



City of Austin Public-Private Partnership

PUBLIC INFRASTRUCTURE NETWORK NODES



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The Impending Tsunami of physical infrastructure within cities

More antennas. A lot more antennas

5G is often described as revolutionary, but the installation of 5G infrastructure is needed before that revolution can become a reality.

So far, the battles for infrastructure have been contests between cities and the four major wireless companies. But, very soon, Intelligent Transportation System and Edge Compute vendors will be joining fray and the politics of access to city infrastructure.

The issue for cities is the increased number of antennas. Unlike existing networks, which use towers that can cover many square miles, 5G uses small-cell waves that don't travel as far and rely on line of sight between antennae and a phone or device. That **means lots and lots and lots of equipment** installed on utility poles throughout a city, or as the industry calls it: "network densification." Each set of boxes must be connected to underground fiber networks, and each needs a power supply, both of which are available on or near streetlights and telephone poles.

Aesthetics are at Risk

Management at Risk

Community at Risk



Public Infrastructure Network Node (PINN)

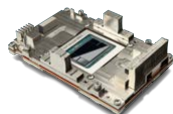
AIRE - RAAS CERTIFIED PLATFORM

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Unified City Infrastructure:

- Radio Access Networks (5G)
- Edge Computing
- Situational Awareness (Radar, cameras, sensors)
- Precision Navigation
- Intelligent Transportation Systems

Base



Edge AI



Hardened

Edge Supercomputing:

- Machine Learning
- Algorithm Processing
- RF Processing
- APNT Processing
- Sensor Fusion (Local Map)
- RALLI Processing



OpenNESS

OpenVINO

Mast

Trimble

Position



GNSS Antenna
UWB RTLS

PHILIPS

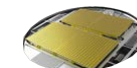
Light



LED Light

NUVOTRONICS

Backhaul



60 GHz/Sat

FORTEM

Awareness



Radar

kapsch



C-V2X/DSRC

MOBOTIX

Sensors



Camera

ERICSSON

Wireless



Environmental

NOKIA



5G NG
CBRS
5.9G

SAMSUNG



Public Infrastructure Network Node (PINN)

AIRE - RAAS CERTIFIED PLATFORM

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PINN

Modular Design Supporting:

- Radio Access Networks (WIFI, 4G, 5G, Backhaul)
- Edge Computing
- Situational Awareness (Radar, cameras, sensors)
- Precision Navigation
- Intelligent Transportation Systems
- Multiple Designs
- City Certified
- Fast Deployment

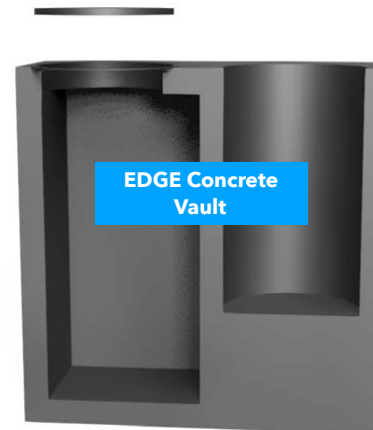
Modules

- Isolated Compartments
- Thermal Management
- Power Management
- Fiber Access
- Edge Compute
- Easy Upgrades



Vault

Vault Components



- Lithium Ion UPS



- Edge Computing Density



- Resilient Power Feeds
- Fiber Optic Interconnect
- Thermal Cooling

The **Tsunami** of Technology **Blight** Coming to Your **City**!

5G
Wireless

Intelligent
Transportation
Systems

Edge
Computing



Radios

Antennas

Compute

Transponders

Storage

Radars

Cameras

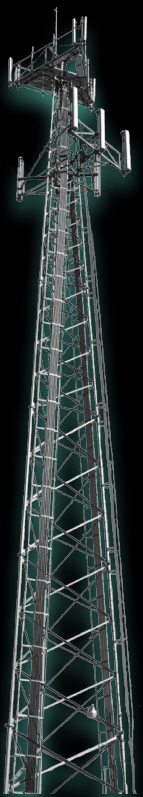
Sensors

Kiosks

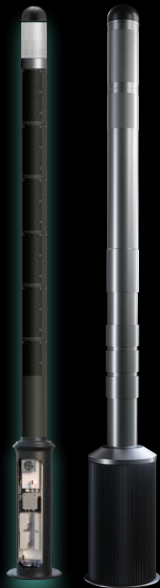
Lights

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Autonomous City Infrastructure



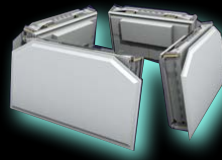
Cell Tower
Macro Edge
Data Centers



Nodes
Public Infrastructure
Network Nodes



5G NR
Resilient and Secure
Communication



Radar
Situational Awareness
Sensors



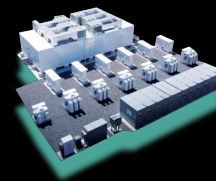
DGNSS
Precision Navigation and
Timing



Compute
Robust Computing at
the Edge



Micro DC
Micro and Nano Data
Centers at Edge



Microgrid
Resilient Power and
Security



ASOCC
Traffic Control Center for
Autonomous Systems

Proposal for the City of Austin - "P3 PINN Project"

Take Control of the Cities most valuable assets and Lead the Nation.

Cities are the future of our society and it will require city leadership to assure the successful integration of technology for the benefit of the community.

The city that leads this initiative will lead the nation. Autonomous Systems will never be deployed at scale until we can get edge compute and key technology at the edge. These become supercritical nano data centers, even more, critical than the computers that run our traffic lights and commercial aviation. The compute in these units would be extremely high-end since they will be performing the RF and sensor fusion processing at the pole itself. This eliminates the major cost of backhaul over fiber and societal issues like privacy and data sovereignty.

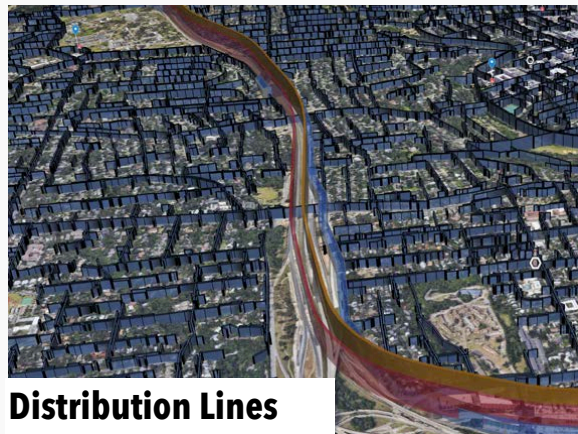
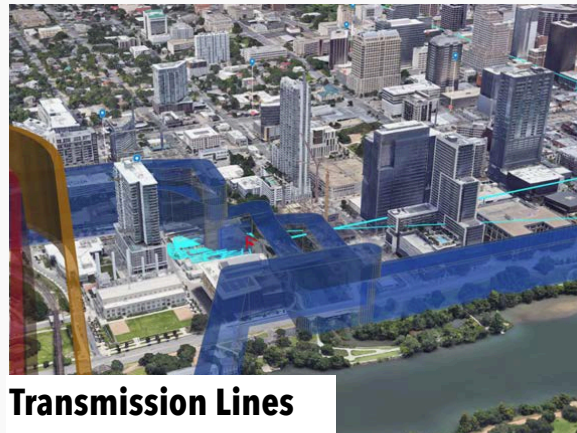
Our goal is for Austin to lead the nation on the creation of a new asset class, **Public Infrastructure Network Nodes** (PINN), which positions the city to control the rollout of 5G, autonomous and other smart city infrastructure. This can be accomplished by leveraging Industry Dollars, vs City Dollars.

