Crisp Infrastructure Report

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Introduction

This project involves a public opinion survey on infrastructure in Texas. This sample was conducted by Ipsos using their KnowledgePanel. The KnowledgePanel is a panel of survey respondents recruited by randomly sampling addresses. This random sample ensures that valid inferences can be drawn from this survey. The survey is then administered online. The survey was fielded from April 26, 2021, to May 14, 2021. The survey includes two separate samples: the first sample included 1200 Texans of whom 610 responded and the second sample was of residents of Harris County and was included 325 respondents of whom 200 responded. The Texas sample included 81 residents of Harris County. The survey covered a variety of issues relating to infrastructure ranging from knowledge of infrastructure, assessment of the reliability of infrastructure in a respondent's local area, questions relating to how flooding impacts infrastructure access, questions relating to the impact of Hurricane Harvey on infrastructure access, and support for additional local and state spending on infrastructure.

Ipsos provided weights for the survey to generate inference that is representative of the public. Because the survey includes a statewide sample and a Harris county sample, the raw data is not representative of the population of Texas. But the Harris county was of particular interest for the client because of its large population and Hurricane Harvey affected many people in Harris county. To adjust for the non-representativeness of the survey Ipsos provided us with survey weights to analyze the population of all adults in Texas and the population of all adults in Harris County. Ipsos used Census Bureau data to understand the population characteristics and then used iterative raking so that the marginal distributions of the weighted data matched the characteristics of the population.

This project and data come from the Institute for Science, Technology and Public Policy at the Bush School at A&M. The goal of this consulting project was to understand public support for Public-Private Partnerships in infrastructure. A public-private partnership is defined in the context of the survey as " cooperative arrangements between public organizations and businesses or nonprofits to complete a project or provide a service". In particular, the survey focuses on public-private infrastructure projects such as roads, bridges, and utilities. Three survey questions were identified as key questions to study: support for the use of public-private

partnerships in infrastructure, support for various aspects of public-private partnerships, and support for policy actions to improve infrastructure. We were tasked with providing regressions that identified key demographic and psychometric variables to predict the three questions of interest.

This survey is somewhat unique because it looks at Texas specifically and asks questions related to the effects of severe weather events on infrastructure access. The client was unsure what variables should be included in the regression and preferred that we use some sort of variable selection method to analyze what variables are good predictors of the questions of interest. The client also asked for a series of visualizations showing the relationship between various variables.

Data Cleaning/Exploratory Data Analysis

Response Variables

Below we list the questions selected by Dr. Vedlitz as important questions to study. These questions are items in a likert scale.

Q15 (PPPSupportUse)

How much would you oppose or support the following types of Public Private Partnerships for the construction of some infrastructure project in your community?

a. A government agency builds something and then sells it to a private operator.

b. A private contractor builds something and then sells it to the government.

c. Government and a private contractor work together to fund, build, and operate an infrastructure element.

d. Government and a nonprofit work together to fund, build, and operate an infrastructure element.

1. Strongly oppose
2. Oppose
3. Neither support nor oppose
4. Support
5. Strongly support

Q17 (PPPSupport)

To what extent do you disagree or agree with the following statements about Public Private Partnerships?

a. The use of Public Private Partnerships can benefit my community.

b. Local officials in my community support the use of Public Private Partnerships.

c. Private industries in my community support the use of Public Private Partnerships.

d. The people in my community support the use of Public Private Partnerships.

1. Strongly disagree

2. Disagree

3. Neither disagree nor agree

4. Agree

5. Strongly agree

Q22 (PPP_Policy)

How much do you oppose or support the following policies to improve your community infrastructure?

a. Limit development in areas where infrastructure failures are likely

b. Provide financial incentives for people to relocate from vulnerable areas

c. Strengthen infrastructure design standards

d. Strengthen building design standards

e. Conduct more frequent maintenance on infrastructure

f. Conduct more frequent replacement of older infrastructure

g. Build additional infrastructure to address vulnerabilities

h. Address identified infrastructure vulnerabilities through coordinated planning

g. Work to engage affected stakeholders and communities in infrastructure decisions

1. Strongly oppose

2. Oppose

3. Neither support nor oppose

4. Support

5. Strongly support

Dimension Reduction

Many questions in the survey are Likert scales measuring a certain psychometric variable. The item in each particular question was designed to be measuring a similar attitude. The options in

the scale were designed to be equally spaced and symmetric across potential attitudes and have numeric equivalents. If question has high internal consistency determined by Cronbach's alpha, and then we take the average across all items in a scale. If the average appears to be normally distributed, we tend remove the individual items as predictors and replace them with this average value.

