



FORT WORTH TO LAREDO

HIGH-SPEED TRANSPORTATION STUDY

ROUND 2: STAKEHOLDER MEETINGS – WACO MPO

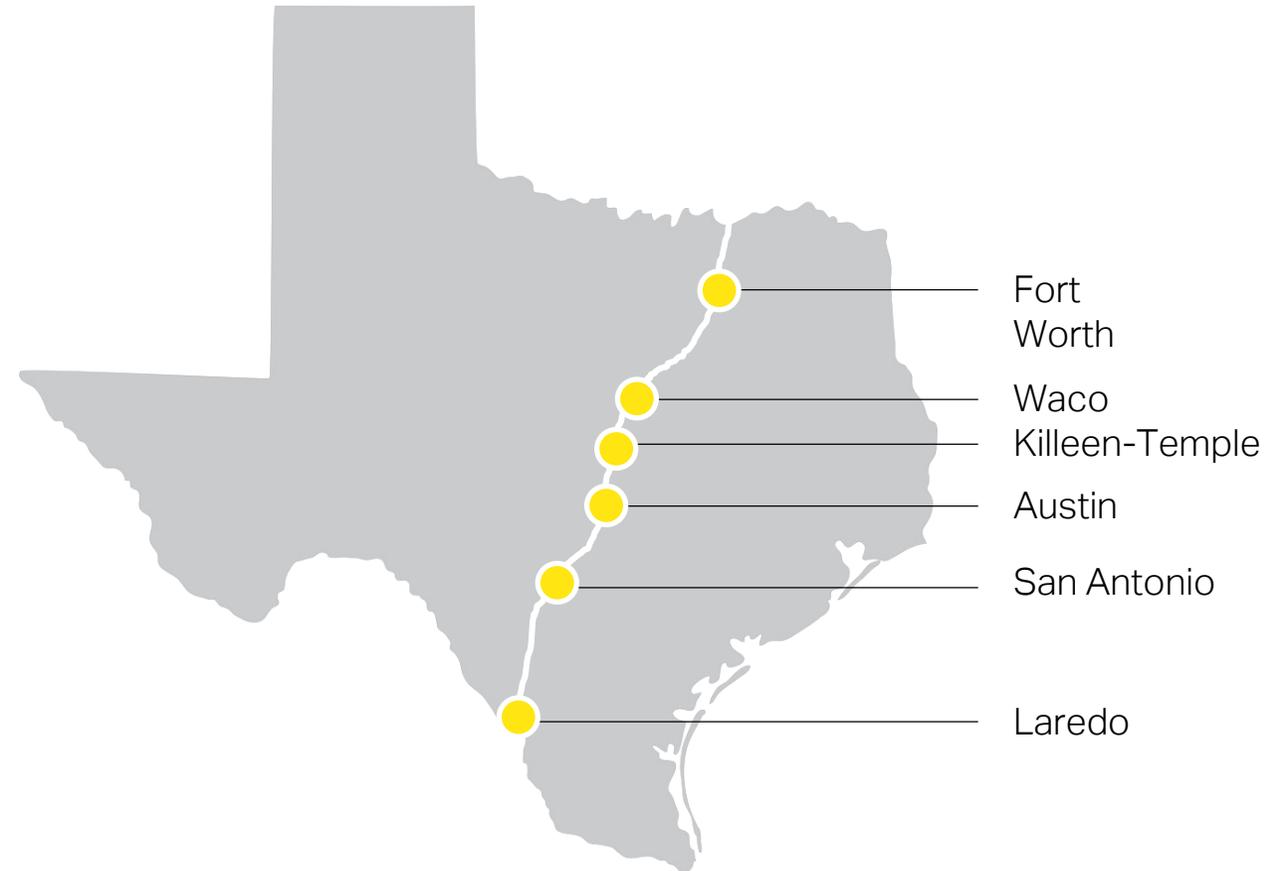
November 21, 2019

MEETING AGENDA

-  Welcome & Introductions
-  Project Background and Purpose
-  Corridor Development- Methodology
-  Corridor Development- Analysis & Preliminary Findings
-  Q & A

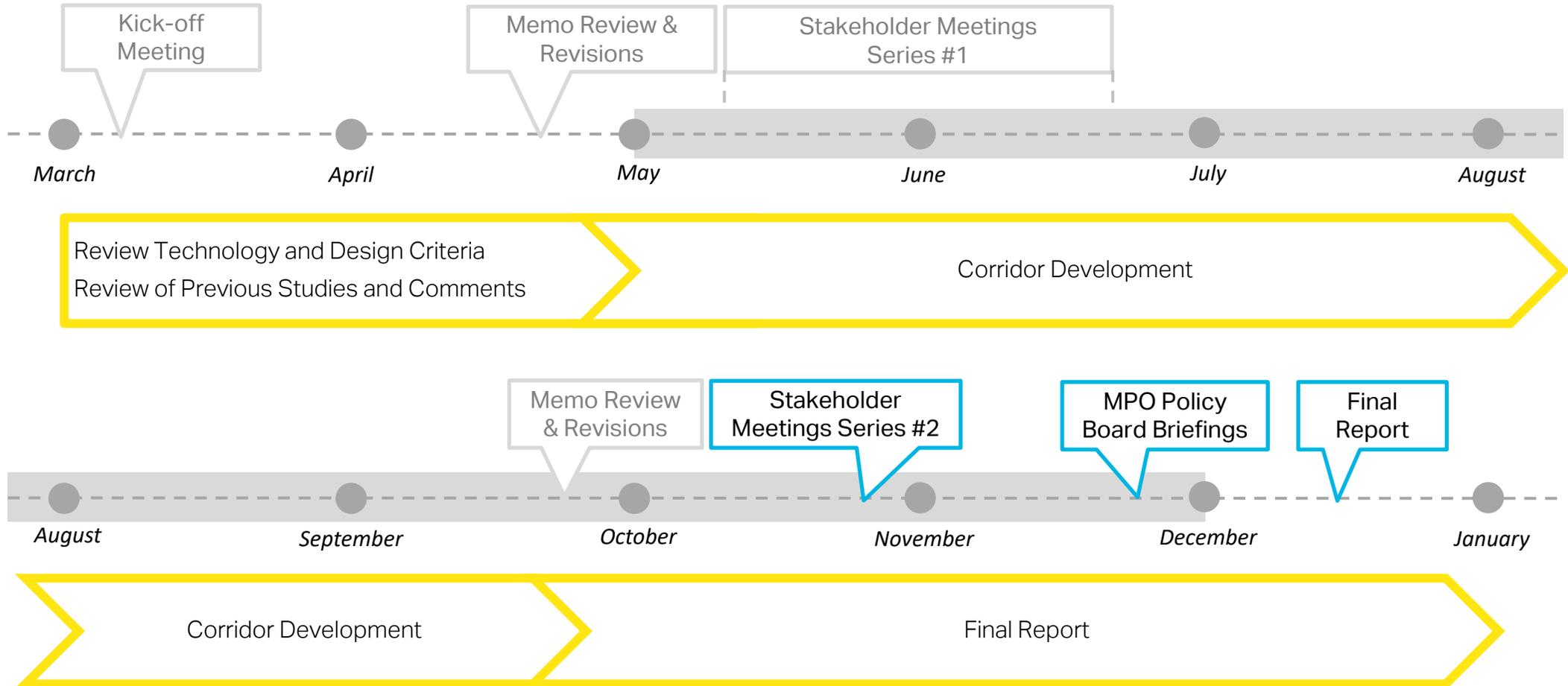
PROJECT PURPOSE

- The project purpose is to **conduct a High-Speed Transportation (HST) study** that connects Fort Worth, Waco, Killeen-Temple, Austin, San Antonio, and Laredo.
- It will **evaluate various technology options** and modes of travel.
- It will **recommend corridors and potential station locations** to include in future NEPA documents.