The Autonomy Institute would like to work with the City of Austin and Austin Energy to:

- Establish a unified infrastructure deployment plan that will establish key standards. Most of this work is in the "TARA Small Cell Infrastructure Design"
- Determine complete list of locations that could be assigned into a Public-Private-Partnership.
- Declare Design Districts within the critical regions of the City aligned with the Autonomous Mobility Corridors.
- Support Industry coming in and providing the required investment for the PINN installation.

Strategic Value for the City of Austin and Austin Energy

Autonomous Systems Infrastructure requires physical easements and supporting service.



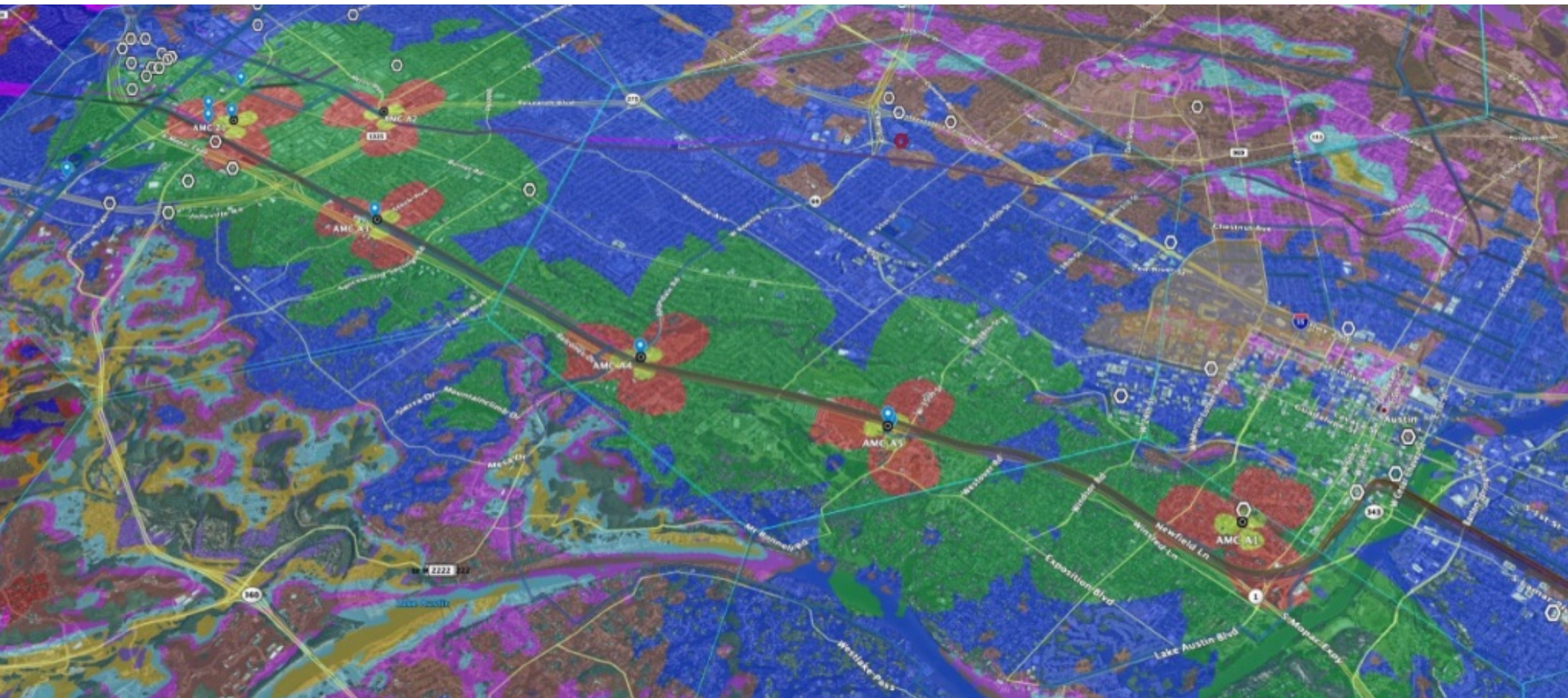
Identify List of PINN Locations to Support Community Services



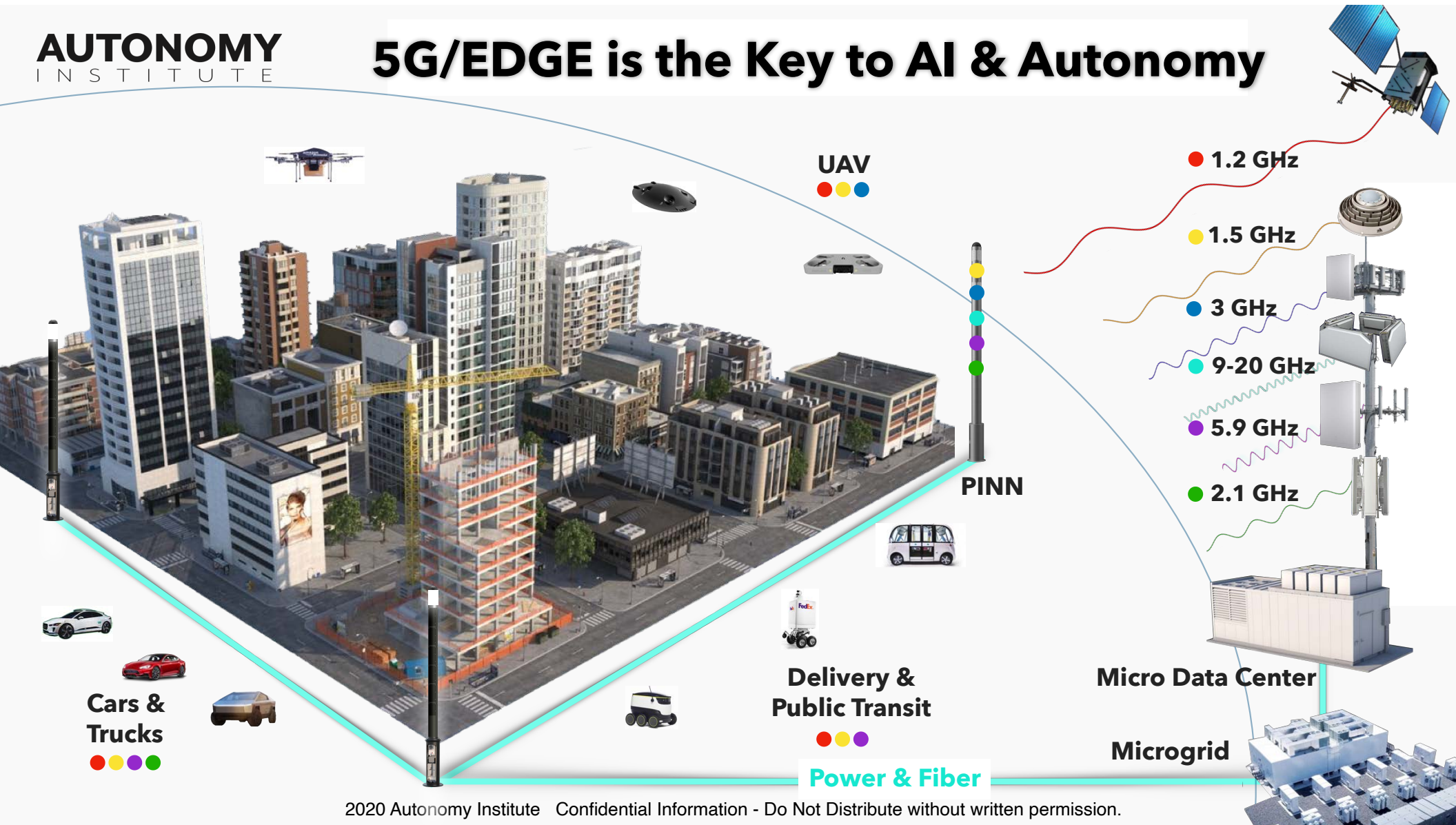
Identify List of PINN Locations to Support Community Services