Methodology

Variable Selection

There is not a lot of literature dealing with variable selection with survey data. One of the features of survey data is that it is almost always weighted. These weights are typically essential for inference because survey respondents are often not representative of the population of interest due to non-response. But many methods for variable selection do not have a structure to include weights inside the variable selection process. It is unclear what the effects of ignoring weights in a variable selection process affect inference. Some variable selection methods are non-parametric such as XGBoost or random forest.

To understand what variable selection method is ideal for this type of data we will use three variable selection methods: lasso, XGBoost, and random forest. The data will be split into 80% training and 20% testing with the spilt stratified by residents of Harris county and residents of other Texas counties. Lasso can use weights, but the typical implementation of random forest and XGBoost do not. However, after the variables are selected from random forest and XGBoost a linear regression can be conducted that uses the survey weights.

Lasso (least absolute shrinkage and selection operator) is a linear regression method that aims to find a parsimonious model. Lasso has a regularization parameter often called λ, which is the maximum sum of the absolute value of the regression coefficients. The goal of Lasso is to find the regression coefficients that minimize prediction error on the data the model is trained on while the absolute value of the coefficients is less than or equal to lambda. It is also possible to choose λ using cross validation. The R package glmnet implements lasso and has a version capable of doing weighted least squares regressions.

Random forest (Breiman 2000) is a tree-based regression and classification method. Random forest builds a series of regression trees. The objective of random forest is to minimize the residuals. Each "branch" of the tree is a binary condition on a certain predictor (i.e. age < 60),

and the algorithm produces a series of branches until further branches do not improve the tree's performance. The algorithm takes the following steps:

1. Draw n bootstrap samples from the data
2. Start a decision tree with each of the n bootstrap samples
3. For each branch consider m predictors where m can be less than the number of potential predictors
4. Pick the best branch that minimizes the prediction error
5. Repeat 3 & 4 until adding a branch no longer reduces the prediction error

The more times a variable appears on a branch, the more important that predictor is. Random forest can be used for variable selection by choosing the most important predictors. The VSURF R package automates this process (R. Genuer, J. M. Poggi and C. Tuleau-Malot 2015). After using the vsurf function in the VSURF package to select the best variables for prediction, those variables are used in an OLS model using the R function lm and the weights provided by Ipsos are used.

(someone else describe XGBoost because I don't completely understand it)

Results

(Include Tables)

Results for Random Forest

Below in the following table the descriptions of the predictor variables in used in the random forest models

Variable	Description
Q19avg	Average of How much do you distrust or trust the following types of organizations?

Q23_10	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Co-workers
Q23_9	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Friends
education	Less than High School Graduate, High School Graduate, Some College, College Educated
Q20avg	Average of How responsible should the following types of organizations be for making policies for your community infrastructure?
Q18	For building infrastructure in your community, would you prefer? Government only or PPP
age	18-29, 30-44, 45-59, 60+
Q5avg	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community?
Q16_4	When deciding whether you support forming a Public Private Partnership to address a community infrastructure project, how important is it that the Partnership offer the following? - Greater opportunities for local economic development
Q16_2	When deciding whether you support forming a Public Private Partnership to address a community infrastructure project, how important is it that the Partnership offer the following? - A higher quality product
Q23_1	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Government officials

Q1_11	How concerned are you about the following public issues facing Texas today? - The environment
Q16_3	When deciding whether you support forming a Public Private Partnership to address a community infrastructure project, how important is it that the Partnership offer the following? - More public participation in the decision process
Q1_5	How concerned are you about the following public issues facing Texas today? - Pollution
Q1_10	How concerned are you about the following public issues facing Texas today? - Local infrastructure
QPID100	Political Party
Q4avg	Average of How reliable are the following types of infrastructure in your community?
Q2_3	Are the following statements true or false? You may view the correct responses after you complete survey. - Transportation infrastructure is important to the working of electrical power supply.

