

Supplement S1. Descriptive statistics of explanatory variables

Table S1. Descriptive statistics of explanatory variables (continuous variables) for analysis 1
(All roads)

Variable		Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Distance to	the main station in the prefecture (m)	207	11,094	15,824	17,048	21,849	69,414
	the nearest station (m)	1	478	787	930	1,213	6,373
	the nearest bus station (m)	0	83	148	176	236	1,694
	the nearest elementary school (m)	1	258	403	437	575	2,427
	the nearest junior high school (m)	1	376	589	639	848	3,603
	the nearest hospital (m)	0	109	200	235	322	3,837
	the nearest post office (m)	0	269	417	459	600	2,993
	the nearest clinic (m)	0	112	206	242	333	3,837
Maximum building coverage ratio (%)		30	50	60	58	60	80

Table S2. Descriptive statistic of explanatory variables (continuous variables) for analysis 1
(Roads with undergrounded lines)

Variable		Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Distance to	the main station in the prefecture (m)	1,230	12,663	20,390	19,415	23,899	53,033
	the nearest station (m)	8	390	646	915	1,034	5,511
	the nearest bus station (m)	0	27	105	146	209	900
	the nearest elementary school (m)	7	210	375	436	621	1,403
	the nearest junior high school (m)	22	281	475	584	823	2,011
	the nearest hospital (m)	1	85	163	22	317	958
	the nearest post office (m)	12	246	420	576	757	2,876
	the nearest clinic (m)	1	88	168	224	319	958
Maximum building coverage ratio (%)		30	50	60	55	60	80

Table S3. Descriptive statistics of explanatory variables (dummy variables) for analysis 1
(All roads)

Variable	No (0)	Yes (1)
Landscape planning area	7,045	287,460
Landscape emphasis planning area	281,961	12,544
Each of the following seven residential districts are considered as a dummy variable		
(i)Category 1 low-rise exclusive residential districts	161,942	132,563
(ii)Category 2 low-rise exclusive residential districts	290,878	3,627
(iii)Category 1 medium-to-high-rise exclusive residential districts	231,843	62,662
(iv)Category 2 medium-to-high-rise exclusive residential districts	283,732	10,773
(v)Category 1 residential districts	225,920	68,585
(vi)Category 2 residential districts	283,602	10,903
(vii)Quasi-residential districts	289,113	5,392
New towns developed after 1976	260,352	34,153
New towns developed before 1976	271,100	23,405

Table S4. Descriptive statistics of explanatory variables (dummy variables) for analysis 1
(All roads)

Variable	No (0)	Yes (1)
Landscape planning area	72	762
Landscape emphasis planning area	640	194
Each of the following seven residential districts are considered as a dummy variable		
(i)Category 1 low-rise exclusive residential districts	614	220
(ii)Category 2 low-rise exclusive residential districts	823	11
(iii)Category 1 medium-to-high-rise exclusive residential districts	661	173
(iv)Category 2 medium-to-high-rise exclusive residential districts	789	45
(v)Category 1 residential districts	636	198
(vi)Category 2 residential districts	737	97
(vii)Quasi-residential districts	744	90
New towns developed after 1976	640	194
New towns developed before 1976	755	79

Table S5. Descriptive statistics of explanatory variables (continuous variables) for analysis 2
(All roads)

Variable		Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Distance to	the main station in the prefecture (m)	20	9,089	15,218	22,582	24,924	251,781
	the nearest station (m)	0	494	833	1,057	1,353	33,116
	the nearest bus station (m)	0	93	162	209	257	5,556
	the nearest elementary school (m)	1	276	432	476	624	5,815
	the nearest junior high school (m)	1	412	648	713	937	5,926
	the nearest hospital (m)	0	236	505	700	970	10,188
	the nearest post office (m)	0	264	415	466	610	2,993
	the nearest clinic (m)	0	114	209	251	340	3,836
Maximum building coverage ratio (%)		30	50	60	57	60	80

Table S6. Descriptive statistics of explanatory variables (continuous variables) for analysis 2
(Roads with undergrounded lines)