Perform FCC Spectrum Analysis for Key Regions of the City



5G/EDGE is the Key to AI & Autonomy



Supported Autonomous Mobility Zone Use Cases



06 Drone Delivery Testing

Wing zipline UBER



01 Drone Inspection & Testing



01

05 Loop 1 Autonomous Vehicle Testing

WAYMO bestmile NAVYA EASY MILE

Shuttles



Cars



03 Ground Rover Delivery Deployment



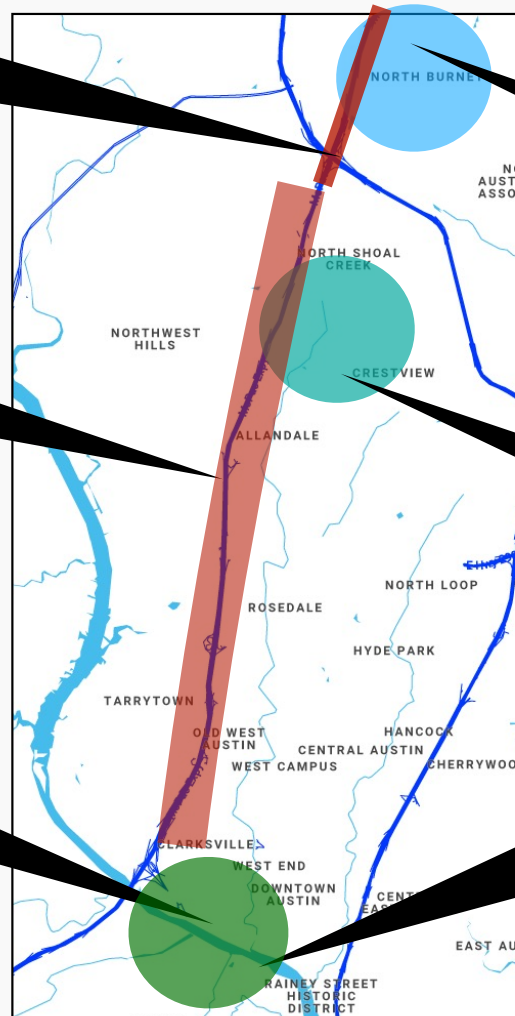
02 Public Safety Drone Deployment



04 Precision Weather and Navigation



04





Autonomous Infrastructure Lab

UT JJ Pickle Research Campus

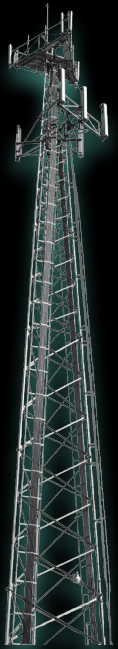
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Over 475 Acre Research Campus

Leading Departments:

- Center for Electromechanical
- Construction Industry Institute
- Center for Aerospace Research
- TACC (5th fastest supercomputer)

Industry Specific Testing:
Energy Grid
Petroleum Engineering
Solar Field
Railroad
Roadways