Random Forest for PPPSupport in TX

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.901774	0.167708	11.33982	1.62E-27
PPPSupportUse	0.166978	0.026531	6.293657	5.42E-10

Q19avg	0.21598	0.030587	7.061073	3.93E-12
Q14No	-0.22527	0.041123	-5.47798	5.97E-08
Q20avg	0.151446	0.03196	4.738669	2.60E-06
Q23_2Not so often	0.00685	0.042718	0.160345	0.872655
Q23_2Somewhat often	-0.01759	0.051331	-0.34266	0.731952
Q23_2Very often	0.048503	0.081225	0.597147	0.550599
Q2_4False	-0.18863	0.060185	-3.13411	0.001795
Q2_4Don’t Know	-0.24374	0.067389	-3.61699	0.000319
Q1_6Not so concerned	0.219936	0.100647	2.185216	0.029198
Q1_6Somewhat concerned	0.229641	0.098041	2.342284	0.019441
Q1_6Very concerned	0.256783	0.10166	2.525884	0.011757
age30-44	0.053904	0.046058	1.170361	0.242247
age45-59	-0.01097	0.047436	-0.23131	0.817143
age60+	-0.07978	0.0499	-1.59886	0.110295
Q23_9Not so often	-0.01872	0.04452	-0.42048	0.674262

Q23_9Somewhat often	-0.01147	0.048787	-0.23504	0.814248
Q23_9Very often	0.220804	0.081643	2.704519	0.007004
Q1_13Not so concerned	-0.07041	0.070506	-0.99866	0.318297
Q1_13Somewhat concerned	-0.17781	0.068857	-2.58233	0.010012
Q1_13Very concerned	-0.09397	0.070032	-1.34181	0.180085
Q8Underground drainage system (such as pipelines and deep ditches)	-0.02931	0.040646	-0.72119	0.471031
Q8Ponds and catch basins	0.091517	0.080108	1.142423	0.253662
Q8No specific type of drainage system	-0.10225	0.07767	-1.31645	0.188448
Q8Don’t know	-0.05666	0.043782	-1.29406	0.196066
Q1_9Not so concerned	-0.06641	0.091529	-0.72555	0.468355
Q1_9Somewhat concerned	-0.02927	0.089068	-0.32857	0.742579
Q1_9Very concerned	-0.06359	0.091395	-0.69573	0.486827

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.130867	0.254489	4.44368	1.31E-05
Q19avg	0.465133	0.053614	8.675651	4.70E-16
PPPSupportUse	0.183046	0.057465	3.185362	0.001624
Q23_10Not so often	0.005615	0.090179	0.06226	0.950404
Q23_10Somewhat often	-0.1216	0.105992	-1.14728	0.252327
Q23_10Very often	-0.11016	0.274351	-0.40154	0.688357
Q23_9Not so often	0.000524	0.097096	0.0054	0.995695
Q23_9Somewhat often	0.024443	0.107881	0.226574	0.820934
Q23_9Very often	0.233469	0.264182	0.88374	0.377659
educationHS	0.247413	0.147239	1.680346	0.0941
educationSome College	0.113108	0.152112	0.743582	0.457806
educationCollege Grad	-0.02404	0.145799	-0.16491	0.869145

Random Forest for TX PPPSupportUse

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.901774	0.167708	11.33982	1.62E-27
PPPSupportUse	0.166978	0.026531	6.293657	5.42E-10