Variable		Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Distance to	the main station in the prefecture (m)	901	10,352	19,249	19,841	23,933	12,369
	the nearest station (m)	8	429	769	1,064	1,273	7,426
	the nearest bus station (m)	0	27	98	139	199	1,225
	the nearest elementary school (m)	7	220	398	445	630	1,502
	the nearest junior high school (m)	21	331	601	660	925	2,011
	the nearest hospital (m)	1	133	319	578	760	4,141
	the nearest post office (m)	8	238	430	562	741	2,876
	the nearest clinic (m)	1	83	167	226	317	1,224
Maximum building coverage ratio (%)		30	50	60	56	60	80

Table S7. Descriptive statistics of explanatory variables (dummy variables) for analysis 2
(All roads)

Variable	No (0)	Yes (1)
Landscape planning area	197,990	670,018
Landscape emphasis planning area	848,822	19,186
Each of the following seven residential districts are considered as a dummy variable		
(i)Category 1 low-rise exclusive residential districts	606,013	261,995
(ii)Category 2 low-rise exclusive residential districts	857,403	10,605
(iii)Category 1 medium-to-high-rise exclusive residential districts	694,383	173,625
(iv)Category 2 medium-to-high-rise exclusive residential districts	790,493	77,515
(v)Category 1 residential districts	595,518	272,490
(vi)Category 2 residential districts	816,134	51,874
(vii)Quasi-residential districts	848,104	19,904
New towns developed after 1976	812,620	55,388
New towns developed before 1976	815,269	52,739

Table S8. Descriptive statistics of explanatory variables (dummy variables) for analysis 2
(Roads with undergrounded lines)

Variable	No (0)	Yes (1)
Landscape planning area	307	1,157
Landscape emphasis planning area	1,230	234
Each of the following seven residential districts are considered as a dummy variable	1,136	328
(i)Category 1 low-rise exclusive residential districts	1,136	328
(ii)Category 2 low-rise exclusive residential districts	1,412	52
(iii)Category 1 medium-to-high-rise exclusive residential districts	1,225	239
(iv)Category 2 medium-to-high-rise exclusive residential districts	1,385	79
(v)Category 1 residential districts	1,072	392
(vi)Category 2 residential districts	1,255	209
(vii)Quasi-residential districts	1,299	165
New towns developed after 1976	1,169	295
New towns developed before 1976	1,373	91

Supplement S2. Regression coefficients of explanatory variables

We show regression coefficients of explanatory variables for analysis 1 and analysis 2. In analysis 1, the regression coefficients are almost the same, not depending on the threshold.

Table S9. Regression coefficients for analysis 1 in linear functional form

Variables	FAR threshold of 2	
	Coefficient	P value
Intercept	144819	0.00.E+00 ***
the main station in the prefecture	-3	0.00.E+00 ***
the nearest station	-18	0.00.E+00 ***
the nearest bus station	-5	4.34.E-35 ***
the nearest elementary school	-2	1.26.E-11 ***
Distance to the nearest junior high school	-3	2.37.E-92 ***
the nearest hospital	-12	1.65.E-21 ***
the nearest post office	-6	1.02.E-175 ***
the nearest clinic	-10	5.49.E-17 ***
Maximum building coverage ratio	-184	3.70.E-36 ***
Maximum floor area ratio	146	0.00.E+00 ***
(i)Category 1 low-rise exclusive residential districts		
(ii)Category 2 low-rise exclusive residential districts	-7912	5.92.E-60 ***
(iii)Category 1 medium-to-high-rise exclusive residential districts	-8035	2.57.E-273 ***
(iv)Category 2 medium-to-high-rise exclusive residential districts	-5219	1.20.E-53 ***
(v)Category 1 residential districts	-9497	7.08.E-306 ***
(vi)Category 2 residential districts	-4224	1.43.E-32 ***
(vii)Quasi-residential districts	-7915	3.95.E-69 ***
New towns developed after 1976	8516	1.45.E-198 ***
New towns developed before 1976	-5376	1.45.E-59 ***
Landscape planning area	-2184	4.64.E-01
Landscape emphasis planning area	-5876	2.59.E-99 ***
Narrow	-	-
Medium	6248	0.00.E+00 ***
Wide	15487	1.13.E-153 ***
UGUL	33459	8.13.E-31 ***
Neighborhood	5557	8.20.E-27 ***
(Wide/Medium)	-20849	9.08.E-09 ***
(High)	-10907	1.14.E-04 ***
(Wide/Medium and High)	20192	2.68.E-06 ***
(Prefecture dummy of Saitama)	-10076	1.38.E-02 *
(Prefecture dummy of Chiba)	-17947	8.63.E-09 ***
(Prefecture dummy of Tokyo)	-6833	1.40.E-02 *
(Prefecture dummy of Kanagawa)	-	-
<i>Sample size</i>	294,504	
R-squared	0.932	
P value of F-Statistic	2.20.E-16	