PROJECT MILESTONES

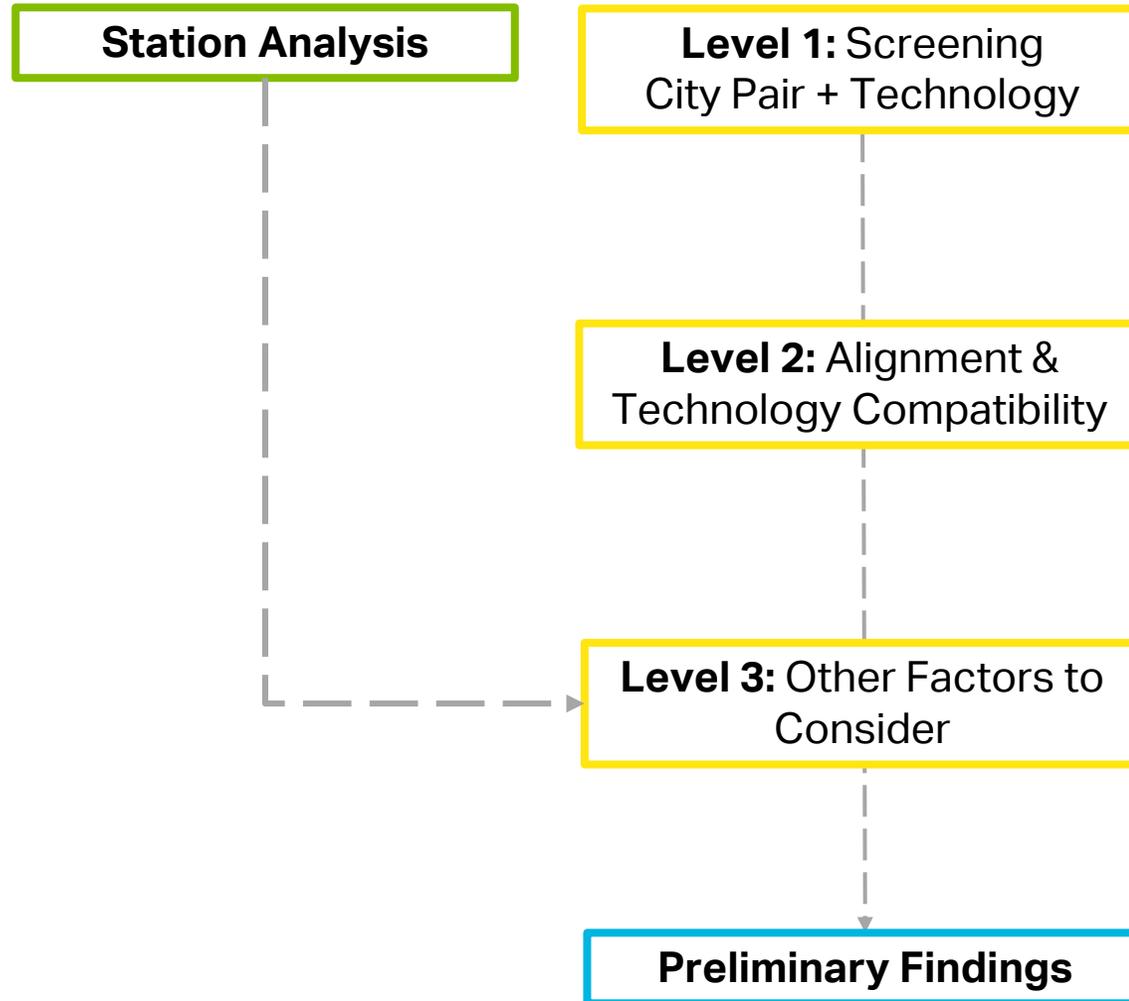
■ Stakeholder coordination



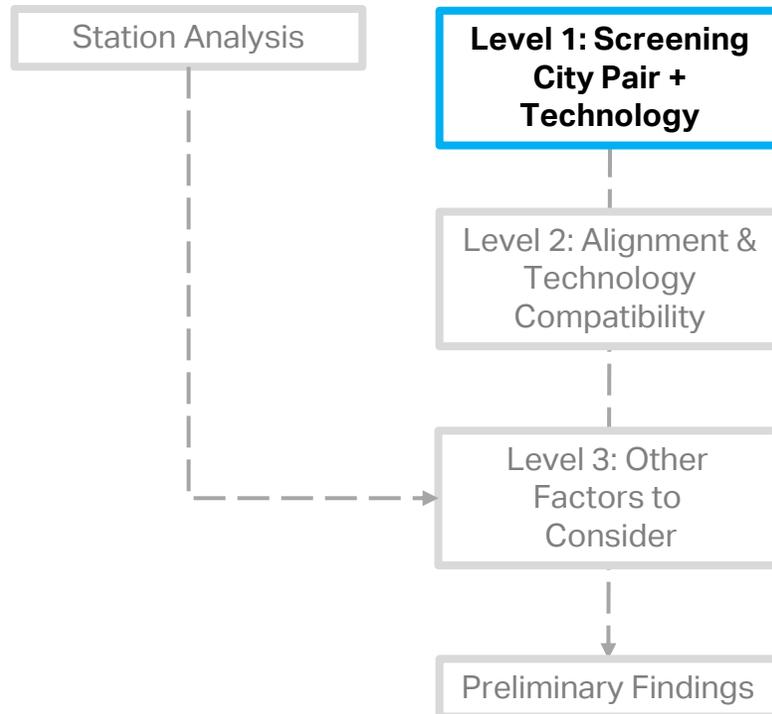


METHODOLOGY

CORRIDOR DEVELOPMENT METHODOLOGY



LEVEL 1: CITY PAIR + TECHNOLOGY SELECTION



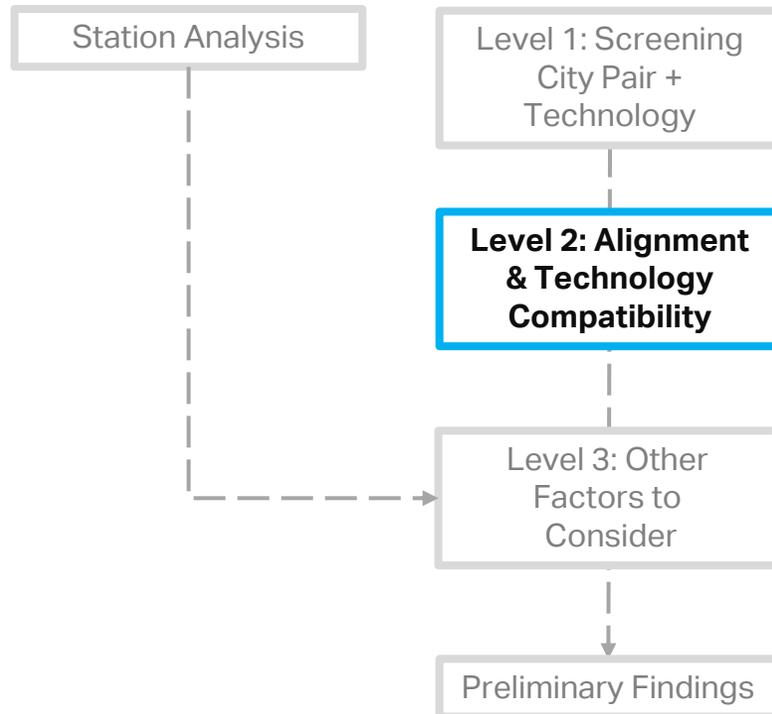
Level 1: Analyzed and developed an initial range of city pairs and suitable technology modes.

Analysis Criteria:

- **City Pair Identification**
 - Service area population
- **Technology Suitability**
 - Optimal station distance
 - Travel time savings-compared to driving
 - Travel time savings-compared to flying

Outcomes: Categorized technologies into Primary and Infill and their potential performance/travel efficiency between cities within the study area.