Cell Tower



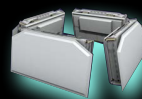
Nodes



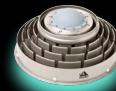
5G NR



Micro DC



Radar



DGNSS



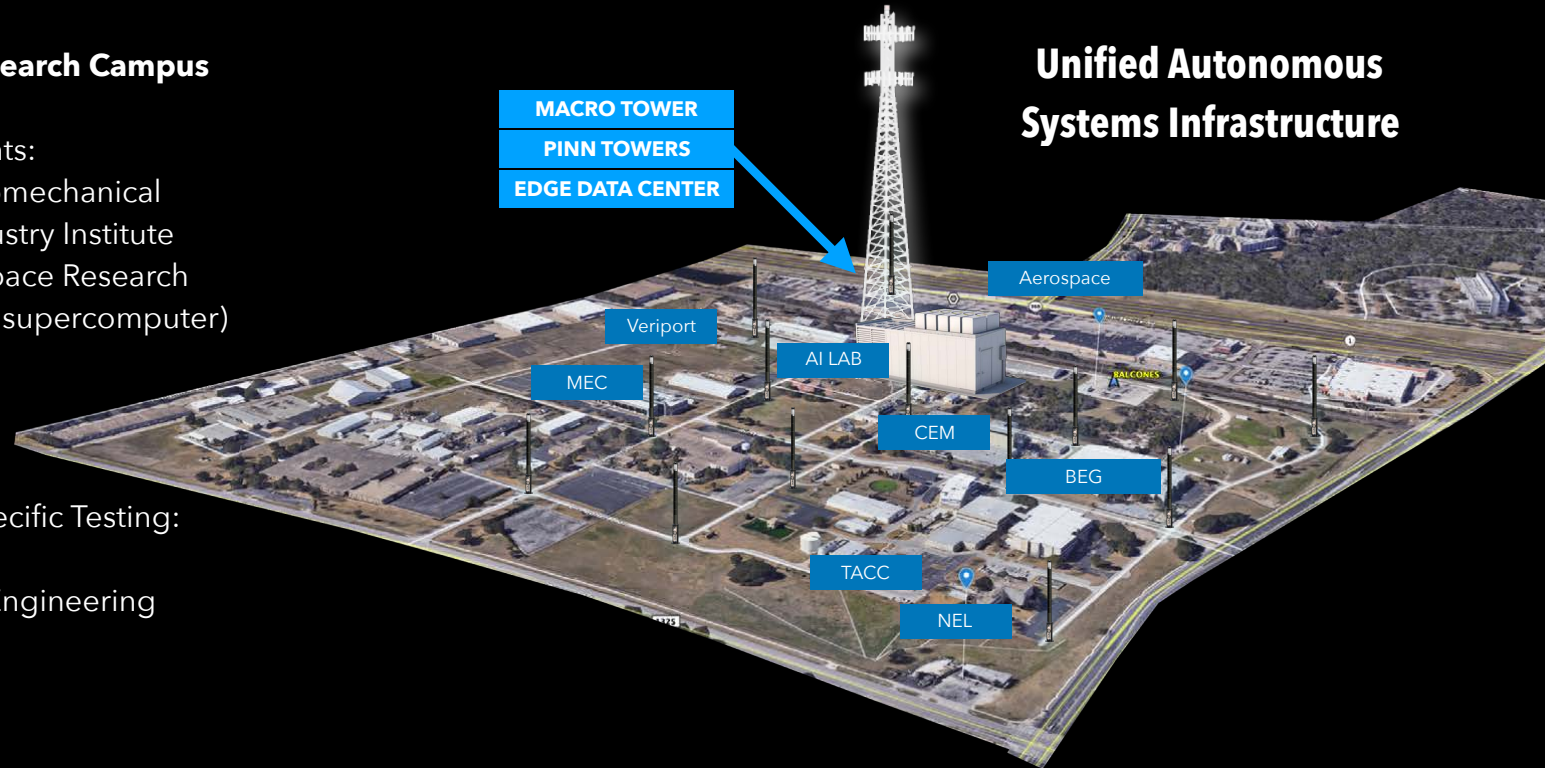
Compute



Microgrid



ASOCC

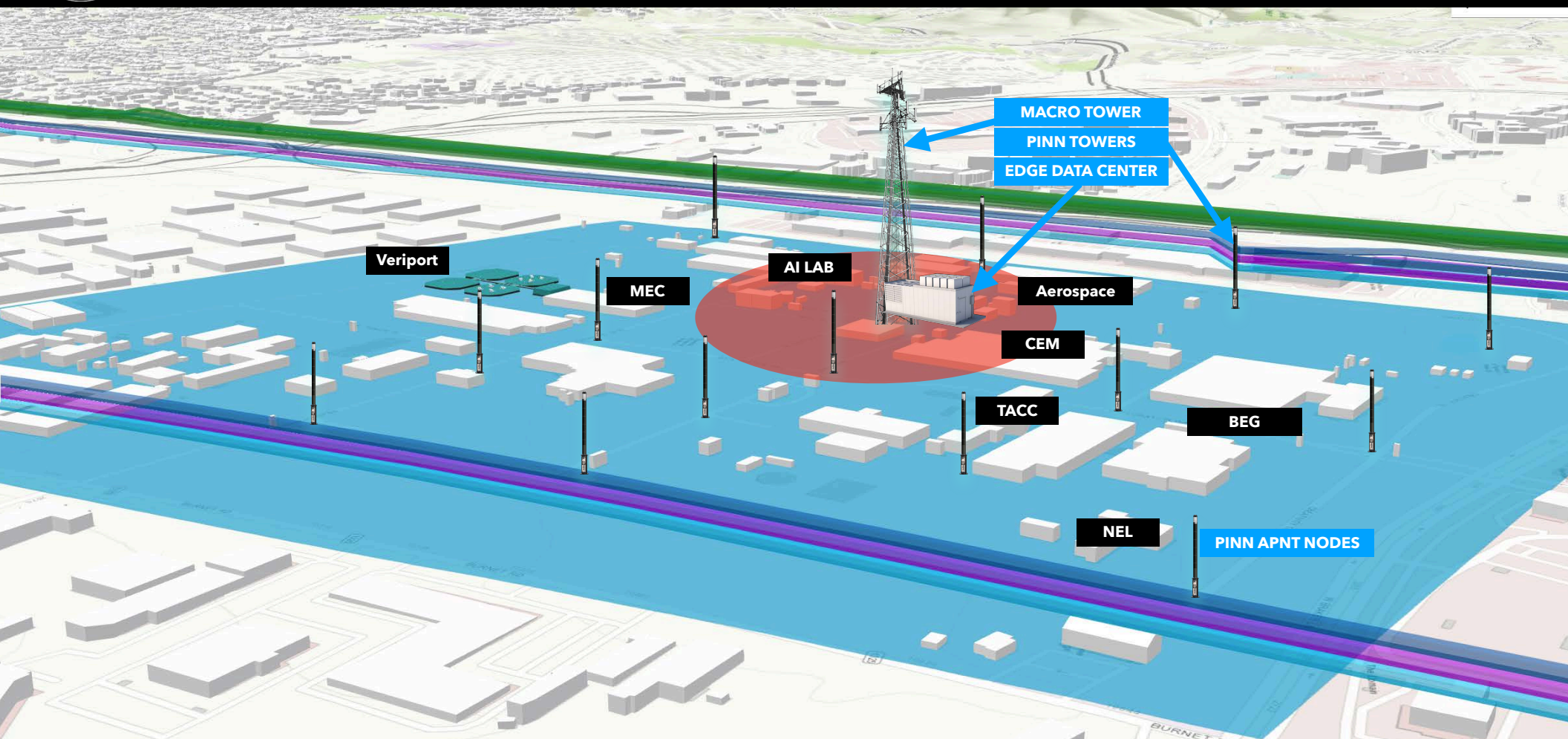


**Unified Autonomous
Systems Infrastructure**



