# New Land Development in Southern California and TOD
## - Geographically Weighted Regression

ESRI International User Conference, July 14, 2010 / San Diego

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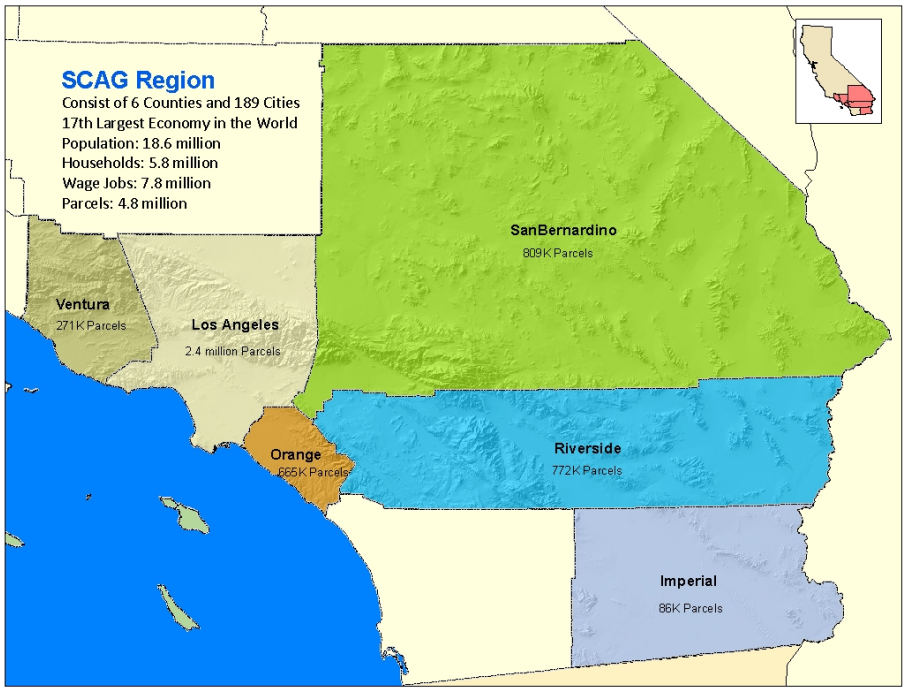
SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS

# Purpose of Study

- Identifying new land development:
  - by planning or market driven
  - Transit oriented
- Understanding the role of unplanned land developments

# Theoretical Background

- Planners seek growth management through implementing land use regulations such as general plan, zoning, and other controls (Pendall, 2000)
- Land use controls do not always work as intended or advertised (Landis, 1992)



# Data

- New land development data
  - 400K records from 2000 to 2008 at parcel level in Southern California
  - Collected by County assessors' offices
- General Plan in Southern California
- Existing Land Use: at parcel level from 1990 to 2008
- Value of land: County assessors' offices
- Socio-economic data: Census 2000 SF3

# Data Processing

- General Plan Data
  - Collected from local jurisdictions
  - General Plan codes were re-categorized into standardized 25 codes
  - For the study purpose, the 25 codes were re-categorized into 8 categories
- Existing Land Use Data
  - Collected from local jurisdictions
  - Land use codes were re-categorized into standardized 101 codes
  - For the study purpose, the codes were re-categorized into 8 categories

