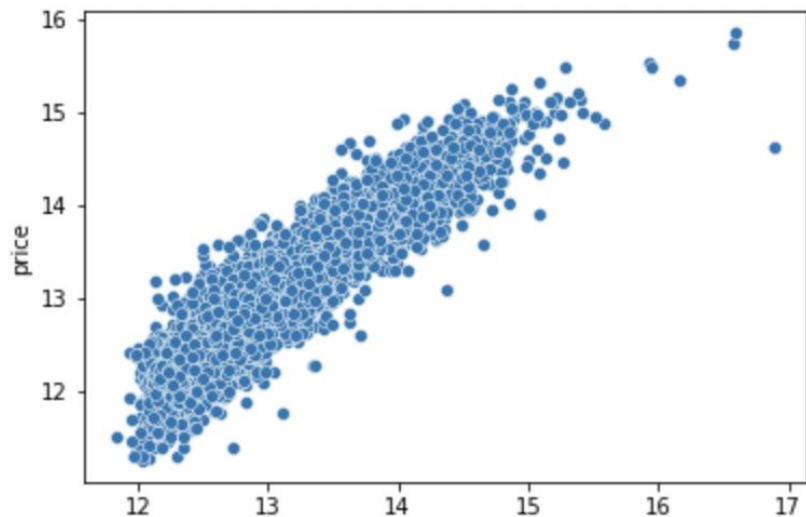
Test Data Results:



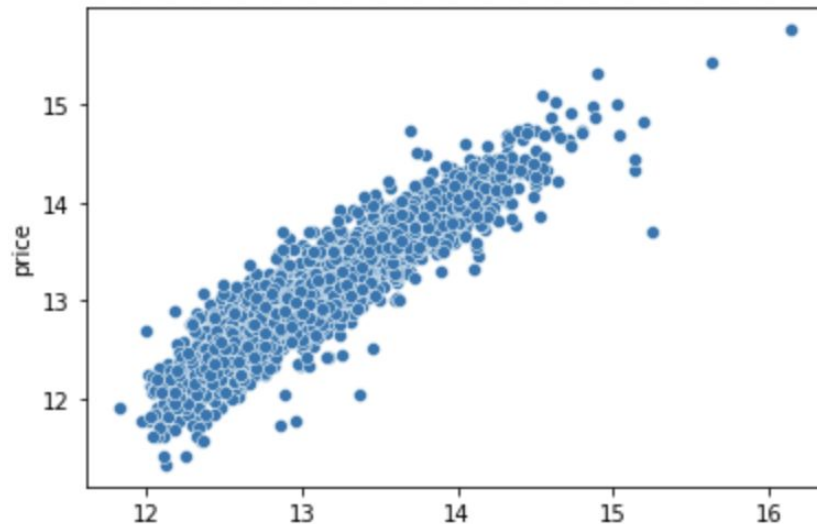
Same $R^2 = .86$

Similar pattern of predicted values between Train and Test

Train



Test



Interpreting the Results



Graduation Rate and Home Sales Price:

When predicting sales price with graduation rate, in conjunction with size, view, condition, grade, and zip code, the log of sale price will increase by 19

So...

Additional funding for school resources aimed at increasing graduation rate is an investment in the property value of homes

Additional Analysis



- Rerun model with Graduation Rate as the only predictor

Benefits:

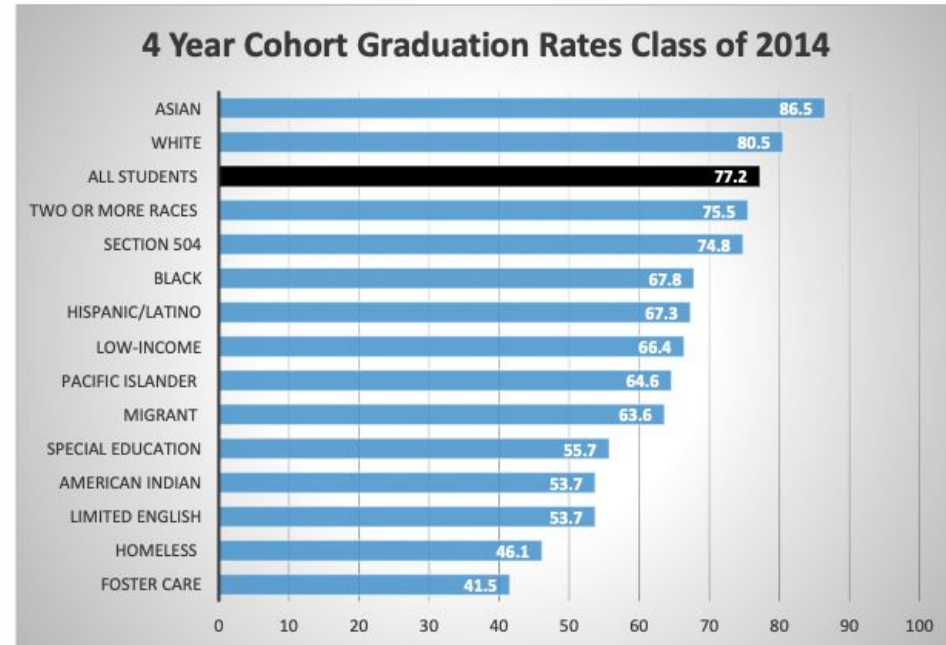
- Provide real price increase associated with an increase in graduation rate
- Confirm that the predictive value remains the same or increases

Recommendation

Propose an increase in property taxes to fund additional education resources for King County aimed specifically at engaging students and increasing graduation rates:

- Increase teacher student ratio to provide additional resources to students on specialized tracks
- Accommodations for students who need to work

FACTORS INFLUENCING HIGH SCHOOL GRADUATION



Next Steps



1. Perform additional iterations of model to confirm forecast
2. Obtain insight into interaction between specific zip codes and graduation rates for targeted interventions
3. Research other programs aimed linking school spending and home prices



Questions



Thank you!

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Appendix - Consolidation of Building Grades



Grade	Description	New Grade
Grades 1-3	Grades 1 - 3 Falls short of minimum building standards. Normally cabin or inferior structure.	1
Grade 4	Grade 4 Generally older low quality construction. Does not meet code.	1
Grade 5	Grade 5 Lower construction costs and workmanship. Small, simple design.	2
Grade 6	Grade 6 Lowest grade currently meeting building codes. Low quality materials, simple designs	2
Grade 7	Grade 7 Average grade of construction and design. Commonly seen in plats and older subdivisions.	3
Grade 8	Grade 8 Just above average in construction and design. Usually better materials in both the exterior and interior finishes.	3
Grade 9	Grade 9 Better architectural design, with extra exterior and interior design and quality.	4
Grade 10	Grade 10 Homes of this quality generally have high quality features. Finish work is better, and more design quality is seen in the floor plans and larger square footage.	4
Grade 11	Grade 11 Custom design and higher quality finish work, with added amenities of solid woods, bathroom fixtures and more luxurious options.	5
Grade 12	Grade 12 Custom design and excellent builders. All materials are of the highest quality and all conveniences are present.	5
Grade 13	Grade 13 Generally custom designed and built. Approaching the Mansion level. Large amount of highest quality cabinet work, wood trim and marble; large entries.	5