PRC Autonomous Infrastructure Lab PINN and Tower Placement

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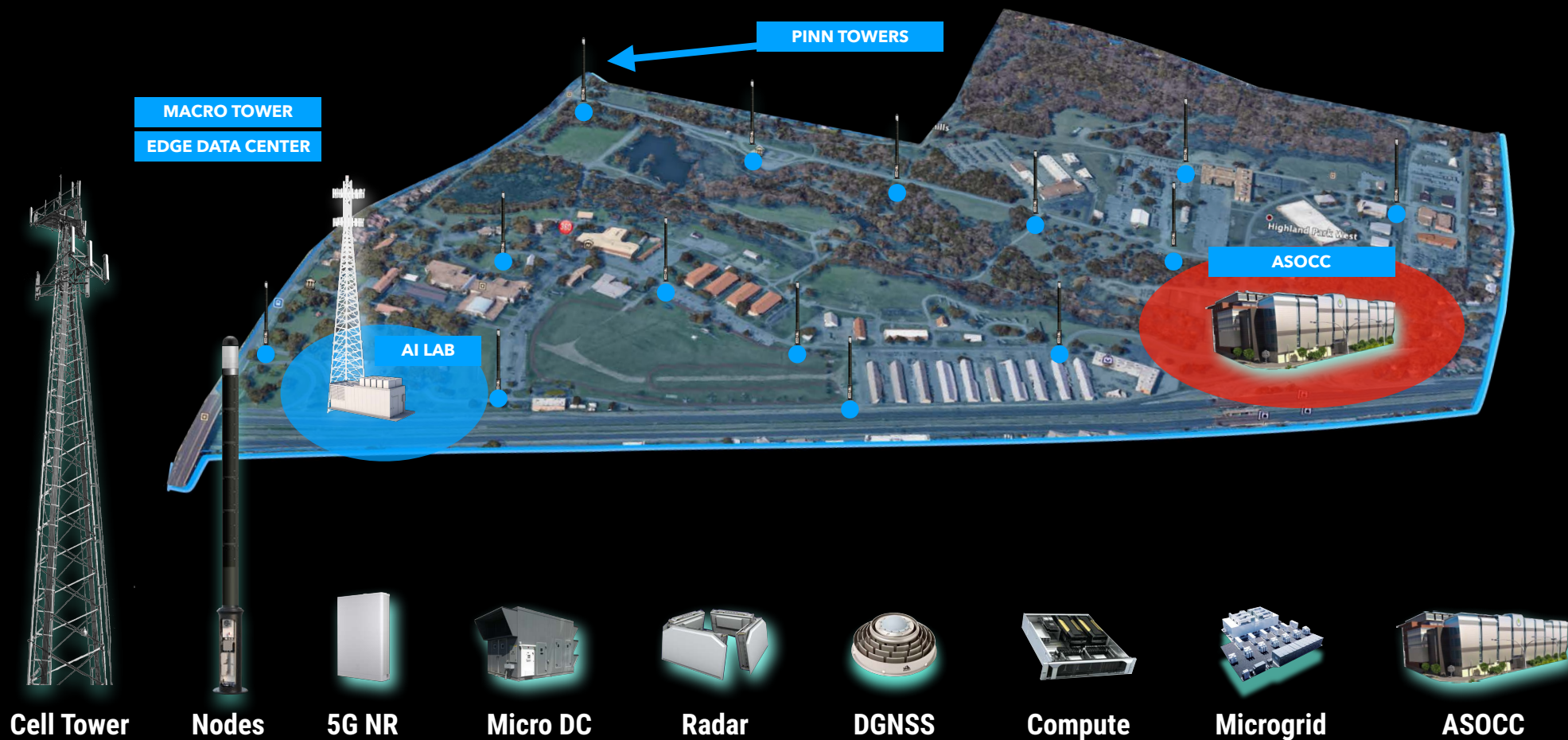




Autonomous Infrastructure Lab

Camp Mabry Campus

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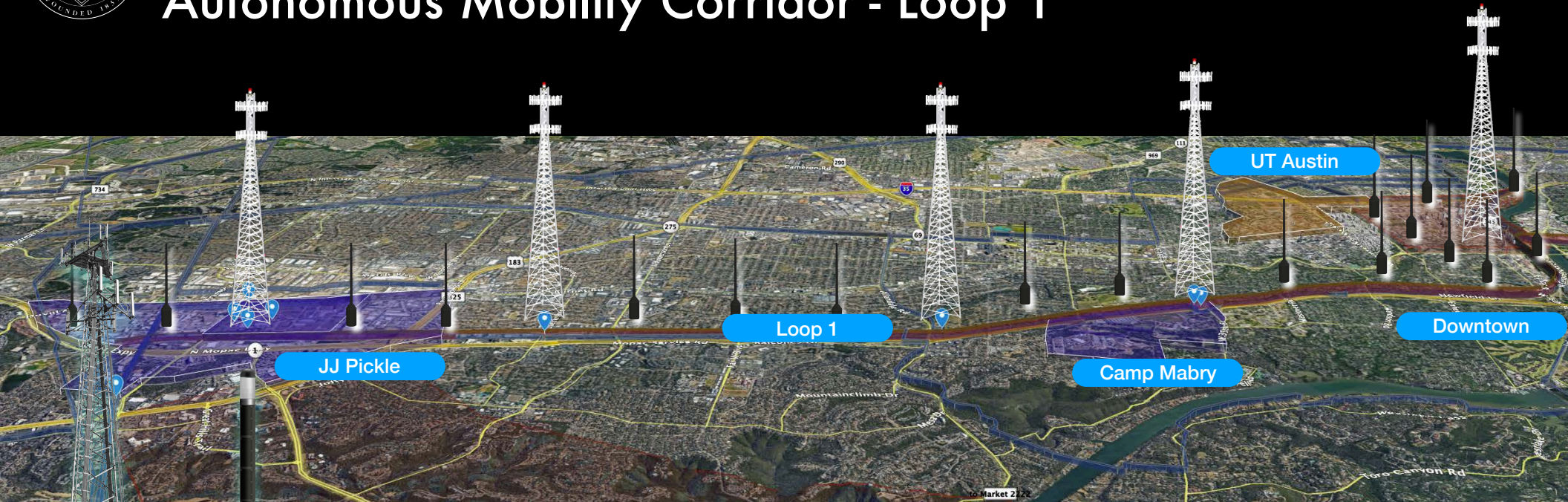