LEVEL 2: ALIGNMENT & TECHNOLOGY COMPATIBILITY

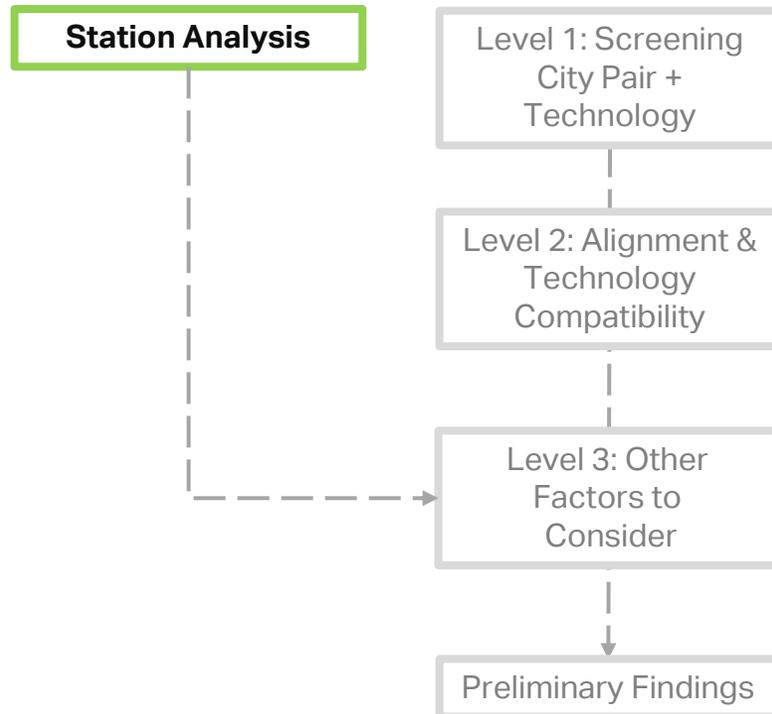


Level 2: Assessed TOPRS Alternatives for compatibility with Technology and Cities from **Level 1**.

- TOPRS Segment & Primary Technology Compatibility
- Primary Technology & Segment Ranking
- End-to-End Primary Technology & Alignment Ranking
- Alignment & Infill Technology Compatibility

Outcomes: A set of evaluated end-to-end technology and alignment combinations.

STATION ANALYSIS

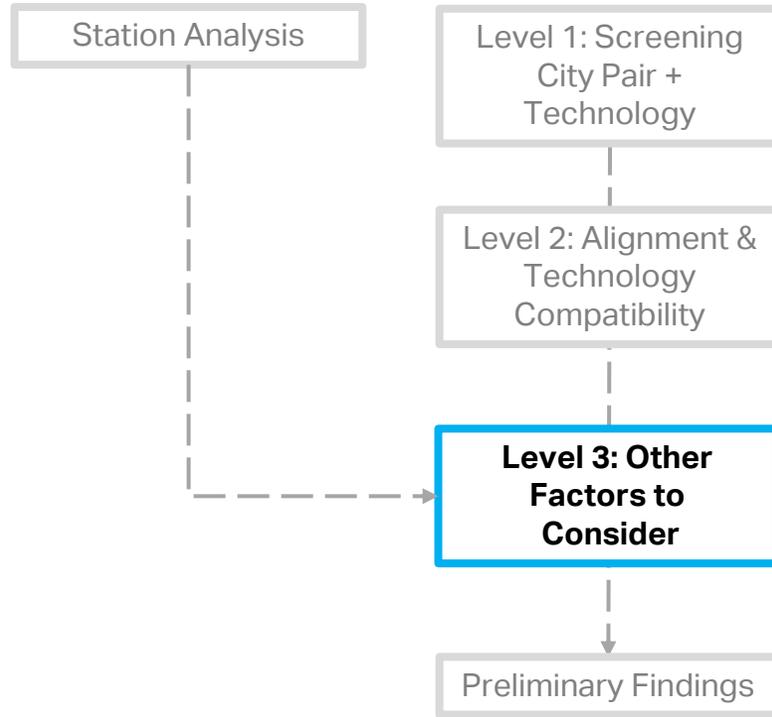


Station Analysis: Assess potential stations in proximity to cities in the study area based on identified metrics.

- **Multimodal Connectivity**
 - Access to transit stops
 - Transit connectivity
 - Existing railroads
 - Existing transit hubs and park & rides
- **Major Activity Centers/Access to Regional Tourism**
 - Modal suitability density (population+employment)
- **Environmental Considerations**
 - Feature coverage (Floodplain, wetland, historic sites, etc.)
- **Existing and Future Land Use/Available Land**
 - Land use compatibility

Outcomes: Develop an inventory of potential station areas in proximity to cities.

LEVEL 3: OTHER FACTORS TO CONSIDER



Level 3: Develop a discussion and ranking of difficult to quantify criteria applicable to technologies.

Outcomes: Provide an additional qualitative lens to the outcomes of **Level 2**.

Station Location Benefits

- Urban vs. suburban station location

Operational

- Required area for ancillary facilities
- Reliability
- O&M costs
- Technology Maturity

Interoperability

- Compatibility with existing technologies

Regulatory

- Regulatory environment
- Public and institutional plan consistency
- Public support

Convenience

- Passenger experience
- Travel efficiency

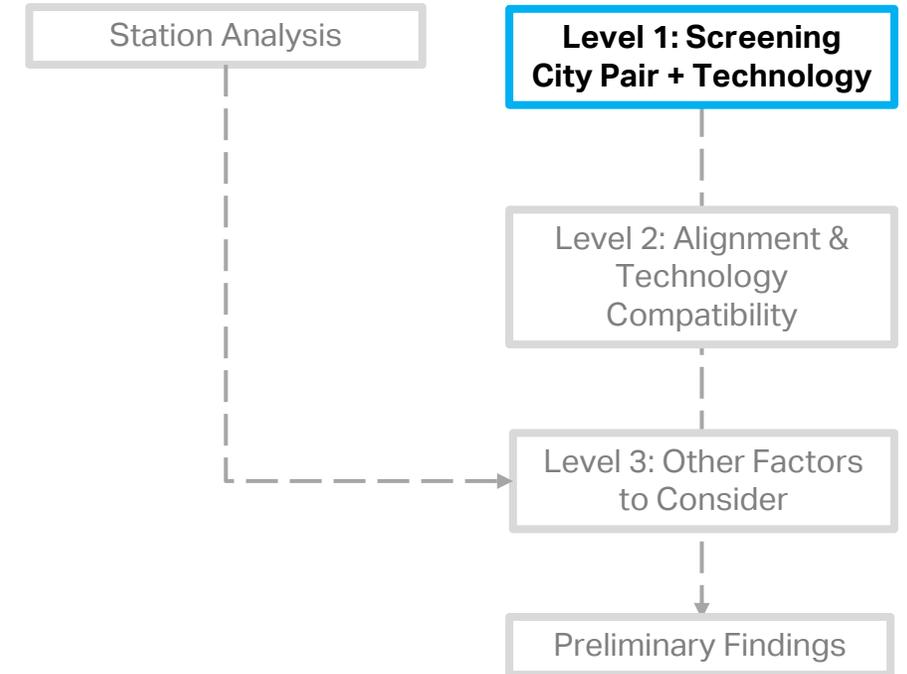
Safety & Resilience

- Vehicle and track safety measures



ANALYSIS & FINDINGS

LEVEL 1: CITY PAIR + TECHNOLOGY SELECTION



LEVEL 1: CITY PAIR + TECHNOLOGY ASSESSMENT

Level 1 identified cities by population size and distance and assessed technologies ability to provide optimal travel time savings.