| Re-Cat | Description | Code | Description |
|---|---|---|---|
| 1 | Residential | 23 | Residential Categories |
| 2 | Commercial | 1 | Regional Retail Categories |
| 2 | Commercial | 2 | Retail/Services Categories |
| 2 | Commercial | 3 | Commercial Categories |
| 2 | Commercial | 4 | Hotel Categories |
| 2 | Commercial | 5 | Miscellaneous Commercial Categories |
| 2 | Commercial | 19 | Urban Mixed Categories |
| 2 | Commercial | 20 | General Commercial Categories |
| 3 | Industrial | 6 | Light Industrial Categories |
| 3 | Industrial | 7 | Heavy Industry Categories |
| 3 | Industrial | 8 | Miscellaneous Industry Categories |
| 3 | Industrial | 21 | General Industrial Categories |
| 4 | Public | 9 | K-12 School Categories |
| 4 | Public | 10 | College Categories |
| 4 | Public | 11 | Transportation Categories |
| 4 | Public | 12 | Utilities Categories |
| 4 | Public | 13 | Other Institutions (Gov,Fire,Church,Clubhouse, Etc) |
| 4 | Public | 22 | Military Categories |
| 5 | Parks | 15 | Open Nodevelopable Categories |
| 5 | Parks | 16 | Cemetery Categories |
| 5 | Parks | 17 | Golf Course Categories |
| 5 | Parks | 18 | Parks Categories |
| 6 | Agricultural | 14 | Agriculture Categories |
| 7 | Vacant | 0 | Vacant |
| 8 | Etc | 99 | Etc |

# Data Processing (cont.)

- Land Value
  - Collected by County assessors' office for tax purpose
  - Adjusted unreasonable values
  - Re-calculated to 2007 constant dollar
  - Aggregated at block group level

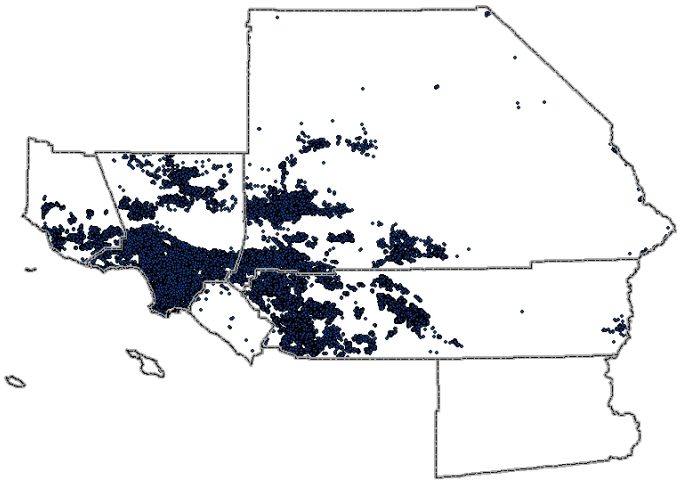
## Data Processing (cont.)

- New land development data
  - For the study, excluded Orange and Imperial county records because of insufficient information
  - Excluded records which developed year were later than GP adopted year
  - Joined to parcel base map with county assessors parcel number
  - Geocoded some records
  - Joined with General Plan map
  - Re-categorized land use codes into 8 groups

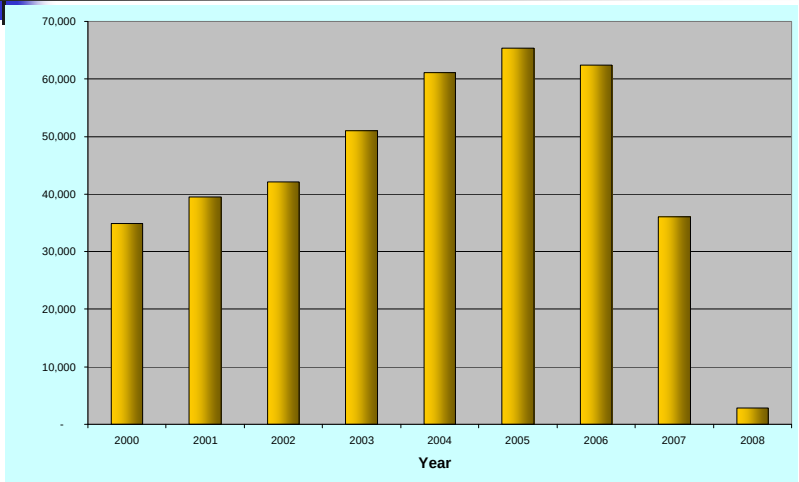
## Data Processing (cont.)