Table S10. Regression coefficients for analysis 1 in semi-log functional form

Variables	FAR threshold of 2	
	Coefficient	P value
Intercept	11.92	0.00.E+00 ***
the main station in the prefecture	-1.91E-05	0.00.E+00 ***
the nearest station	-1.36.E-04	0.00.E+00 ***
the nearest bus station	-5.48E-06	2.52.E-02 *
the nearest elementary school	-3.12E-05	2.63.E-106 ***
the nearest junior high school	-3.10E-05	4.27.E-220 ***
the nearest hospital	-9.99E-05	1.21.E-40 ***
the nearest post office	-5.70E-05	0.00.E+00 ***
the nearest clinic	-1.04.E-04	3.04.E-46 ***
Maximum building coverage ratio	-1.62.E-03	3.29.E-72 ***
Maximum floor area ratio	4.95.E-04	3.31.E-263 ***
(i)Category 1 low-rise exclusive residential districts		
(ii)Category 2 low-rise exclusive residential districts	-3.86.E-03	1.94.E-01
(iii)Category 1 medium-to-high-rise exclusive residential districts	1.31.E-03	3.46.E-01
(iv)Category 2 medium-to-high-rise exclusiveresidential districts	2.16.E-02	2.01.E-25 ***
(v)Category 1 residential districts	-7.41.E-03	1.91.E-06 ***
(vi)Category 2 residential districts	4.67.E-02	5.42.E-102 ***
(vii)Quasi-residential districts	1.03.E-02	1.80.E-04 ***
New towns developed after 1976	6.92.E-02	0.00.E+00 ***
New towns developed before 1976	-3.75.E-02	1.91.E-76 ***
Landscape planning area	4.64.E-03	8.00.E-01
Landscape emphasis planning area	1.08.E-03	5.23.E-01
Narrow		
Medium	4.11.E-02	0.00.E+00 ***
Wide	1.02.E-01	3.70.E-176 ***
UGUL	0.2320	2.58.E-57 ***
Neighborhood	0.0590	8.83.E-77 ***
(Wide/Medium)	-0.1130	3.05.E-07 ***
(High)	-0.0515	2.53.E-03 **
(Wide/Medium and High)	0.0627	1.70.E-02 *
(Prefecture dummy of Saitama)		
(Prefecture dummy of Chiba)		
(Prefecture dummy of Tokyo)	-0.1281	9.64.E-28 ***
(Prefecture dummy of Kanagawa)		
<i>Sample size</i>	294,504	
R-squared	0.932	
P value of F-Statistic	2.20.E-16	