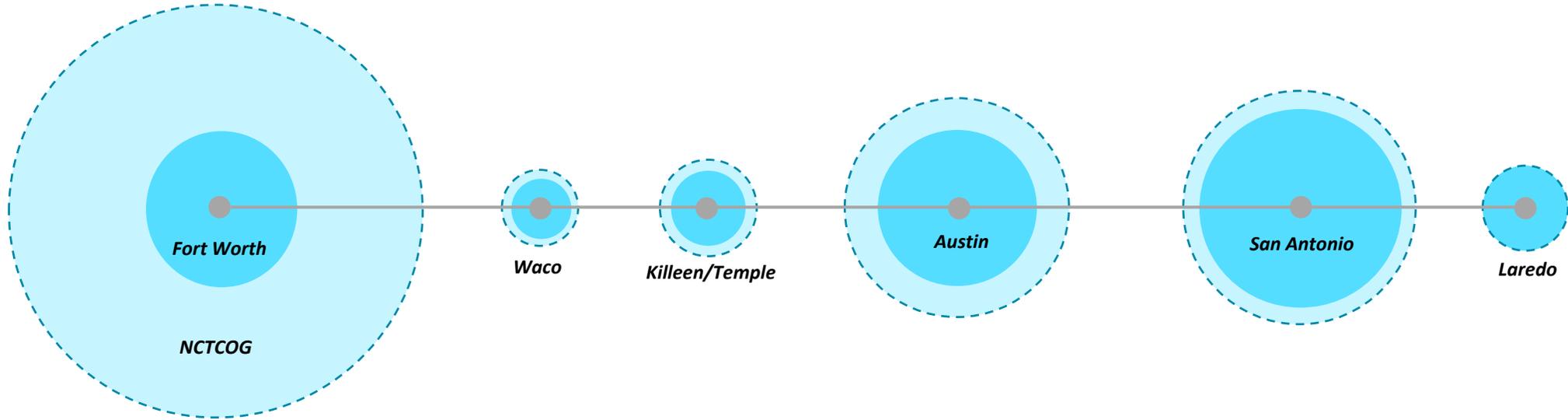
Assessment Criteria:

- **City & MPO Population Size**
- **Technology Mode:**
 - Primary Technology
 - Infill Technology
- **City Pair Distance**
- **Travel Time Savings:**
 - Compared to Driving
 - Compared to Flying

LEVEL 1: CITY PAIR IDENTIFICATION

2 corridor wide routes to be considered

Service Area Population



Corridor Wide Routes

Fort Worth to Laredo-All stops

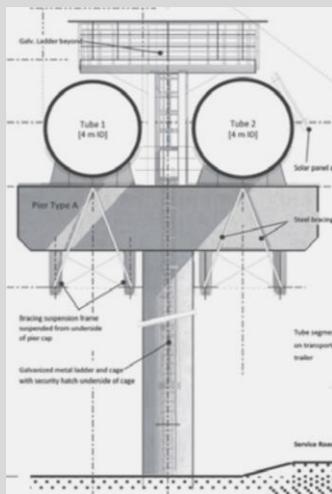


Fort Worth-Austin-San Antonio-Laredo



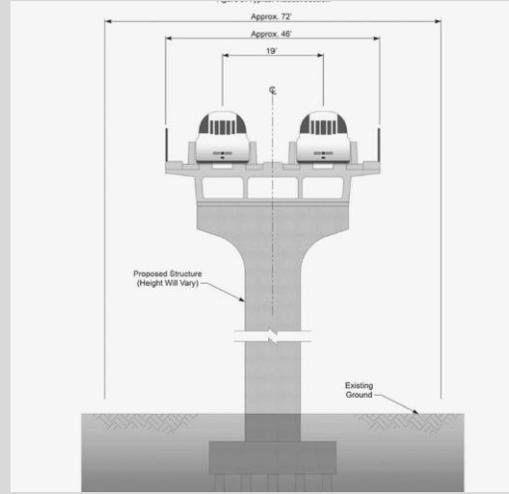
TECHNOLOGIES: PRIMARY (INTER-REGIONAL)

● Hyperloop



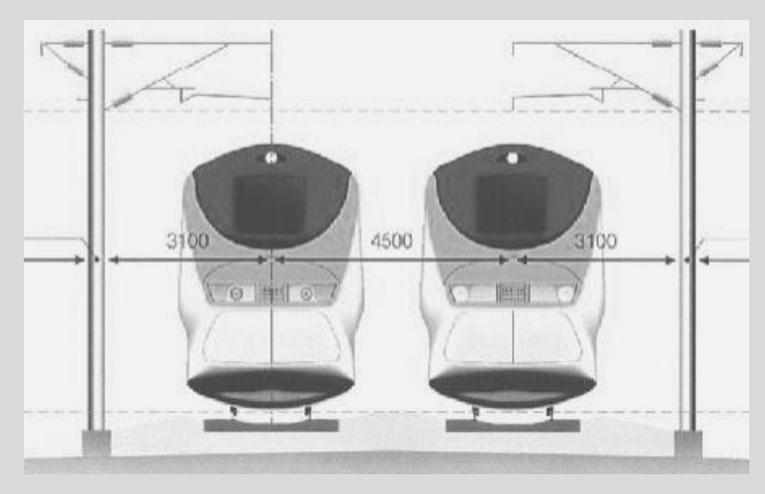
~40- 60 ft right-of-way

● Maglev Train



~75 - 95ft right-of-way

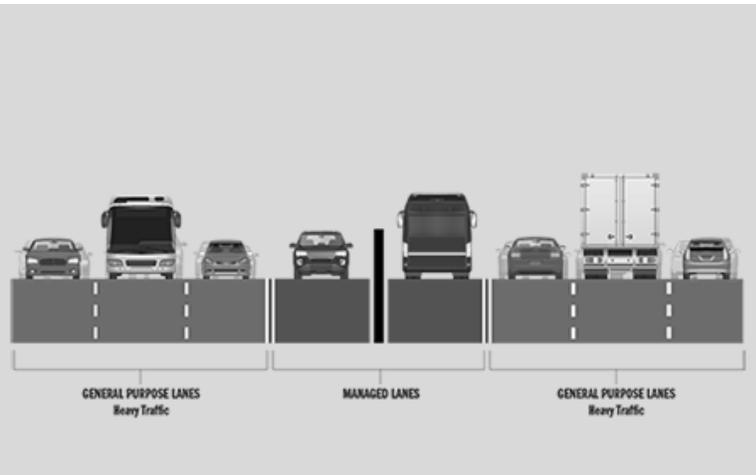
● High-Speed Rail (Over 150 mph)



~45 - 65ft right-of-way

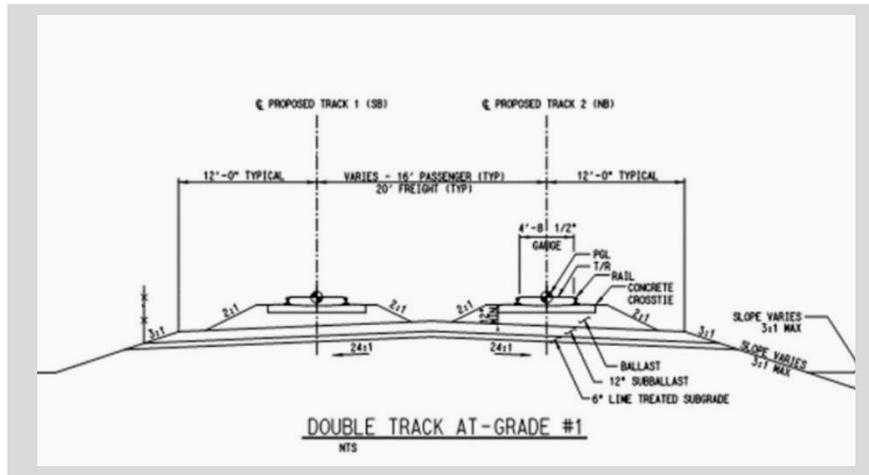
TECHNOLOGIES: INFILL (INTRA-REGIONAL)