- High Quality Transit Corridor
  - A corridor with fixed route bus service with service intervals no longer 15 minutes during peak commute hours
  - Used 2003 transit network in SCAG region

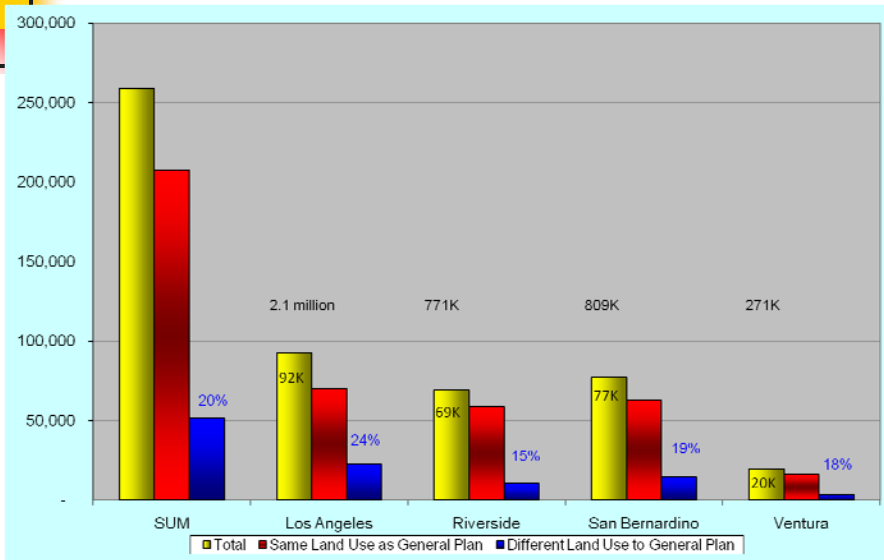
## Location of New Land Development



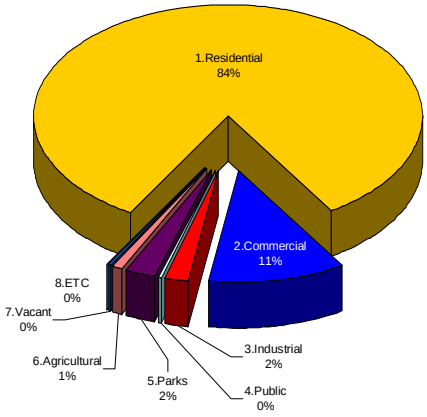
## New Land Development by Year



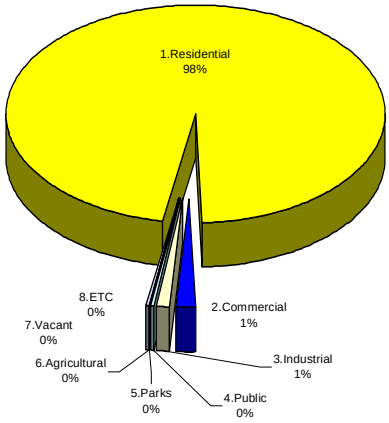
## New Land Development by County

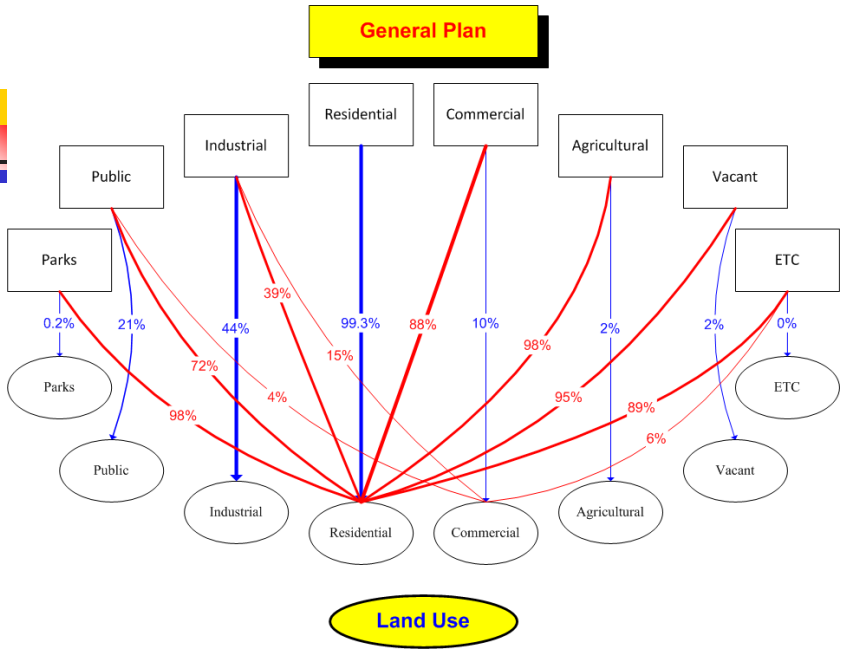



## New Land Development by GP Land Use Type



## New Land Development by Land Use Type



# Result of Logistic Regression

| | | Estimate | P-value |
|---|---|---|---|
| Dependant Variable: Development with Land Use Change | | | |
| Intercept | | -5.7965 | *** |
| Block Group SES | Population | 0.7398 | *** |
| | Household Income | 8.8132 | *** |
| | Land Value | 19.2423 | |
| County Dummy (Reference: Los Angeles) | Riverside | 0.1334 | *** |
| | San Bernardino | -0.2369 | *** |
| | Ventura | -0.8855 | *** |
| General Plan (Reference: Residential) | Commercial | 7.4561 | *** |
| | Industrial | 5.5856 | *** |
| | Parks | 10.6271 | *** |
| | Public | 6.7378 | *** |
| | Agricultural | 9.8217 | *** |
| Transit | Distance to HQTC | 5.2746 | *** |
| R-Square | | 0.5482 | |
| Max-rescaled R-Square | | 0.8693 | |
| Number of Observation | | 260,722 | |