Q19avg	0.21598	0.030587	7.061073	3.93E-12
Q14No	-0.22527	0.041123	-5.47798	5.97E-08
Q20avg	0.151446	0.03196	4.738669	2.60E-06
Q23_2Not so often	0.00685	0.042718	0.160345	0.872655
Q23_2Somewhat often	-0.01759	0.051331	-0.34266	0.731952
Q23_2Very often	0.048503	0.081225	0.597147	0.550599
Q2_4False	-0.18863	0.060185	-3.13411	0.001795
Q2_4Don’t Know	-0.24374	0.067389	-3.61699	0.000319
Q1_6Not so concerned	0.219936	0.100647	2.185216	0.029198
Q1_6Somewhat concerned	0.229641	0.098041	2.342284	0.019441
Q1_6Very concerned	0.256783	0.10166	2.525884	0.011757
age30-44	0.053904	0.046058	1.170361	0.242247
age45-59	-0.01097	0.047436	-0.23131	0.817143
age60+	-0.07978	0.0499	-1.59886	0.110295
Q23_9Not so often	-0.01872	0.04452	-0.42048	0.674262
Q23_9Somewhat often	-0.01147	0.048787	-0.23504	0.814248
Q23_9Very often	0.220804	0.081643	2.704519	0.007004
Q1_13Not so concerned	-0.07041	0.070506	-0.99866	0.318297

Q1_13Somewhat concerned	-0.17781	0.068857	-2.58233	0.010012
Q1_13Very concerned	-0.09397	0.070032	-1.34181	0.180085
Q8Underground drainage system (such as pipelines and deep ditches)	-0.02931	0.040646	-0.72119	0.471031
Q8Ponds and catch basins	0.091517	0.080108	1.142423	0.253662
Q8No specific type of drainage system	-0.10225	0.07767	-1.31645	0.188448
Q8Don’t know	-0.05666	0.043782	-1.29406	0.196066
Q1_9Not so concerned	-0.06641	0.091529	-0.72555	0.468355
Q1_9Somewhat concerned	-0.02927	0.089068	-0.32857	0.742579
Q1_9Very concerned	-0.06359	0.091395	-0.69573	0.486827

Random Forest for HC PPPSupportUse

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	2.740493	0.37419	7.3238	3.64E-12
PPPSupport	0.339855	0.088667	3.832954	0.000162
Q19avg	0.100005	0.08388	1.192237	0.234346
Q20avg	0.007719	0.096371	0.080101	0.936224
PPP_Policy	-0.26347	0.072058	-3.65643	0.000314

Q18Private sector only	-0.00219	0.167584	-0.01307	0.989585
Q18Partnership between government and the private sector	0.259557	0.109154	2.377897	0.018196
age30-44	-0.48889	0.11039	-4.42875	1.44E-05
age45-59	-0.47239	0.111573	-4.2339	3.27E-05
age60+	-0.35042	0.118611	-2.95435	0.003445
Q5avg	0.126881	0.070113	1.809665	0.071599

Random forest for Texas PPP_Policy

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.719378	0.218217	7.879221	1.21E-14
Q16_4Not so important	-0.11175	0.224549	-0.49768	0.618859
Q16_4Somewhat important	-0.23548	0.217062	-1.08486	0.278344
Q16_4Very important	-0.08124	0.215483	-0.37703	0.706266
Q16_2Not so important	0.480954	0.294671	1.632174	0.103078
Q16_2Somewhat important	0.678419	0.286545	2.367585	0.018167
Q16_2Very important	0.956953	0.286848	3.336105	0.000893

Q1_11Not so concerned	0.144106	0.118711	1.213925	0.225173
Q1_11Somewhat concerned	0.129045	0.123349	1.046183	0.295826
Q1_11Very concerned	0.408482	0.13333	3.063681	0.002268
Q23_1Not so often	-0.14549	0.048119	-3.02353	0.002587
Q23_1Somewhat often	0.028383	0.050636	0.560536	0.575288
Q23_1Very often	0.079263	0.095579	0.829298	0.40721
Q16_3Not so important	0.121798	0.264052	0.461266	0.644747
Q16_3Somewhat important	0.146295	0.253405	0.577316	0.563906
Q16_3Very important	0.201625	0.252586	0.798242	0.424992
Q1_5Not so concerned	-0.01224	0.132881	-0.09214	0.926611
Q1_5Somewhat concerned	-0.0025	0.135986	-0.01836	0.985356
Q1_5Very concerned	0.063445	0.145277	0.436717	0.662447
PPPSupport	0.270823	0.041856	6.470326	1.80E-10
Q1_10Not so concerned	0.070027	0.125085	0.559841	0.575761
Q1_10Somewhat concerned	0.139449	0.125668	1.109661	0.267514
Q1_10Very concerned	0.172262	0.13172	1.307792	0.19136
PPPSupportUse	0.028313	0.031841	0.889205	0.374189
QPID100Democrat	0.002915	0.054258	0.053717	0.957176