City of Austin Infrastructure

Autonomous Mobility Corridor - Loop 1

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Cell Tower

Nodes

5G NR

Micro DC

Radar

DGNSS

Compute

Microgrid

ASOCC



Mueller Development Catellus and Pecan Street

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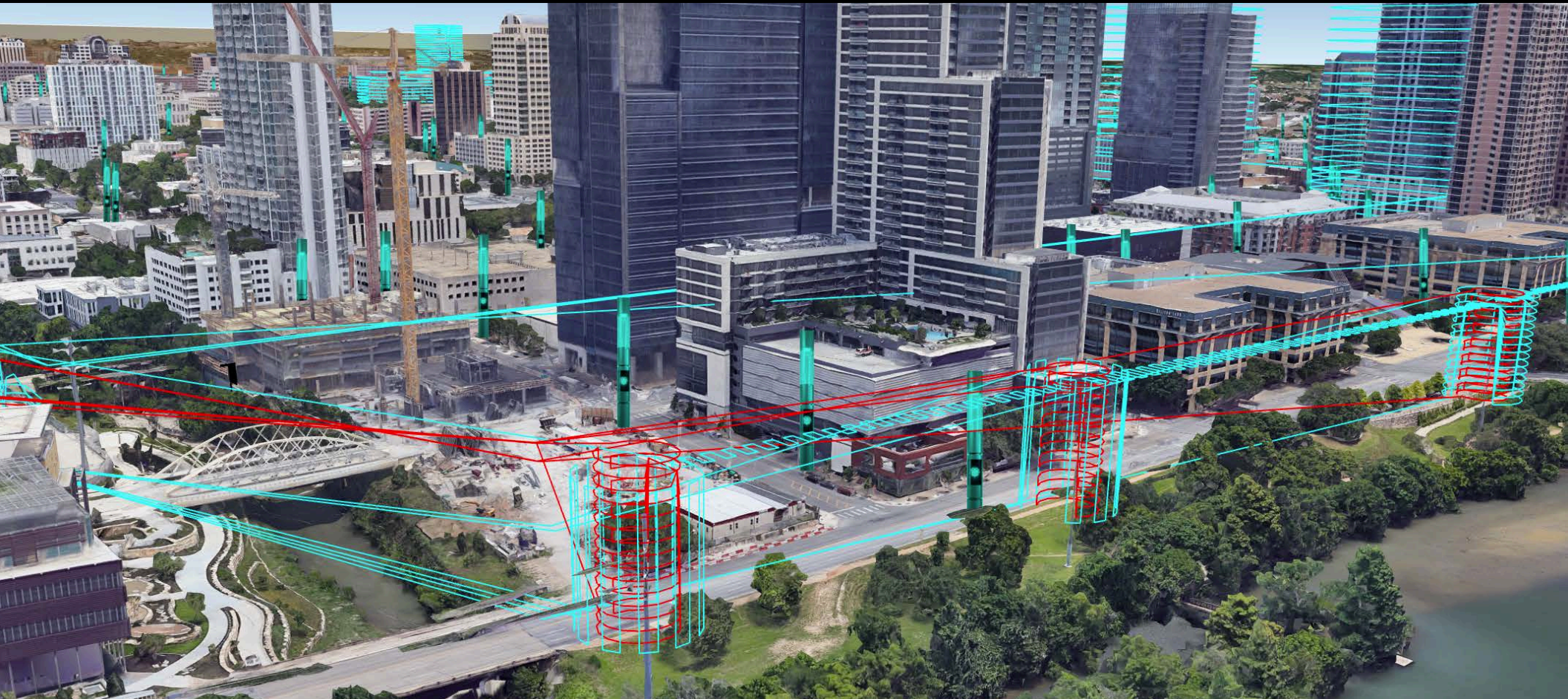




City of Austin Infrastructure

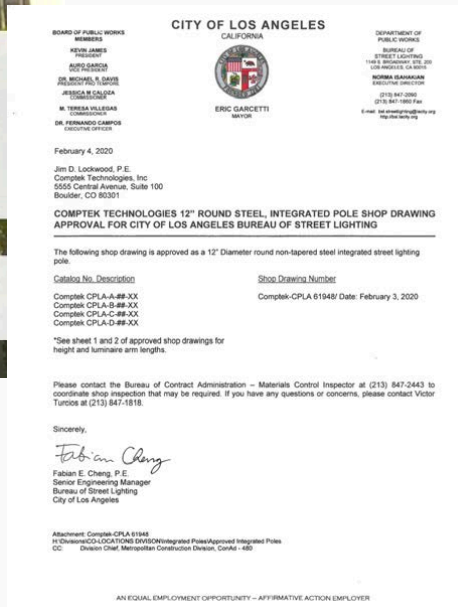
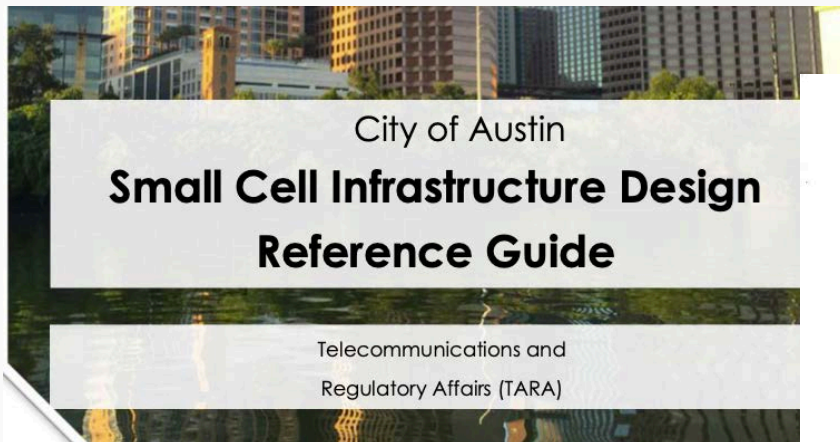
AUTONOMOUS MOBILITY CORRIDORS

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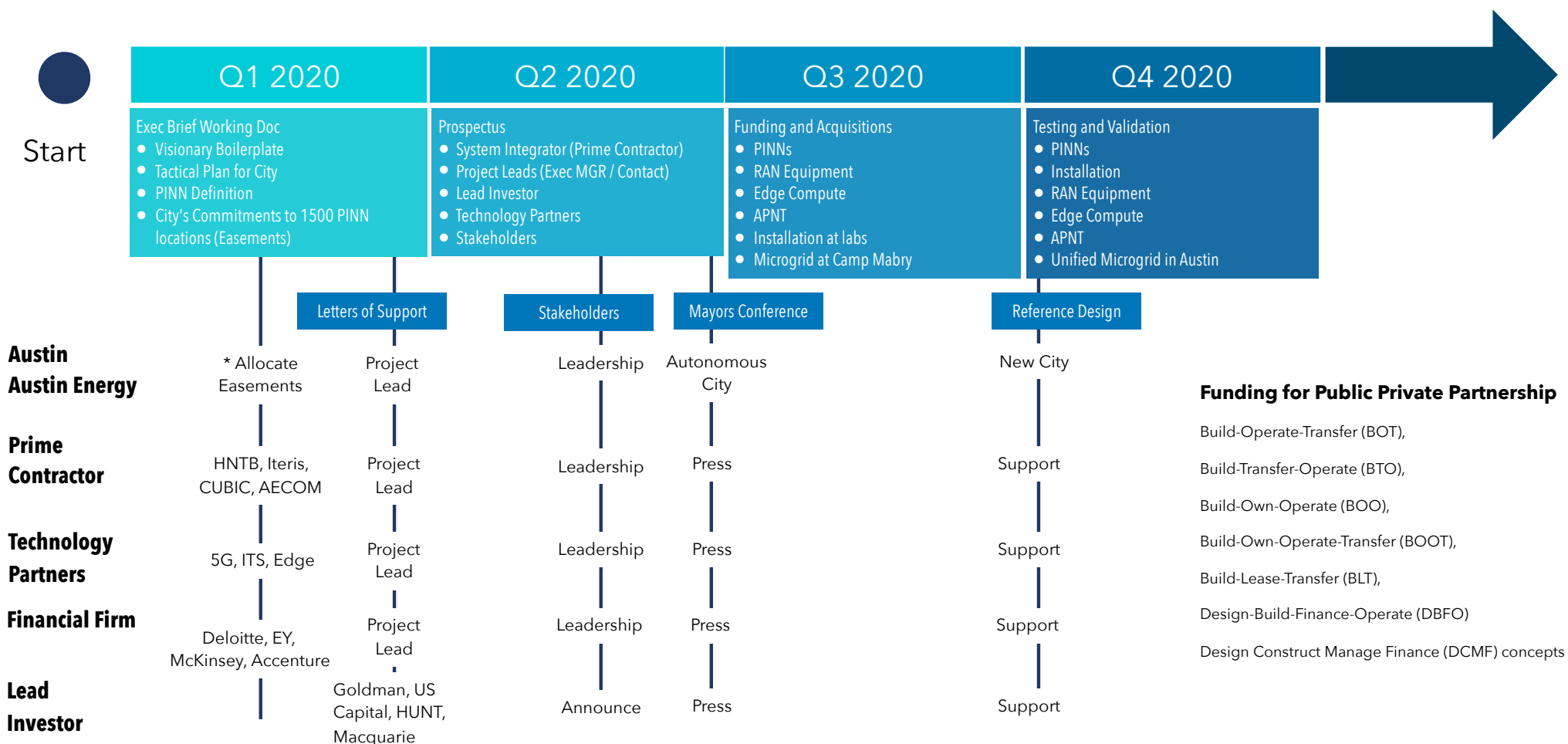
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Aero Wireless has lead the Standards efforts for many cities.