P-value: *** p<0.001

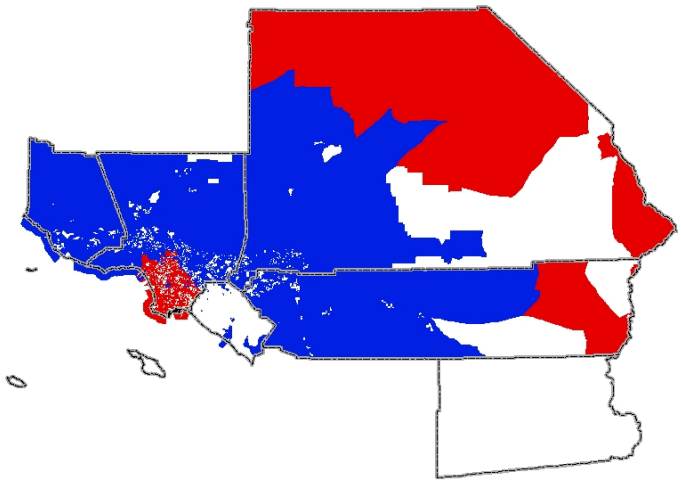
# Descriptive Statistics

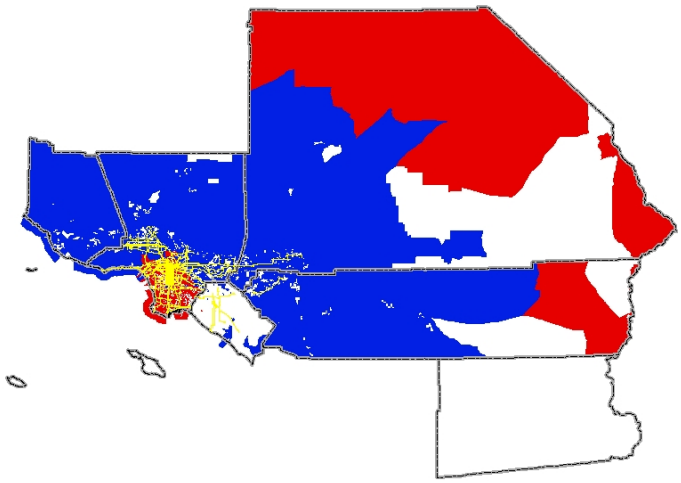
| Variable | Mean | Minimum | Maximum |
|---|---|---|---|
| Number of Land Development | 58.02 | 1.00 | 11,321.00 |
| Percent of Planned Development | 0.77 | 0.00 | 1.00 |
| Mean of Distance to HQTC | 9,473.14 | 12.67 | 262,003.04 |
| Population | 1,646.83 | 0.00 | 14,568.00 |
| Median Household Income | 48,436.92 | 0.00 | 200,001.00 |
| Mean of Developed Land Value | 401,300.65 | 5,113.68 | 87,521,156.38 |

# Result of GWR

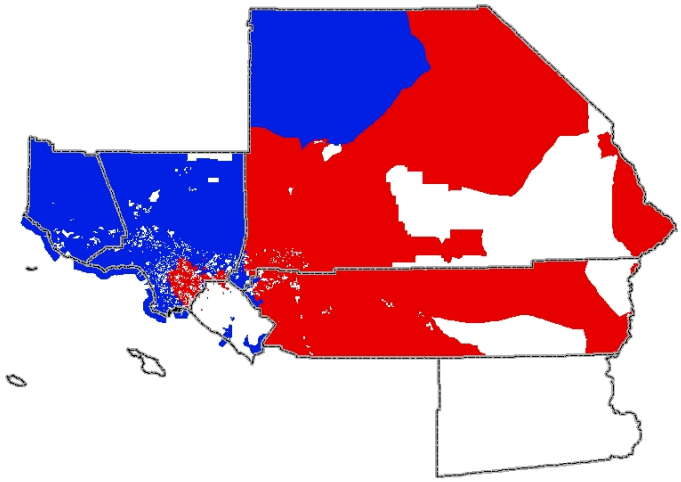
- Bandwidth : 75081.63749453431
- ResidualSquares : 393682106.78363055
- EffectiveNumber : 49.95440872538077
- Sigma : 247.90074132499763
- AICc : 89546.83545509345
- R2 : 0.21493640803857994
- R2Adjusted : 0.20893702457982943

Dependant Variable: Land Development with Land Use Change
Coefficient of Distance to HQTC





Dependant Variable: Land Development with Land Use Change
Coefficient of Median Household Income