QPID100Independent	-0.01105	0.049953	-0.22128	0.824934
QPID100Something else	-0.27561	0.075179	-3.66609	0.000264
Q5avg	0.027109	0.03569	0.75957	0.447759

Random Forest for Harris County PPP_Policy

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.82198	0.338587	2.42768	0.015935
Q16_2Not so important	3.058667	0.74108	4.127311	5.07E-05
Q16_2Somewhat important	3.265524	0.769697	4.24261	3.16E-05
Q16_2Very important	3.578088	0.767864	4.659796	5.26E-06
Q16_4Not so important	0.487041	0.452079	1.077336	0.282416
Q16_4Somewhat important	0.583479	0.44492	1.311424	0.190973
Q16_4Very important	0.644708	0.44667	1.443367	0.150226
Q23_1Not so often	0.033879	0.071515	0.473734	0.636122
Q23_1Somewhat often	0.275602	0.074724	3.68829	0.00028

Q23_1Very often	0.476136	0.125037	3.807955	0.000178
Q16_3Not so important	-0.82302	0.493713	-1.667	0.096824
Q16_3Somewhat important	-1.09894	0.498143	-2.20607	0.028331
Q16_3Very important	-0.82128	0.500055	-1.64237	0.101829
Q2_3False	-0.21926	0.089192	-2.45828	0.014671
Q2_3Don’t Know	-0.20793	0.066564	-3.12384	0.002006
PPPSupport	0.179813	0.064723	2.77817	0.005901
PPPSupportUse	0.07582	0.047599	1.592898	0.112505
Q5avg	-0.06507	0.053185	-1.22355	0.222328
Q4avg	-0.17973	0.062972	-2.85411	0.004694

Analyze tables and discuss key variables

Comparison of Variable Selection

Below in the following table the average absolute residuals of the testing data are compared.

	Random Forest	Lasso	XGBoost
PPPSupportTX	0.306		
PPPSupportHC	0.415		

PPPSupportUseTX	0.401		
PPPSupportUseHC	0.528		
PPP_PolicyTX	0.425		
PPP_PolicyHC	0.48		

Below in the following table the adjusted R-square or pseudo-R-square is displayed.

	Random Forest	Lasso	XGBoost
PPPSupportTX	0.321		
PPPSupportHC	0.341		
PPPSupportUseTX	0.241		
PPPSupportUseHC	0.235		
PPP_PolicyTX	0.4		
PPP_PolicyHC	0.632		

Discussion

Conclusion and talk about policy implications

References

Breiman L (2001). "Random Forests". Machine Learning. 45 (1): 5–32. doi:10.1023/A:1010933404324

Genuer, R., Poggi, J. M., & Tuleau-Malot, C. (2010). Variable selection using random forests. *Pattern recognition letters*, *31*(14), 2225-2236.

Tibshirani, R. (1996). Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society: Series B (Methodological)*, *58*(1), 267-288.

Appendix Survey Variables

Name	Label
StartDate	Start Date
EndDate	End Date
Duration__in_seconds_	Duration (in seconds)
RecordedDate	Recorded Date
ResponseId	Response ID
S1	Are you a resident of Texas? [Field-RI_DD]
S2	Do you currently reside in Harris County? [Field-RI_DD]
S3	What is your zip code? [Field-RI_NO]
Q1_1	How concerned are you about the following public issues facing Texas today? - Economic growth
Q1_2	How concerned are you about the following public issues facing Texas today? - Income inequality
Q1_3	How concerned are you about the following public issues facing Texas today? - Government spending
Q1_4	How concerned are you about the following public issues facing Texas today? - Immigration
Q1_5	How concerned are you about the following public issues facing Texas today? - Pollution
Q1_6	How concerned are you about the following public issues facing Texas today? - Energy supply
Q1_7	How concerned are you about the following public issues facing Texas today? - Health care
Q1_8	How concerned are you about the following public issues facing Texas today? - Climate change
Q1_9	How concerned are you about the following public issues facing Texas today? - National security
Q1_10	How concerned are you about the following public issues facing Texas today? - Local infrastructure
Q1_11	How concerned are you about the following public issues facing Texas today? - The environment
Q1_12	How concerned are you about the following public issues facing Texas today? - Domestic terrorism