● **Guaranteed Transit**



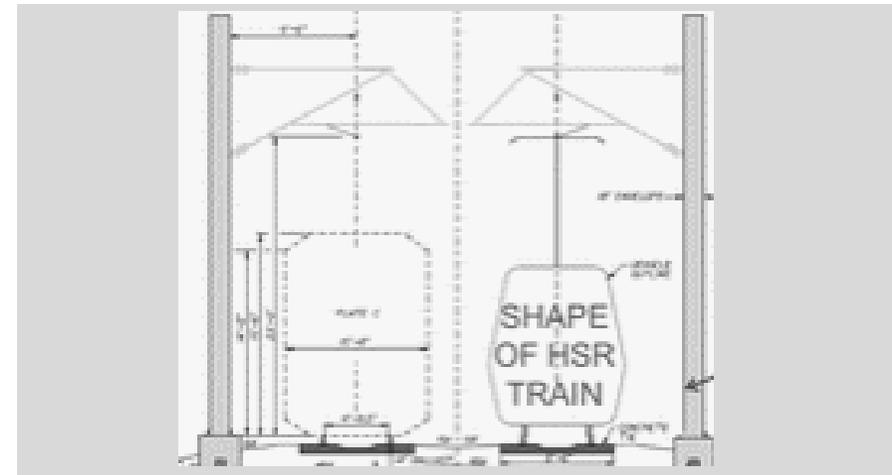
Typical managed lane right-of-way

● **Conventional Rail**



Typical Conventional Rail right-of-way

● **Higher-Speed Rail (Up to 150 mph)**



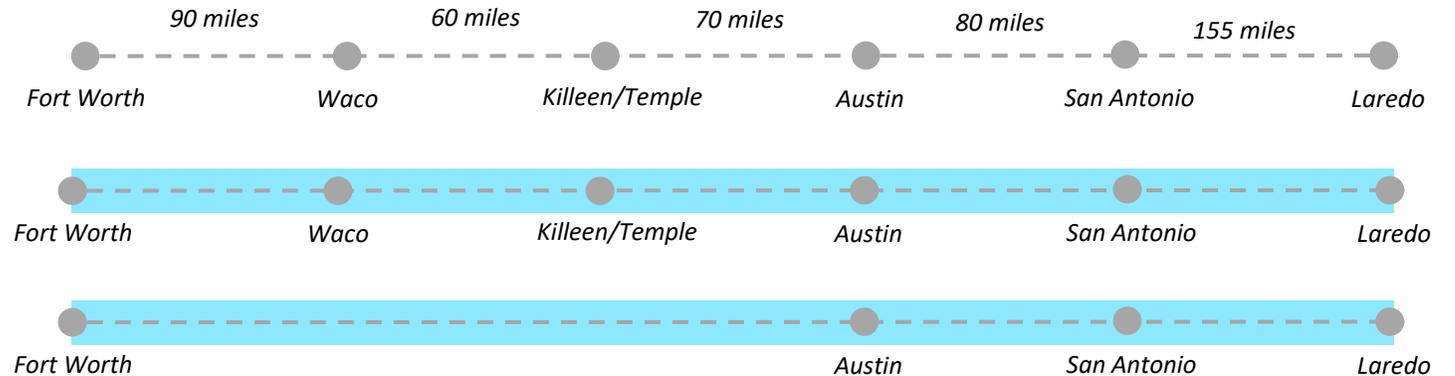
Typical Higher-Speed Rail right-of-way

POTENTIAL STATION DISTANCE

Findings

- For **Level 1**:
 - Optimal **station distances** and **service area population** find that Hyperloop, Maglev and High-Speed Rail are appropriate for all stops, as well as a Fort Worth-Austin-San Antonio-Laredo stopping pattern

Fort Worth to Laredo-All stops



Fort Worth-Austin-San Antonio-Laredo

TRAVEL TIME (COMPARED TO DRIVING)

Inline platform dwell time is estimated to be 3 minutes

Travel Time when compared to driving (mins)

City Pairs	Drive Time (Mins)	Hyperloop	Maglev	High-Speed Rail	Higher-Speed Rail	Conventional Intercity Passenger Rail	Guaranteed Transit
Fort Worth-Waco	85-105	15	20	30	45	60	70
Waco-Killeen/Temple	60-75	10	15	25	30	40	50
Killeen/Temple-Austin	70-85	10	15	25	35	45	55
Austin-San Antonio	80-100	15	20	30	40	55	65
San Antonio-Laredo	150-185	20	30	50	75	100	120



Higher relative time savings

Lower relative time savings

TRAVEL TIME (COMPARED TO FLYING)

Assumes 130 minutes of dwell time.

Travel Time when compared to Flying (mins)

City Pairs	Flight route	Flight time (mins)	Hyperloop	Maglev	High-Speed Rail	Higher-Speed Rail	Conventional Intercity Passenger Rail	Guaranteed Transit
Waco-Fort Worth	Direct flight	175	15	20	30	45	60	70



Higher relative time savings

Lower relative time savings



No time savings

LEVEL 1 - SUMMARY

- Based on this analysis, **five single mode options** were generated for primary technology modes. **Two of these options stop at all stations.**
- **9 double mode (Primary + Infill) options were generated.** These cover all stops.
- Primary technology modes provide at **least 50% savings** in time compared to driving time.

	Primary technology modes		
	Hyperloop	Maglev	High-Speed Rail
Fort Worth to Laredo-All stops	Higher relative time savings	Higher relative time savings	Higher relative time savings
Fort Worth-Austin-San Antonio-Laredo	Higher relative time savings	Higher relative time savings	Higher relative time savings