Table S11. Regression coefficients for analysis 1 in full log functional form

Variables	FAR threshold of 2	
	Coefficient	P value
Intercept	1.51.E+01	0.00.E+00 ***
the main station in the prefecture	-2.80.E-01	0.00.E+00 ***
the nearest station	-1.07.E-01	0.00.E+00 ***
the nearest bus station	-1.08.E-03	4.46.E-04 ***
the nearest elementary school	-1.62.E-02	1.74.E-212 ***
the nearest junior high school	-1.91.E-02	4.25.E-295 ***
the nearest hospital	-1.50.E-02	1.06.E-16 ***
the nearest post office	-1.59.E-02	1.08.E-229 ***
the nearest clinic	-1.63.E-02	1.08.E-19 ***
Maximum building coverage ratio	-1.03.E-01	9.81.E-87 ***
Maximum floor area ratio	7.99.E-02	8.88.E-200 ***
(i)Category 1 low-rise exclusive residential districts		
(ii)Category 2 low-rise exclusive residential districts	-7.31.E-03	1.59.E-02 *
(iii)Category 1 medium-to-high-rise exclusive residential districts	-6.02.E-03	7.90.E-05 ***
(iv)Category 2 medium-to-high-rise exclusive residential districts	1.29.E-02	2.93.E-09 ***
(v)Category 1 residential districts	-1.65.E-02	1.19.E-22 ***
(vi)Category 2 residential districts	4.12.E-02	3.41.E-72 ***
(vii)Quasi-residential districts	8.35.E-03	3.65.E-03 **
New towns developed after 1976	4.57.E-02	1.15.E-148 ***
New towns developed before 1976	-1.18.E-02	8.70.E-09 ***
Landscape planning area	7.24.E-04	9.69.E-01
Landscape emphasis planning area	-1.99.E-03	2.49.E-01
Narrow		
Medium	3.96.E-02	0.00.E+00 ***
Wide	9.89.E-02	1.11.E-159 ***

UGUL	0.1212	2.35.E-13 ***
Neighborhood	0.0632	3.93.E-85 ***
(Wide/Medium)	-0.0681	2.43.E-03 **
(High)	0.0052	7.67.E-01
(Wide/Medium and High)	0.0351	1.88.E-01
(Prefecture dummy of Saitama)	-	-
(Prefecture dummy of Chiba)	0.0488	4.17.E-03 **
(Prefecture dummy of Tokyo)	-0.0699	2.29.E-06 ***
(Prefecture dummy of Kanagawa)	-	-
<i>Sample size</i>	294,504	
R-squared	0.930	
P value of F-Statistic	2.20.E-16	