Q1_13	How concerned are you about the following public issues facing Texas today? - Pandemics
Q2_1	Are the following statements true or false? You may view the correct responses after you complete survey. - Bridge and road construction decisions are made primarily by private entities.
Q2_2	Are the following statements true or false? You may view the correct responses after you complete survey. - Flooding never happens outside of traditional flood plain areas.
Q2_3	Are the following statements true or false? You may view the correct responses after you complete survey. - Transportation infrastructure is important to the working of electrical power supply.
Q2_4	Are the following statements true or false? You may view the correct responses after you complete survey. - People who live in wealthier communities are more likely to lose access to everyday services during flooding.
Q2_5	Are the following statements true or false? You may view the correct responses after you complete survey. - The development of transportation systems may increase the risks of flooding.
Q2_6	Are the following statements true or false? You may view the correct responses after you complete survey. - Natural disasters are not the primary cause of damages to roads and bridges.
Q4_1	How reliable are the following types of infrastructure in your community? - Electrical power
Q4_2	How reliable are the following types of infrastructure in your community? - Natural gas
Q4_3	How reliable are the following types of infrastructure in your community? - Transportation
Q4_4	How reliable are the following types of infrastructure in your community? - Flood control
Q4_5	How reliable are the following types of infrastructure in your community? - Emergency response services
Q4_6	How reliable are the following types of infrastructure in your community? - Internet service
Q4_7	How reliable are the following types of infrastructure in your community? - Phone service
Q4_8	How reliable are the following types of infrastructure in your community? - Drinking water
Q4_9	How reliable are the following types of infrastructure in your community? - Wastewater management
Q5_1	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - Heavy rain
Q5_2	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - High winds
Q5_3	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - Snow

Q5_4	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - Extreme temperatures
Q5_5	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - Poor design
Q5_6	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - Inadequate maintenance
Q5_7	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - Insufficient capacity
Q5_8	How much of a problem do you think the following potential causes of infrastructure disruptions are in your community? - Old age
Q6_1	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Flooding
Q6_2	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Release of untreated sewage
Q6_3	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Damage to property
Q6_4	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Difficulty evacuating
Q6_5	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Difficulty getting to work
Q6_6	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Delays in emergency response
Q6_7	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Difficulty getting to a grocery store
Q6_8	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Difficulty getting to a pharmacy
Q6_9	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Difficulty getting to a gas station
Q6_10	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Difficulty getting to health care facilities
Q6_11	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Difficulty getting to social service facilities

Q6_12	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Loss of electrical power
Q6_13	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Loss of natural gas
Q6_14	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Loss of running water
Q6_15	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Loss of phone service
Q6_16	In a storm related emergency, how likely do you think it is that each of the following will happen in your community? - Loss of internet
Q8	To the best of your knowledge, what is the main type of storm water drainage system in your community? [Field-RI_DD]
Q9	Over the past five (5) years, have you experienced any flooding in your area? [Field-RI_DD]
Q10_1	During any of these floods, did you lose access to any of the following facilities or services that you used prior to the flood? - Grocery store[Field-snsrel_a]
Q10_2	During any of these floods, did you lose access to any of the following facilities or services that you used prior to the flood? - Pharmacy[Field-snsrel_b]
Q10_3	During any of these floods, did you lose access to any of the following facilities or services that you used prior to the flood? - Gas station[Field-snsrel_c]
Q10_4	During any of these floods, did you lose access to any of the following facilities or services that you used prior to the flood? - Healthcare facility[Field-snsrel_d]
Q10_5	During any of these floods, did you lose access to any of the following facilities or services that you used prior to the flood? - Social services[Field-snsrel_e]
Q10_6	During any of these floods, did you lose access to any of the following facilities or services that you used prior to the flood? - Place of work[Field-snsrel_f]
Q10_7	During any of these floods, did you lose access to any of the following facilities or services that you used prior to the flood? - School[Field-snsrel_g]
Q11_1_1_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 1 - Grocery store[Field-snsrel_a] - Minutes
Q11_2_1_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 1 - Pharmacy[Field-snsrel_b] - Minutes