Higher relative time savings

Lower relative time savings

Not recommended

LEVEL 1 SUMMARY- PRIMARY MODE OPTIONS

Option 1 Hyperloop



Option 2 Hyperloop



Option 3 Maglev



Option 4 Maglev



Option 5 HSR

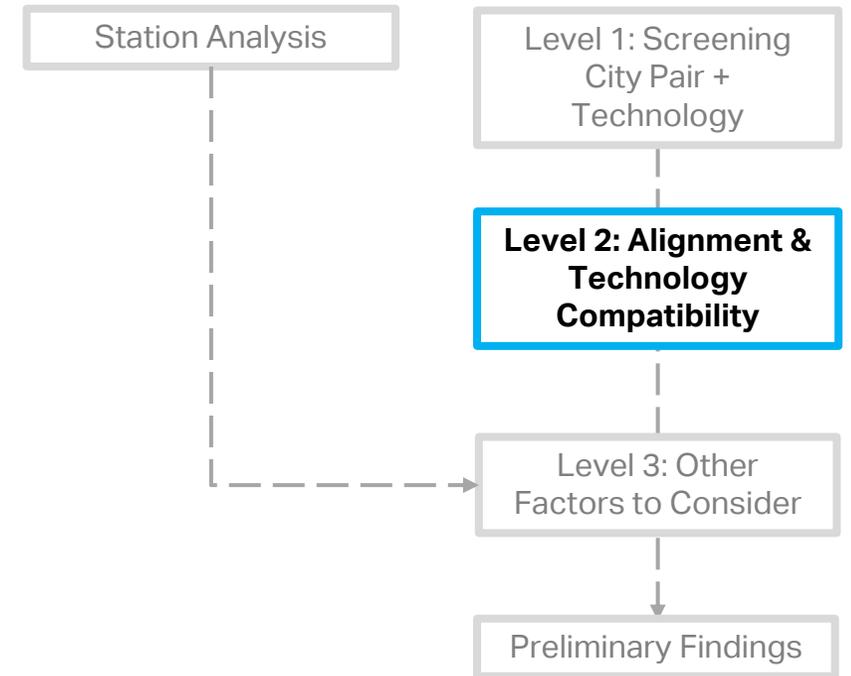


Option 6 HSR



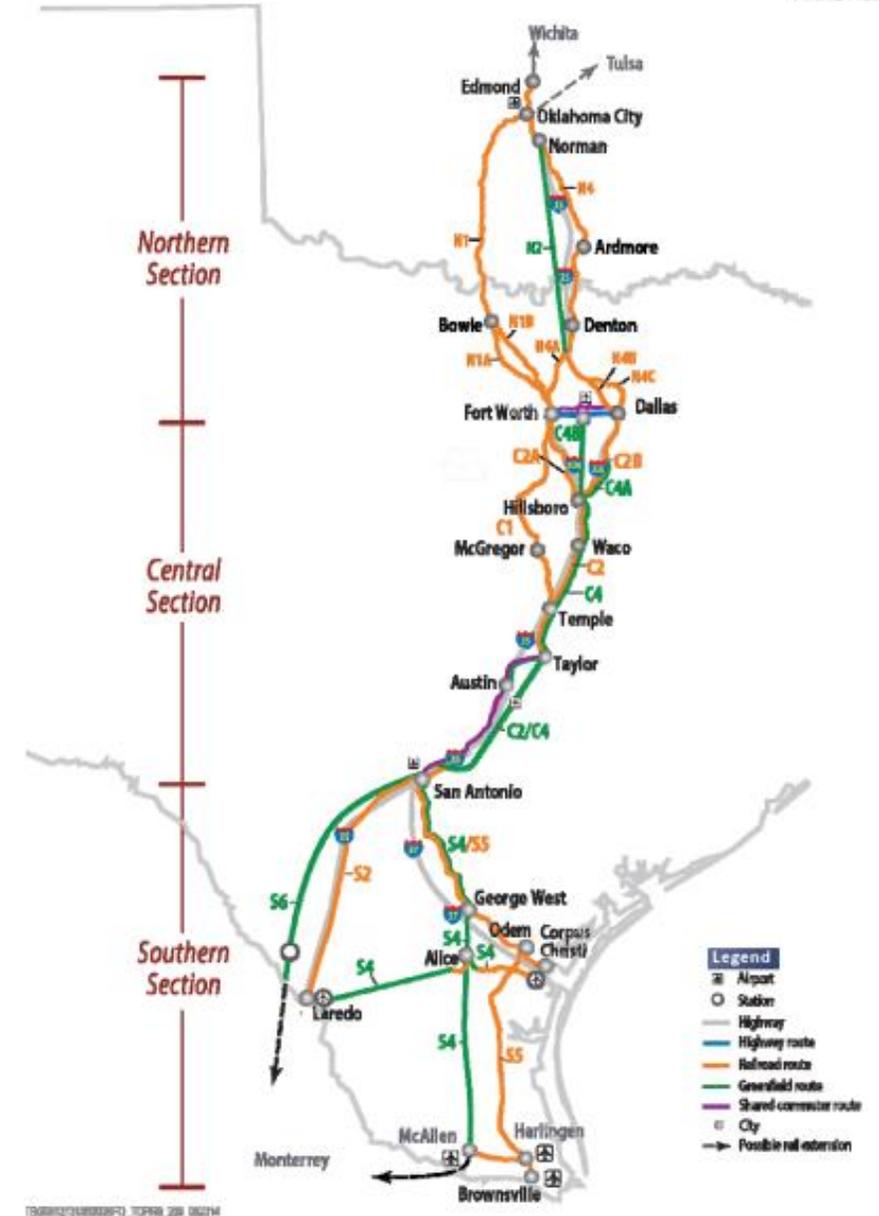
-  Hyperloop station
-  Maglev Station
-  HSR Station

LEVEL 2: ALIGNMENT AND TECHNOLOGY COMPATIBILITY



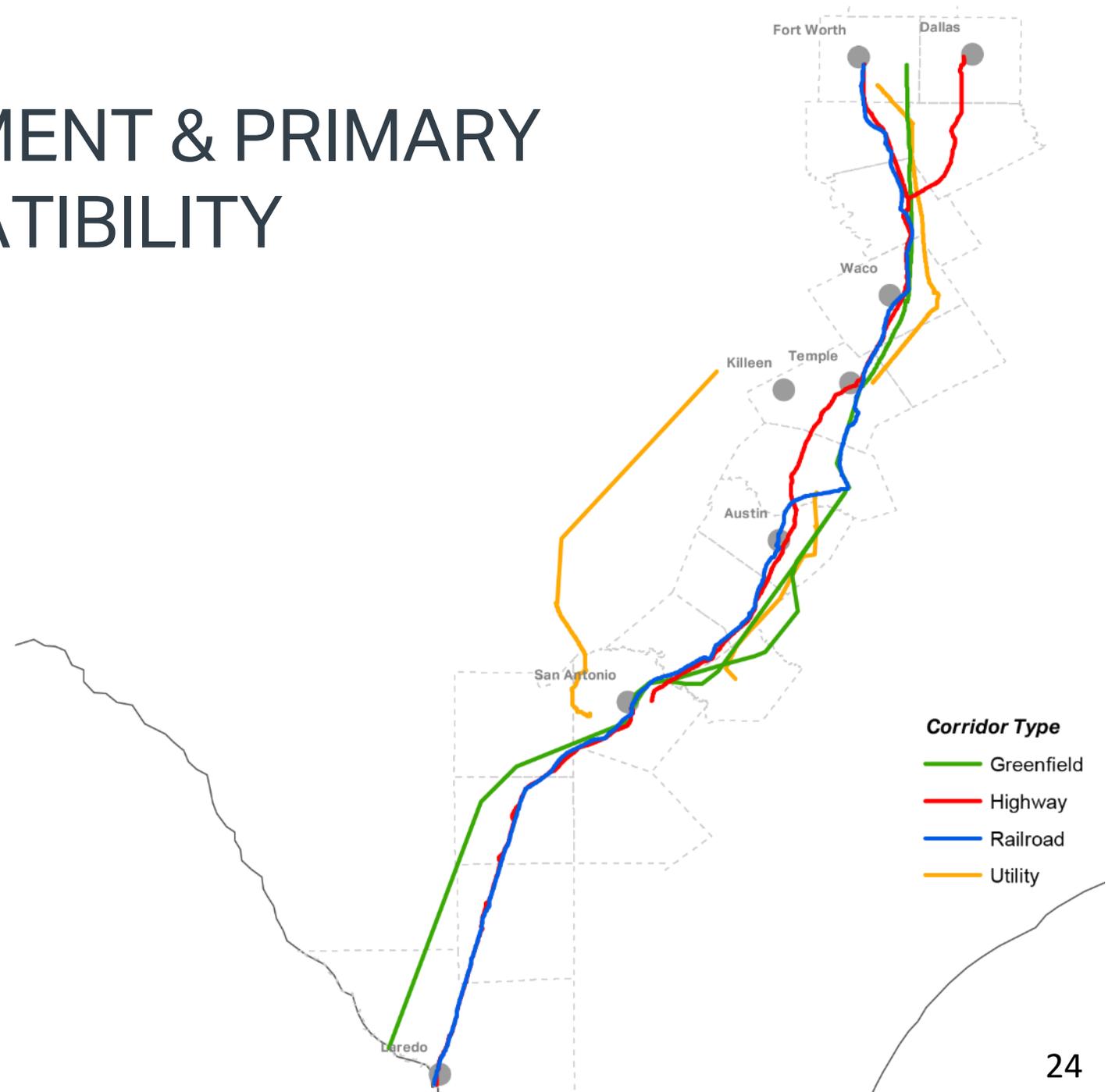
LEVEL: 2 OVERVIEW

- **Step 1:** Assess alignments and segments from the TOPRS study.
- **Step 2:** Screen combinations of Primary Technology with TOPRS segments.
- **Step 3:** Identify preliminary technology and alignment combination.



LEVEL: 2 TOPRS SEGMENT & PRIMARY TECHNOLOGY COMPATIBILITY

- Applied **high-level criteria** to **narrow down feasible segments** from TOPRS
- A total of **23 city-to-city** segments evaluated.
- Corridor types included:
 - Greenfield (new location)
 - Existing highway corridors
 - Existing railroad corridors
 - Existing utility corridors



LEVEL: 2 TOPRS SEGMENT & PRIMARY TECHNOLOGY COMPATIBILITY



Highway Corridors

- **Maglev and HSR cannot operate along highway routes** because both have more restrictive horizontal and vertical design criteria. To follow an existing highway, the speed of the technology would be greatly reduced.
- **Hyperloop has less restrictive design criteria** and could follow highway routes but a reduction in speed would be necessary.