Table S12. The regression coefficients of explanatory variables for analysis 2

Variables	Linear		Semi Log		Full Log	
	Coefficient	P value	Coefficient	P value	Coefficient	P value
Intercept	63560	0.00.E+00 ***	1.10.E+01	0.00.E+00 ***	1.36.E+01	0.00.E+00 ***
the main station in the prefecture	-2	0.00.E+00 ***	-2.01.E-05	0.00.E+00 ***	-2.44.E-01	0.00.E+00 ***
the nearest station	-7	0.00.E+00 ***	-8.19.E-05	0.00.E+00 ***	-7.66.E-02	0.00.E+00 ***
the nearest bus station	-2	4.37.E-71 ***	-3.75.E-05	2.77.E-234 ***	-6.59.E-03	4.78.E-226 ***
the nearest elementary school	-2	2.89.E-61 ***	-4.09.E-05	0.00.E+00 ***	-2.12.E-02	0.00.E+00 ***
the nearest junior high school	-3	0.00.E+00 ***	-3.73.E-05	0.00.E+00 ***	-2.65.E-02	0.00.E+00 ***
the nearest hospital	-1	1.16.E-177 ***	-3.65.E-05	0.00.E+00 ***	-1.79.E-02	0.00.E+00 ***
the nearest post office	-5	0.00.E+00 ***	-5.39.E-05	0.00.E+00 ***	-1.67.E-02	0.00.E+00 ***
the nearest clinic	-18	0.00.E+00 ***	-2.29.E-04	0.00.E+00 ***	-4.00.E-02	0.00.E+00 ***
Maximum building coverage ratio	38	6.38.E-08 ***	1.63.E-03	3.58.E-152 ***	7.83.E-02	6.01.E-105 ***
Maximum floor area ratio	87	0.00.E+00 ***	2.33.E-04	7.90.E-99 ***	3.28.E-02	9.08.E-64 ***
(i)Category 1 low-rise exclusive residential districts						
(ii)Category 2 low-rise exclusive residential districts	-2274	1.10.E-25 ***	-1.54.E-03	4.26.E-01	-9.50.E-03	1.22.E-06 ***
(iii)Category 1 medium-to-high-rise exclusive residential districts	-7465	0.00.E+00 ***	-3.13.E-02	4.57.E-164 ***	-2.72.E-02	3.82.E-105 ***
(iv)Category 2 medium-to-high-rise exclusive residential districts	-6954	0.00.E+00 ***	-8.65.E-03	6.66.E-11 ***	-4.54.E-03	1.64.E-03 **
(v)Category 1 residential districts	-10087	0.00.E+00 ***	-5.52.E-02	0.00.E+00 ***	-5.55.E-02	0.00.E+00 ***
(vi)Category 2 residential districts	-5788	1.30.E-261 ***	1.53.E-02	1.02.E-24 ***	6.50.E-03	3.84.E-05 ***
(vii)Quasi-residential districts	-8090	0.00.E+00 ***	-2.08.E-03	2.62.E-01	3.19.E-03	9.89.E-02
New towns developed after 1976	2994	4.84.E-169 ***	3.65.E-02	0.00.E+00 ***	2.94.E-02	1.99.E-201 ***
New towns developed before 1976	414	1.29.E-04 ***	1.39.E-02	2.05.E-47 ***	1.94.E-02	3.38.E-88 ***
Landscape planning area	4775	6.38.E-40 ***	4.09.E-02	4.27.E-37 ***	3.59.E-02	2.65.E-28 ***
Landscape emphasis planning area	-6440	8.38.E-298 ***	-1.18.E-02	2.45.E-14 ***	-1.34.E-02	1.35.E-17 ***
Narrow	-	-	-	-	-	-
Medium	5310	0.00.E+00 ***	5.61.E-02	0.00.E+00 ***	5.21.E-02	0.00.E+00 ***
Wide	11671	0.00.E+00 ***	1.38.E-01	0.00.E+00 ***	1.33.E-01	0.00.E+00 ***
UGUL	17343	2.23.E-38 ***	1.96.E-01	4.68.E-79 ***	8.96.E-02	2.77.E-15 ***
Neighborhood	8184	1.39.E-184 ***	8.92.E-02	8.04.E-276 ***	8.65.E-02	1.36.E-253 ***
(Medium)	-2561	2.57.E-02 *	-6.03.E-02	4.25.E-09 ***	-5.24.E-02	4.52.E-07 ***
(Wide)	-7678	4.60.E-04 ***	-1.14.E-01	2.01.E-09 ***	-1.12.E-01	6.66.E-09 ***
Hokkaido	-12374	3.32.E-03 **	-	-	1.13.E-01	2.58.E-03 **
Ibaraki	-21608	1.84.E-05 ***	-1.83.E-01	3.91.E-05 ***	-8.84.E-02	5.08.E-02
Tochigi	-20181	1.87.E-08 ***	-1.52.E-01	1.41.E-06 ***	-	-
Saitama	-	-	-	-	8.72.E-02	3.64.E-04 ***
Chiba	-5954	1.19.E-03 **	-	-	1.07.E-01	2.87.E-11 ***
Tokyo	4810	2.11.E-03 **	-1.23.E-01	4.82.E-22 ***	-3.44.E-02	1.15.E-02 *
(The Kanagawa	-	-	-	-	-	-
prefecture Nigata	-9602	1.54.E-04 ***	4.95.E-02	2.33.E-02 *	1.48.E-01	5.46.E-11 ***
dummy of Gifu	-	-	-	-	1.87.E-01	3.60.E-06 ***
Aichi	-15315	2.47.E-04 ***	-1.54.E-01	2.59.E-05 ***	-	-
Mie	-	-	1.16.E-01	2.04.E-03 **	1.95.E-01	3.53.E-07 ***
Kyoto	7184	8.60.E-04 ***	5.82.E-02	1.48.E-03 **	1.62.E-01	1.90.E-17 ***
Osaka	-	-	-5.93.E-02	1.06.E-02 *	-	-
Hyogo	-7962	9.08.E-04 ***	-9.26.E-02	5.66.E-06 ***	-	-
Fukuoka	6694	1.88.E-02 *	1.47.E-01	2.52.E-09 ***	2.39.E-01	3.86.E-21 ***
Sample size	868,007		868,007		868,007	
R-squared	0.931		0.937		0.936	
P value of F-Statistic	2.20E-16		2.20E-16		2.20E-16	