Q11_3_1_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 1 - Gas station[Field-snsrel_c] - Minutes
Q11_4_1_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 1 - Healthcare facility[Field-snsrel_d] - Minutes
Q11_1_2_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 2 - Grocery store[Field-snsrel_a] Alternative facility not available
Q11_2_2_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 2 - Pharmacy[Field-snsrel_b] Alternative facility not available
Q11_3_2_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 2 - Gas station[Field-snsrel_c] Alternative facility not available
Q11_4_2_1	If available, about how many minutes did you need to travel one-way in order to get to an alterna... - Click to write Scale Point 2 - Healthcare facility[Field-snsrel_d] Alternative facility not available
Q12	Suppose there is an online public forum where local government officials are trying to gather people's opinions about a new [Field-Q3_13] in your community. Would you be willing to spend some time at this online forum to provide your opinions? [Field-RI_F40
Q12a	How much time would you be willing to spend there to provide your opinions? [Field-RI_DD]
Q14	Have you heard the term Public Private Partnership used to describe a public works effort in your community? Public Private Partnerships are cooperative arrangements between public organizations and businesses or nonprofits to complete a project or providF40.2IME20
Q15_1	How much would you oppose or support the following types of Public Private Partnerships for the construction of some infrastructure project in your community? - A government agency builds something and then sells it to a private operator.
Q15_2	How much would you oppose or support the following types of Public Private Partnerships for the construction of some infrastructure project in your community? - A private contractor builds something and then sells it to the government.
Q15_3	How much would you oppose or support the following types of Public Private Partnerships for the construction of some infrastructure project in your community? - Government and a private contractor work together to fund, build, and operate an infrastructureF40.2IME2
Q15_4	How much would you oppose or support the following types of Public Private Partnerships for the construction of some infrastructure project in your community? - Government and a nonprofit work together to fund, build, and operate an infrastructure element.

Q16_1	When deciding whether you support forming a Public Private Partnership to address a community infrastructure project, how important is it that the Partnership offer the following? - A less expensive option
Q16_2	When deciding whether you support forming a Public Private Partnership to address a community infrastructure project, how important is it that the Partnership offer the following? - A higher quality product
Q16_3	When deciding whether you support forming a Public Private Partnership to address a community infrastructure project, how important is it that the Partnership offer the following? - More public participation in the decision process
Q16_4	When deciding whether you support forming a Public Private Partnership to address a community infrastructure project, how important is it that the Partnership offer the following? - Greater opportunities for local economic development
Q17_1	To what extent do you disagree or agree with the following statements about Public Private Partnerships? - The use of Public Private Partnerships can benefit my community.
Q17_2	To what extent do you disagree or agree with the following statements about Public Private Partnerships? - Local officials in my community support the use of Public Private Partnerships.
Q17_3	To what extent do you disagree or agree with the following statements about Public Private Partnerships? - Private industries in my community support the use of Public Private Partnerships.
Q17_4	To what extent do you disagree or agree with the following statements about Public Private Partnerships? - The people in my community support the use of Public Private Partnerships.
Q18	For building infrastructure in your community, would you prefer? [Field-RI_DD]
Q19_1	How much do you distrust or trust the following types of organizations? - City government
Q19_2	How much do you distrust or trust the following types of organizations? - County government
Q19_3	How much do you distrust or trust the following types of organizations? - State government
Q19_4	How much do you distrust or trust the following types of organizations? - Federal government
Q19_5	How much do you distrust or trust the following types of organizations? - Private industry
Q19_6	How much do you distrust or trust the following types of organizations? - Nonprofit organizations
Q19_7	How much do you distrust or trust the following types of organizations? - Public Private Partnerships