Attributes of GeographicallyWeightedRegression1

| FID | Shape * | Observed | Cond | LocalR2 | Predicted | Intercept | C1_dist_hq | C2_value_m | C3_pop | C4_hhinc | Residual | StdError | StdErr_Int | StdErrC1_d | StdErrC2_v | StdErrC3_p | StdErrC4_h | StdResid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5249 | Polygon | 0.666667 | 17.155753 | 0.536037 | 0.239158 | 1.475575 | -0.000004 | 0 | -0.000068 | -0.000006 | 0.427509 | 0.280903 | 0.352118 | 0.000001 | 0 | 0.000068 | 0.000007 | 1.52191 |
| 6053 | Polygon | 0.285714 | 11.11466 | 0.534435 | 0.231622 | 1.197059 | -0.000004 | 0 | -0.00003 | -0.000001 | 0.054092 | 0.227929 | 0.175257 | 0.000001 | 0.000001 | 0.000038 | 0.000004 | 0.23732 |
| 5248 | Polygon | 0.047619 | 17.187564 | 0.526613 | 0.08925 | 1.49743 | -0.000005 | 0 | -0.000071 | -0.000006 | -0.041631 | 0.333732 | 0.355494 | 0.000001 | 0 | 0.000072 | 0.000007 | -0.124743 |
| 5247 | Polygon | 0.122449 | 10.381744 | 0.510334 | 0.172676 | 1.339008 | -0.000004 | 0 | -0.000049 | -0.000005 | -0.050227 | 0.337479 | 0.153238 | 0.000001 | 0 | 0.00003 | 0.000003 | -0.148629 |
| 5254 | Polygon | 0 | 18.449742 | 0.509024 | 0.044138 | 1.517374 | -0.000005 | 0 | -0.000075 | -0.000006 | -0.044138 | 0.305639 | 0.383445 | 0.000001 | 0 | 0.000081 | 0.000007 | -0.144414 |
| 5255 | Polygon | 0.045977 | 18.364945 | 0.508095 | -0.024716 | 1.519256 | -0.000005 | 0 | -0.000075 | -0.000006 | 0.070693 | 0.294004 | 0.381906 | 0.000001 | 0 | 0.00008 | 0.000007 | 0.240451 |
| 5258 | Polygon | 0 | 18.989518 | 0.505343 | 0.086737 | 1.518562 | -0.000005 | 0 | -0.000075 | -0.000007 | -0.086737 | 0.331842 | 0.394187 | 0.000001 | 0 | 0.000083 | 0.000007 | -0.261382 |
| 5257 | Polygon | 0 | 18.928759 | 0.504567 | 0.099562 | 1.519997 | -0.000005 | 0 | -0.000075 | -0.000007 | -0.099562 | 0.33249 | 0.39312 | 0.000001 | 0 | 0.000083 | 0.000007 | -0.299445 |
| 5252 | Polygon | 0 | 19.015613 | 0.50273 | 0.122331 | 1.523731 | -0.000005 | 0 | -0.000076 | -0.000007 | -0.122331 | 0.341947 | 0.394942 | 0.000001 | 0 | 0.000084 | 0.000007 | -0.357748 |
| 5251 | Polygon | 0 | 20.154369 | 0.50104 | 0.088891 | 1.518098 | -0.000005 | 0 | -0.000075 | -0.000007 | -0.088891 | 0.330287 | 0.415656 | 0.000001 | 0 | 0.000089 | 0.000008 | -0.269132 |
| 5256 | Polygon | 0 | 19.206381 | 0.4982 | -0.022193 | 1.52782 | -0.000005 | 0 | -0.000076 | -0.000007 | 0.022193 | 0.291893 | 0.398787 | 0.000001 | 0 | 0.000086 | 0.000007 | 0.076032 |
| 5253 | Polygon | 0 | 19.436687 | 0.497679 | 0.037242 | 1.526822 | -0.000005 | 0 | -0.000076 | -0.000007 | -0.037242 | 0.328439 | 0.403032 | 0.000001 | 0 | 0.000087 | 0.000008 | -0.113392 |
| 5250 | Polygon | 0.03 | 19.028143 | 0.482691 | 0.095866 | 1.546008 | -0.000005 | 0 | -0.000079 | -0.000007 | -0.065866 | 0.339623 | 0.410918 | 0.000001 | 0 | 0.000091 | 0.000008 | -0.194511 |