Freight Corridors

- **Hyperloop, Maglev and HSR cannot operate on existing railroad tracks.**
- Track gauge for high-speed systems is incompatible with freight rail and potential interference with overhead catenary systems for electrical HSR vehicles.
- High-speed transit systems require 100 percent grade-separation to achieve high speeds.



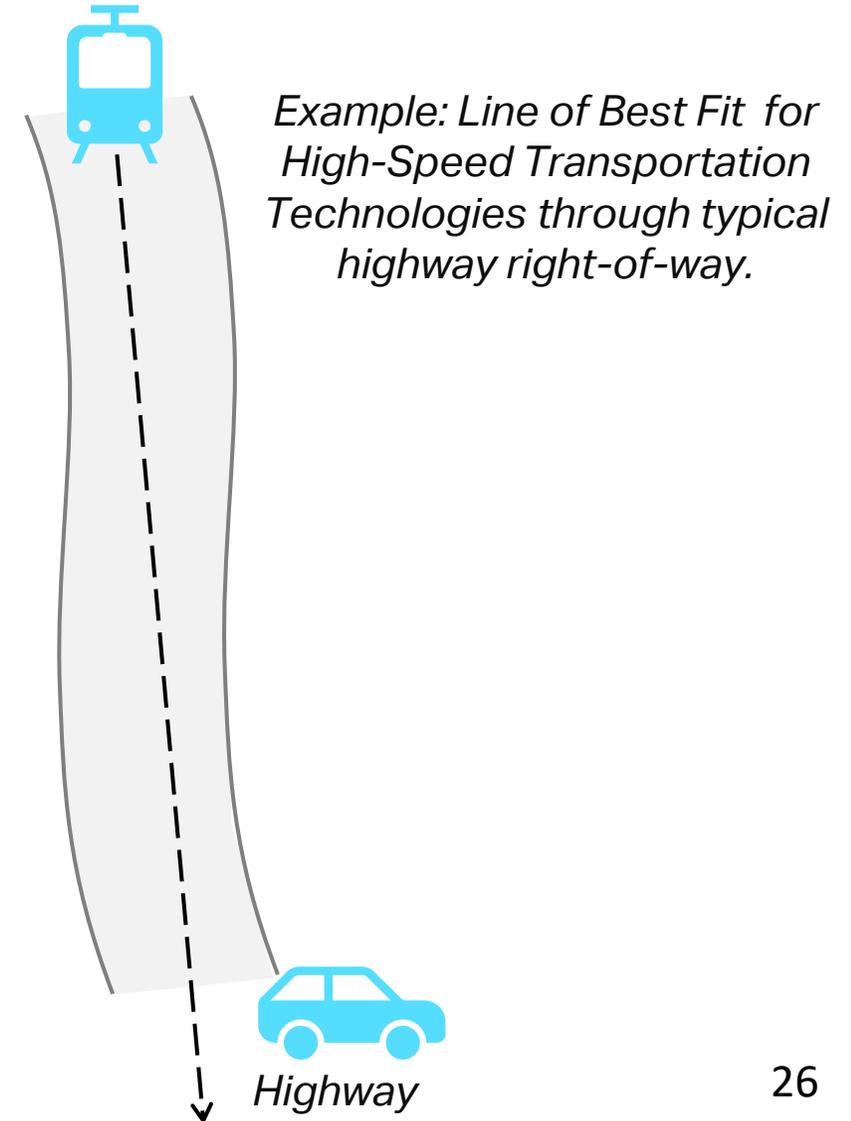
Utility Corridors

- Primary technologies are feasible **generally following utility corridors**, and favorable in Texas due to geography and **long segments of uninterrupted linear paths.**

LEVEL: 2 PRIMARY TECHNOLOGY & SEGMENT ANALYSIS

Screening Criteria included:

- Segment characteristics
 - Length
 - Study area acreage
- Travel time savings by technology mode
- Capital costs
- Assessment of land use type and acreage from the National Land Cover Database via US Geological Survey.
- Travel time savings criteria assess the Primary Technology's speed and travel efficiency on in various corridors. Speed and time savings become degraded as each mode is assessed with various horizontal curvatures.



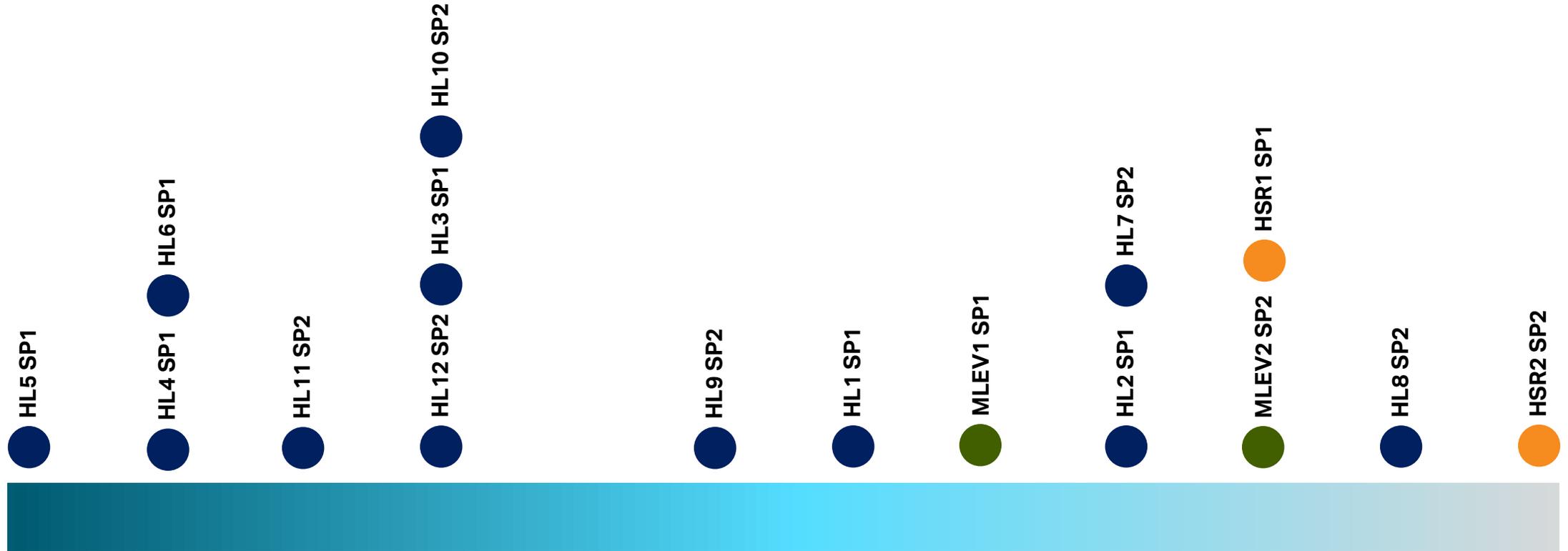
LEVEL: 2 – HIGHEST SCORING TECHNOLOGY AND ALIGNMENT

ID	Fort Worth to Waco	Waco to Temple	Temple to Taylor	Taylor to San Antonio	Temple to San Antonio	San Antonio to Laredo
HL1 SP1	Utility	Greenfield	Greenfield	Greenfield		Greenfield
HL2 SP1	Greenfield	Greenfield	Greenfield	Greenfield		Greenfield
HL3 SP1	Utility	Greenfield	Greenfield	Utility		Greenfield
HL4 SP1	Greenfield	Greenfield	Greenfield	Utility		Greenfield
HL5 SP1	Utility	Greenfield			Highway	Greenfield
HL6 SP1	Greenfield	Greenfield			Highway	Greenfield
HL7 SP2	Utility	Greenfield	Greenfield	Greenfield		Greenfield
HL8 SP2	Greenfield	Greenfield	Greenfield	Greenfield		Greenfield
HL9 SP2	Utility	Greenfield	Greenfield	Utility		Greenfield
HL10 SP2	Greenfield	Greenfield	Greenfield	Utility		Greenfield
HL11 SP2	Utility	Greenfield			Highway	Greenfield
HL12 SP2	Greenfield	Greenfield			Highway	Greenfield
MLEV1 SP1	Utility	Greenfield	Greenfield	Utility		Greenfield
MLEV2 SP2	Utility	Greenfield	Greenfield	Utility		Greenfield
HSR1 SP1	Utility	Greenfield	Greenfield	Utility		Greenfield
HSR2 SP2	Utility	Greenfield	Greenfield	Utility		Greenfield