Citywide Infrastructure Deployment "Austin PINN P3"

Austin Public Infrastructure Network Node Installation



List of PINN Locations to Support Community Services



The City has already assigned physical address locations for PINN locations across the city.

**Unified Support for
Intelligent City and
Autonomous Systems
(5G, Edge, ITS)**

863035	10345TH	701ANDERSON	6907	510CESAR	816CONGRESS	308GRADY	2904LAKELINE	1068MEARNS	2018OLTORF
942635	60845TH	LN	BITTERROOT	CHAVEZ	301CONGRESS	708LAMAR	708LAMAR	9808ORIOLE	9808ORIOLE
480135	50146TH	700ANDERSON	313BLACKSON	401CESAR	1316	1717GRAND	9204LAMAR	1306MEARNS	1403PALO
52235	100546TH	LN	909BLACKSON	CHAVEZ	CONGRESS	AVENUE	9717LAMAR	MEADOW	DURO
681335	91246TH	307ANDERSON	1117BLANCO	517CESAR	8415	6916GRAND	620LAMAR	2906MEDICAL	1904PALO
1130035	20648TH	LN	6903BLESSING	CHAVEZ	CONGRESS	CANYON	300LAMAR	ARTIS	DURO
1021835	60049TH	504ANDERSON	6801BLUE	906CESAR	8515CONTOUR	9606GRAY	9005LAMAR	502MEDINA	8309PARK
641535	4024TH	LN	DAWN	CHAVEZ	704COOPER	3406GROOMS	9309LAMAR	6401MESA	1515PARKER
820535	1004TH	707ANDERSON	4705BLUE	709CESAR	406COOPER	6600GROVER	9416LAMAR	9106METRIC	2300PARKER
471935	2004TH	LN	MEADOW	CHAVEZ	600COPELAND	701	8632LAMAR	9102METRIC	1409PARKER
561235	1174TH	416ANDERSON	6608BLUFF	816CESAR	2005COVERED	GUADALUPE	4827LAMAR	10910METRIC	8501
21510TH	6174TH	LN	SPRINGS	CHAVEZ	WAGON	1500	7211LAMAR	7425	PARKFIELD
41310TH	94051ST	708ANDERSON	6404BLUFF	301CESAR	4905CREST	GUADALUPE	6618LAMAR	METROPOLIS	9714
60111TH	120151ST	LN	SPRINGS	CHAVEZ	OAK	7521	2301LAMAR	301MIDDLE	PARKFIELD
61311TH	111351ST	1108	308BOWIE	2704CESAR	213	GUADALUPE	4546LAMAR	6004MIDDLE	9448
51611TH	30351ST	ANDERSON LN	300BOWIE	CHAVEZ	CRESTLAND	1410	BLVD	FISKVILLE	PARKFIELD
21411TH	110051ST	2303ANKEN	307BOWIE	217CESAR	2236	GUADALUPE	4011LAMAR	4100	4100
10311TH	96053RD	205APPLEGATE	505BOWIE	CHAVEZ	CROMWELL	4301	BLVD	104MILTON	PARKSTONE
40512TH	20053RD	8316BOWLING	200BRAKER	223CESAR	LOMA	5300LARK	5300LARK	6600MIRA	HEIGHTS
221112TH	60053RD	504APPLEGATE	GREEN	CHAVEZ	CROMWELL	1600	CREEK	408MONROE	2100PAYNE
292113TH	80253RD HALF	1314ARCADIA	8600BOWLING	201CESAR	409CROSLIN	GUADALUPE	216LAVACA	2515	MONTOPOLIS
40413TH	20055TH	6100ARROYO	GREEN	CHAVEZ	1912CROSSING	4488	614LAVACA	702MORROW	836PAYTON
41013TH	90855TH HALF	SECO	10502BOYER	711CESAR	1706CROSSING	GUADALUPE	1617LAVACA	9701MOUNTAIN	GIN
31714TH	6175TH	6700ATHLETIC	812BRAKER	CHAVEZ	1521CROSSING	5114	817LAVACA	QUAIL	1349PAYTON
60114TH	1195TH	6411AUBURN	200BRAKER	118CESAR	204DEEN	GUADALUPE	1617LAVACA	1037PAYTON	GIN
71815TH	9025TH	4535AVENUE C	2324BRAKER	CHAVEZ	301DELMAR	1011	317LAVACA	7800MULLEN	GIN
60015TH	3005TH	4012AVENUE C	400BRAZOS	2505	104DENSON	GUADALUPE	1219LAVACA	5601NASSAU	1001PAYTON
30115TH	9185TH	4006AVENUE F	516BRAZOS	CHAPARRAL	4710DEPEW	612	1817LAVACA	517NAVASOTA	GIN
32015TH	5165TH	4603AVENUE G	417BRAZOS	5413	10112	GUADALUPE	1220LAVACA	800NECHES	GIN
12015TH	1035TH	1490DAVEY	917BRAZOS	DUNESTERFIELD	1511	GUADALUPE	717LAVACA	700NECHES	12203PAYTON
30016TH	22135TH	RANCH	802BRAZOS	1511	DIRECTORS	5301	112LAVACA	102NELLIE	GIN
11016TH	8055TH	8413BANGOR	115BRAZOS	CHOQUETTE	2207DOVE	GUADALUPE	LEATHERLEAF	409NIXON	1811PEARL
20717TH	9035TH	8429BANGOR	1025BARTON	3212CLAWSON	SPRINGS	6311HANEY	2302LEHIGH	416NORTH	2104PEARL
30417TH	8005TH	SPRINGS	700BRAZOS	1101CLAYTON	7828CLOCK	3503HARMON	2203LEONA	BLUFF	2213PEARL
50018TH	12006TH	4719BARTON	3424	1615	4702DUAL	6505LINDA	10418LITTLE	1312NORTH	11103PECAN
41218TH	6236TH	SPRINGS	BRECKENRIDGE	1615	4209DUAL	2100	LOOP	2404PENNY	PARK
38181ST	9046TH	611BARTON	E	CLOVERLEAF	4524DUAL	HARTFORD	PEBBLE	6510	2015PEOPLES
111224TH	5226TH	SPRINGS	1204	8806COLONIAL	4300DUAL	2501HATLEY	9001LITTLE	NORTHEAST	5600
61224TH	16016TH	1404BARTON	BROADMOOR	1213COLONIAL	4526DUAL	107HAZELTINE	WALNUT	2903	PEPPERTREE