| 6054 | Polygon | 0 | 8.599851 | 0.433158 | 0.307504 | 1.206731 | -0.000004 | 0 | -0.000015 | -0.000004 | -0.307504 | 0.29034 | 0.132787 | 0.000001 | 0 | 0.000032 | 0.000003 | -1.059116 |
| 5270 | Polygon | 0 | 19.882066 | 0.375264 | 0.316089 | 1.650932 | -0.000005 | 0 | -0.000101 | -0.000007 | -0.316089 | 0.258496 | 0.404051 | 0.000001 | 0 | 0.000099 | 0.000008 | -1.222602 |
| 6101 | Polygon | 0.085714 | 20.733773 | 0.360834 | 0.226622 | 1.522133 | -0.000002 | -0.000003 | 0.000093 | -0.000019 | -0.140908 | 0.099258 | 0.588206 | 0.000001 | 0.000002 | 0.00014 | 0.000013 | -1.419619 |
| 6102 | Polygon | 0.5 | 22.023738 | 0.321543 | 0.327203 | 1.552331 | -0.000002 | -0.000002 | 0.000042 | -0.000016 | 0.172797 | 0.205338 | 0.585419 | 0.000001 | 0.000002 | 0.000142 | 0.000013 | 0.841522 |
| 6100 | Polygon | 1 | 23.119312 | 0.318051 | 0.758746 | 1.553217 | -0.000002 | -0.000002 | 0.000038 | -0.000016 | 0.241254 | 0.209046 | 0.594892 | 0.000001 | 0.000002 | 0.000147 | 0.000013 | 1.154071 |
| 6103 | Polygon | 0.964545 | 19.463342 | 0.313882 | 0.610222 | 1.555353 | -0.000002 | -0.000002 | 0.000051 | -0.000016 | 0.344324 | 0.289624 | 0.545667 | 0.000001 | 0.000002 | 0.000125 | 0.000012 | 1.188864 |
| 6055 | Polygon | 0 | 8.134946 | 0.292179 | 0.376217 | 1.196751 | -0.000003 | 0 | -0.000003 | -0.000006 | -0.376217 | 0.284836 | 0.110368 | 0.000001 | 0 | 0.000025 | 0.000002 | -1.320819 |
| 6057 | Polygon | 0.7 | 7.898225 | 0.263261 | 0.525184 | 1.012048 | -0.000003 | 0 | -0.000019 | -0.000001 | 0.174816 | 0.327049 | 0.09208 | 0.000001 | 0 | 0.00003 | 0.000002 | 0.534525 |
| 6099 | Polygon | 0.702128 | 21.398869 | 0.250909 | 0.417891 | 1.764733 | -0.000004 | -0.000001 | -0.000138 | -0.000007 | 0.284237 | 0.292672 | 0.398436 | 0.000001 | 0.000001 | 0.000113 | 0.000008 | 0.970515 |
| 6184 | Polygon | 0 | 29.400294 | 0.224937 | 0.175892 | 1.813421 | -0.000005 | 0 | -0.000151 | -0.000007 | -0.175892 | 0.258017 | 0.475699 | 0.000001 | 0.000001 | 0.000138 | 0.000008 | -0.680932 |
| 5902 | Polygon | 0 | 7.822929 | 0.181143 | 0.336326 | 0.874097 | -0.000003 | 0 | 0.000001 | 0.000001 | -0.336326 | 0.238986 | 0.110648 | 0.000001 | 0 | 0.000019 | 0.000001 | -1.407303 |
| 6060 | Polygon | 0.333333 | 7.747913 | 0.120525 | 0.508038 | 0.843375 | -0.000002 | 0 | -0.00002 | 0.000002 | -0.174705 | 0.144267 | 0.084719 | 0.000001 | 0 | 0.000027 | 0.000002 | -1.210981 |
| 6185 | Polygon | 0 | 7.133725 | 0.114411 | 0.43805 | 0.800593 | -0.000006 | 0 | 0.000023 | 0 | -0.43805 | 0.354449 | 0.036128 | 0.000001 | 0 | 0.00001 | 0 | -1.235962 |
| 6210 | Polygon | 0.823529 | 6.950131 | 0.109277 | 0.51875 | 0.80874 | -0.000006 | 0 | 0.000021 | 0 | 0.30475 | 0.358115 | 0.034746 | 0.000001 | 0 | 0.00001 | 0 | 0.851068 |
| 6219 | Polygon | 0.1 | 6.966169 | 0.109175 | 0.501827 | 0.807498 | -0.000006 | 0 | 0.000021 | 0 | -0.401827 | 0.357907 | 0.034816 | 0.000001 | 0 | 0.00001 | 0 | -1.122712 |