Q20_1	How responsible should the following types of organizations be for making policies for your community infrastructure? - City government
Q20_2	How responsible should the following types of organizations be for making policies for your community infrastructure? - County government
Q20_3	How responsible should the following types of organizations be for making policies for your community infrastructure? - State government
Q20_4	How responsible should the following types of organizations be for making policies for your community infrastructure? - Federal government
Q20_5	How responsible should the following types of organizations be for making policies for your community infrastructure? - Private industry
Q20_6	How responsible should the following types of organizations be for making policies for your community infrastructure? - Nonprofit organizations
Q20_7	How responsible should the following types of organizations be for making policies for your community infrastructure? - Public Private Partnerships
Q21_1	How responsible should the following types of organizations be for spending money on your community infrastructure? - City government
Q21_2	How responsible should the following types of organizations be for spending money on your community infrastructure? - County government
Q21_3	How responsible should the following types of organizations be for spending money on your community infrastructure? - State government
Q21_4	How responsible should the following types of organizations be for spending money on your community infrastructure? - Federal government
Q21_5	How responsible should the following types of organizations be for spending money on your community infrastructure? - Private industry
Q21_6	How responsible should the following types of organizations be for spending money on your community infrastructure? - Nonprofit organizations
Q21_7	How responsible should the following types of organizations be for spending money on your community infrastructure? - Public Private Partnerships
Q22_1	How much do you oppose or support the following policies to improve your community infrastructure? - Limit development in areas where infrastructure failures are likely

Q22_2	How much do you oppose or support the following policies to improve your community infrastructure? - Provide financial incentives for people to relocate from vulnerable areas
Q22_3	How much do you oppose or support the following policies to improve your community infrastructure? - Strengthen infrastructure design standards
Q22_4	How much do you oppose or support the following policies to improve your community infrastructure? - Strengthen building design standards
Q22_5	How much do you oppose or support the following policies to improve your community infrastructure? - Conduct more frequent maintenance on infrastructure
Q22_6	How much do you oppose or support the following policies to improve your community infrastructure? - Conduct more frequent replacement of older infrastructure
Q22_7	How much do you oppose or support the following policies to improve your community infrastructure? - Build additional infrastructure to address vulnerabilities
Q22_8	How much do you oppose or support the following policies to improve your community infrastructure? - Address identified infrastructure vulnerabilities through coordinated planning
Q22_9	How much do you oppose or support the following policies to improve your community infrastructure? - Work to engage affected stakeholders and communities in infrastructure decisions
Q23_1	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Government officials
Q23_2	How often do you normally look for information about policy issues related to infrastructure from the following sources? - University researchers
Q23_3	How often do you normally look for information about policy issues related to infrastructure from the following sources? - News media
Q23_4	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Social media
Q23_5	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Business leaders
Q23_6	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Community meetings
Q23_7	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Leaders from my political party
Q23_8	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Family members

Q23_9	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Friends
Q23_10	How often do you normally look for information about policy issues related to infrastructure from the following sources? - Co-workers
IDEO	In general, do you think of yourself as... [Field-RI_DD]
QPID100	Generally speaking, do you think of yourself as... [Field-RI_DD]
QPID110	Would you call yourself a... [Field-RI_DD]
QPID120	Would you call yourself a... [Field-RI_DD]
QPID130	Do you think of yourself as closer to the... [Field-RI_DD]
intlen	Interview length
screenlen	Screener Length
xcrisp	(sample type) 1=Main Texas 2=Augment Harris county
field_start_date	field_start_date
DOV_zip	Combine profile zip (xzip) and those asked at S3
DOV_county	Combine profile fips (xfips) and those captured from the zipcode crosswalk
DOV_xtract	Combine profile (xtract) and those captured from the zipcode crosswalk
ppstaten_final	ppstaten_final
ppage	ppage
ppeducat	ppeducat
ppeduc5	ppeduc5
ppethm	ppethm
ppgender	ppgender
pphhsize	pphhsize
pphouse4	pphouse4
ppinc7	ppinc7
ppmarit5	ppmarit5
ppmsacat	ppmsacat
ppreg4	ppreg4
pprent	pprent
ppstaten	ppstaten
ppemploy	ppemploy
ppt18ov	ppt18ov
ppkid017	ppkid017
weight1_PID	total sample
weight2_PID	two areas separately

partyid7	Party ID