102324TH	1006TH	SPRINGS	8501	PARK	3006DUAL	711	105LONGSPUR	NORTHEAST	5408
62424TH	8406TH	1226BARTON	BROOKFIELD	1508COLONY	47EAST	HENDERSON	6509LOYOLA	9103	PEPPERTREE
70224TH	9216TH	SPRINGS	5100BRUNING	CREEK	9802	6500HICKMAN	904LUTHER	NORTHGATE	3111PHEASANT
110224TH	3087TH	1627BARTON	2002BURBANK	1614COLONY	EASTWEND	300HICKOK	4410MAGIN	3345	16429PIENZA
51225TH	7057TH	SPRINGS	2314	CREEK	6612ELM	MEADOW	NORTHLAND	3001PIN OAK	3001PIN OAK
61125TH	7017TH	101BARTON	BURLESON	208COLORADO	CREEK	302HOME	6907MANOR	1500	5514PINE
40026TH	1187TH	SPRINGS	5818BURNET	200COLORADO	5817FENCINAL	906HOUSTON	7607MARBLE	NORTHBRIDGE	2316PLEASANT
90626TH	5007TH	1628BARTON	6311BURNET	900COLORADO	2408ENFIELD	1609HOUSTON	CREST	1402	VALLEY
4022ND	3107TH	SPRINGS	8408BURRELL	1410	EXPOSITION	9307HUNTERS	912MARTIN	NORTHBRIDGE	2702PLEASANT
4542ND	26177TH	1123BATTLE	1843BURTON	COLORADO	12612	LUTHER KING	LUTHER KING	1042	VALLEY
12132ND	4007TH	BEND	7519CAMERON	501COLORADO	2415	HYMEADOW	JR	NORWOOD	3100PLEASANT
2092ND	7167TH	9301BAVARIA	6300CAMERON	806COLORADO	14304	EXPOSITION	2111MARTIN	PARK	VALLEY
6012ND	4018TH	502BAYLOR	7210CAMERON	1712	IMMANUEL	1411FAIRFIELD	LUTHER KING	6006NOTRE	1210PLEASANT
4012ND	1008TH	108BEAVER	8106CAMERON	COLORADO	1001FAIRFIELD	COOK	DAWIE	4518NUCKOLS	VALLEY
91530TH	3018TH	9316BECKETT	5517CAMERON	100COLORADO	8440FALL	MEADOW	702MARTIN	8516	9708PLOVER
10830TH	7178TH	6108BELFAST	7401CAMERON	800COLORADO	800COLORADO	JAMESTOWN	LUTHER KING	CROSSING	2107POMPTON
10430TH	5108TH	2101BEN	1010CAMINO	400COLORADO	510COLORADO	8512	JR	600NUJECES	5316PONCIANA
20131ST	12039TH	WHITE	LA COSTA	600COLORADO	2008	2008	5009MASHIE	2500NUJECES	710POWELL
60731ST HALF	2444BEN	FERGUSON	836CAMINO LA	507FERGUSON	2009	JAMESTOWN	500	221NUJECES	801POWELL
20832ND	9189TH	WHITE	LA COSTA	MASTERTON	2009	10501JEAN	MASTERTON	1016NUJECES	PLANT
70332ND	6189TH	701BEN WHITE	1031CAMINO	CONESTOGA	205FERGUSON	1922JUSTIN	428	300NUJECES	309PRAIRIE
40434TH	4009TH	2305BENDING	LA COSTA	524CONGRESS	8009	1711KAREN	MATAMOROS	2801NUJECES	DELL
41535TH	8009TH	5404BENNETT	1309CAMINO	8728	FORBDALE	1204KOENIG	808MAUDE	516NUJECES	2313PRATHER
150938TH	7217BENNETT	4905AIRPORT	LA COSTA	CONGRESS	2113FORDHAM	722KOENIG	5113MAUFFRAIS	113NUJECES	405PRESSLER
11538TH	5502BENNETT	6415AIRPORT	1221CAMINO	98CONGRESS	1308MC KIE	903LA POSADA	1308MC KIE	417NUJECES	417NUJECES
100839TH	5766AIRPORT	7601BENNETT	LA COSTA	6209	PARK	931LA POSADA	1304MC KIE	5090DELL	PROVIDENCE
9163RD	5762AIRPORT	4312BENNETT	1118CAMINO	CONGRESS	5100	1012LA	4005MC	401OAK	7307
4013RD	4465AIRPORT	5020BERKMAN	LA COSTA	205CONGRESS	FRIEDRICH	POSADA	KINNEY FALLS	9913OAK	PROVIDENCE
1063RD	5555AIRPORT	6115BERKMAN	3307CAPITAL	709CONGRESS	9055	934LA POSADA	9617MC NEIL	HOLLOW	7303
5003RD	1992ALEGRIA	7041BERKMAN	OF TEXAS	1416	47LAKELAKE	813MC PHAUL	47LAKELAKE	47LAKELAKE	PROVIDENCE
6063RD	8040	1414	7003CARVER	CONGRESS	AUSTIN	7311MEADOW	7311MEADOW	1909OLTORF	8001PURNELL
1153RD	ANDERSON	BERKSHIRE	6905CARVER	102CONGRESS	QUAIL	2303LAKE	9219MEADOW	1941OLTORF	8606PUTNAM
90241ST	1300	7217BETHUNE	4708CASWELL	1612	2800	AUSTIN	VALE	2010OLTORF	9949QUAIL
20143RD	ANDERSON	1018BIRD	5020CESAR	CONGRESS	GONZALES	1715MEARNS	4548OLTORF	9571QUAIL	9971QUAIL
80144TH		CREEK	CHAVEZ	228CONGRESS	2809GOVALLE	CREEK	MEADOW	1809OLTORF	10409QUAIL



City of Austin Infrastructure

AUTONOMOUS MOBILITY CORRIDORS

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INSTITUTE

The First Autonomous Corridor with
integrated support for Autonomous Cars,
Shuttles, Trucks, Rovers, Drones and Urban Air

Unified Autonomous Infrastructure
Engineered City Corridors

Come Join the First Autonomous City.

5G and Edge Partners
Autonomous Infrastructure Partners
Drone Delivery Partners
Automotive Partners
Trucking Partners
Industrial Robotic Partners
Data Partners