| 6209 | Polygon | 0.25 | 6.943733 | 0.108741 | 0.492525 | 0.806959 | -0.000006 | 0 | 0.000021 | 0.000001 | -0.242525 | 0.357408 | 0.034585 | 0.000001 | 0 | 0.00001 | 0 | -0.678567 |
| 6214 | Polygon | 0.076923 | 6.866671 | 0.108628 | 0.513851 | 0.812004 | -0.000006 | 0 | 0.00002 | 0 | -0.436928 | 0.358238 | 0.034276 | 0.000001 | 0 | 0.00001 | 0 | -1.219659 |
| 6215 | Polygon | 0.25 | 6.815906 | 0.108453 | 0.55505 | 0.811966 | -0.000006 | 0 | 0.00002 | 0 | -0.30505 | 0.358876 | 0.034091 | 0.000001 | 0 | 0.00001 | 0 | -0.850016 |
| 6220 | Polygon | 0 | 6.980382 | 0.108328 | 0.490891 | 0.80564 | -0.000006 | 0 | 0.000021 | 0.000001 | -0.490891 | 0.357707 | 0.034804 | 0.000001 | 0 | 0.00001 | 0 | -1.372327 |
| 6213 | Polygon | 0.571429 | 6.913467 | 0.108289 | 0.528376 | 0.808133 | -0.000006 | 0 | 0.000021 | 0.000001 | 0.043053 | 0.358025 | 0.034524 | 0.000001 | 0 | 0.00001 | 0 | 0.12025 |
| 6218 | Polygon | 0 | 7.007564 | 0.107957 | 0.504537 | 0.808439 | -0.000006 | 0 | 0.000021 | 0 | -0.504537 | 0.357996 | 0.035054 | 0.000001 | 0 | 0.00001 | 0 | -1.409337 |
| 6221 | Polygon | 0 | 6.969693 | 0.107946 | 0.525627 | 0.805484 | -0.000006 | 0 | 0.000021 | 0.000001 | -0.525627 | 0.357876 | 0.034833 | 0.000001 | 0 | 0.00001 | 0 | -1.468741 |
| 6217 | Polygon | 0 | 7.030583 | 0.107641 | 0.487032 | 0.808674 | -0.000006 | 0 | 0.000021 | 0 | -0.487032 | 0.357364 | 0.03519 | 0.000001 | 0 | 0.00001 | 0 | -1.362772 |
| 6223 | Polygon | 0 | 6.980461 | 0.107562 | 0.546691 | 0.807297 | -0.000006 | 0 | 0.000021 | 0 | -0.546691 | 0.357788 | 0.034884 | 0.000001 | 0 | 0.00001 | 0 | -1.527973 |
| 6222 | Polygon | 1 | 6.949749 | 0.107517 | 0.512577 | 0.804816 | -0.000006 | 0 | 0.000021 | 0.000001 | 0.487423 | 0.358197 | 0.034708 | 0.000001 | 0 | 0.00001 | 0 | 1.360771 |
| 6225 | Polygon | 0 | 6.957815 | 0.107307 | 0.538862 | 0.806345 | -0.000006 | 0 | 0.000021 | 0.000001 | -0.538862 | 0.358136 | 0.034747 | 0.000001 | 0 | 0.00001 | 0 | -1.504626 |
| 6211 | Polygon | 0.171875 | 6.889402 | 0.107249 | 0.512514 | 0.805909 | -0.000006 | 0 | 0.000021 | 0.000001 | -0.340639 | 0.358276 | 0.034358 | 0.000001 | 0 | 0.00001 | 0 | -0.950772 |

Record: 0 Show: All Selected Records (0 out of 6456 Selected) Options

# Findings

- New land developments in SCAG region were mainly for residential developments. It would be explained by the real estate bubble in the period.
- New land developments mainly occurred in the parcels that were categorized in residential use.
- About 20% of new land developments were unplanned and it was higher in Los Angeles County where most of land were already developed.
- New land developments less likely associated with transit network.
- But land near transit network more likely developed with land use change.