HL- Hyperloop
MLEV- Maglev
HSR- High Speed Rail

SP1- Stopping Pattern 1- All (6) Stops
SP2- Stopping Pattern 2 – Fort Worth- Austin- San Antonio- Laredo (4) Stops

LEVEL: 2 – HIGHEST SCORING TECHNOLOGY AND ALIGNMENT



High

HL- Hyperloop
 MLEV- Maglev
 HSR- High Speed Rail

SP1- Stopping Pattern 1- All (6) Stops
 SP2- Stopping Pattern 2 – Fort Worth- Austin- San Antonio- Laredo (4) Stops

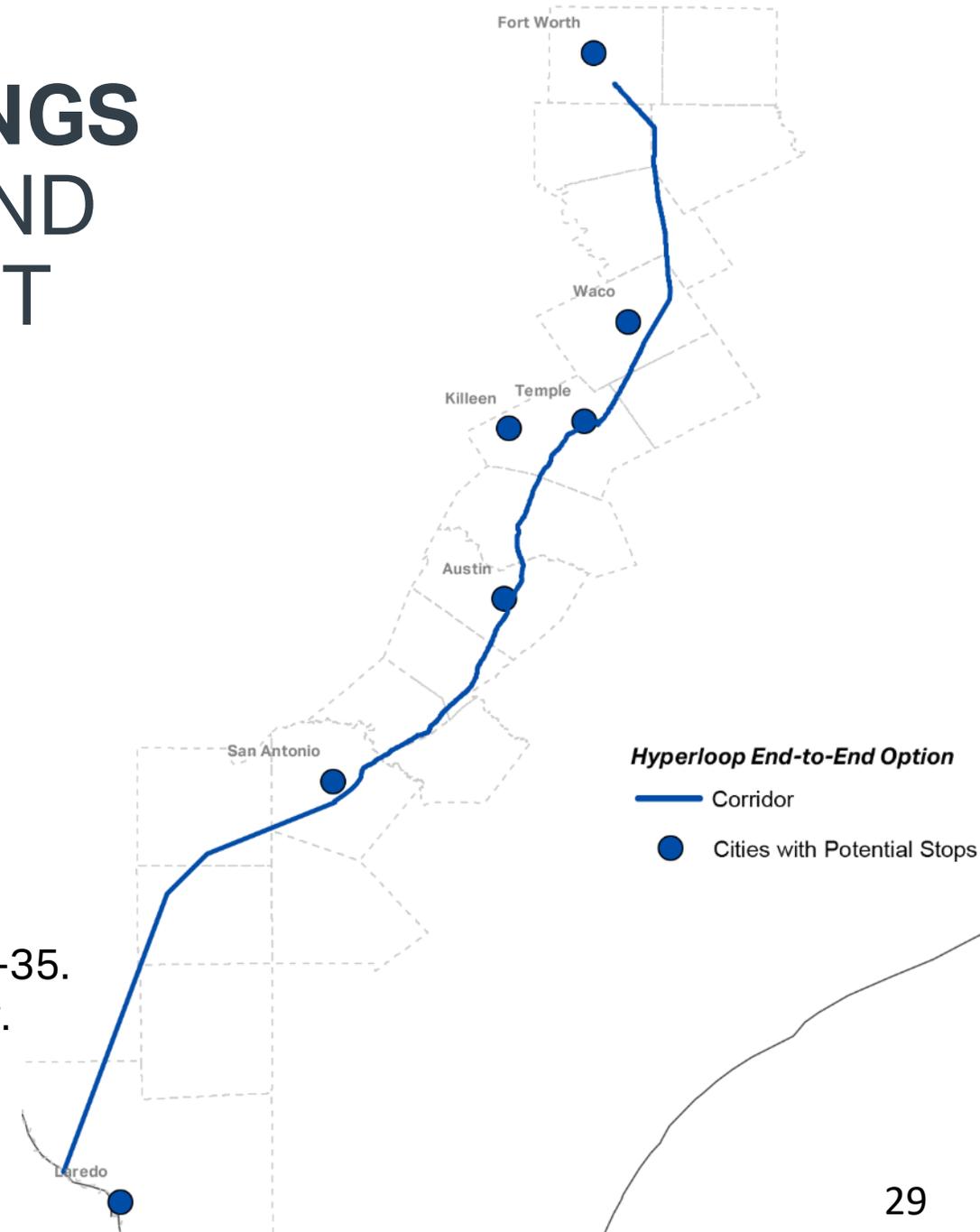
Low

- Hyperloop
- Maglev
- HSR

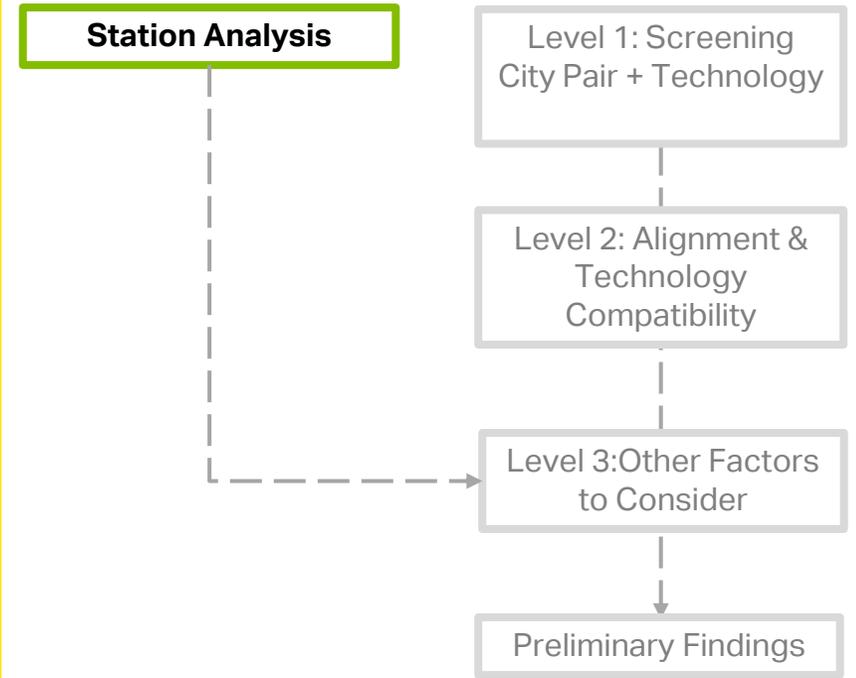
LEVEL: 2 PRELIMINARY FINDINGS

HIGHEST SCORING END-TO-END TECHNOLOGY AND ALIGNMENT

- **Hyperloop with six potential stops in:**
 - Fort Worth
 - Waco
 - Killeen/Temple
 - Austin
 - San Antonio
 - Laredo
- **Alignment generally follows:**
 - Traveling south from Fort Worth to Waco generally following a Utility Corridor.
 - From Temple to San Antonio, generally following IH-35.
 - From San Antonio to Laredo in a greenfield corridor.



STATION ANALYSIS



STATION ANALYSIS

Assessed station suitability based on identified metrics:



Multimodal Connectivity

- Access to transit stops
- Transit connectivity
- Existing railroads
- Existing transit hubs and park & rides



Major Activity Centers/Access to Regional Tourism

- Modal suitability density (population+ employment)



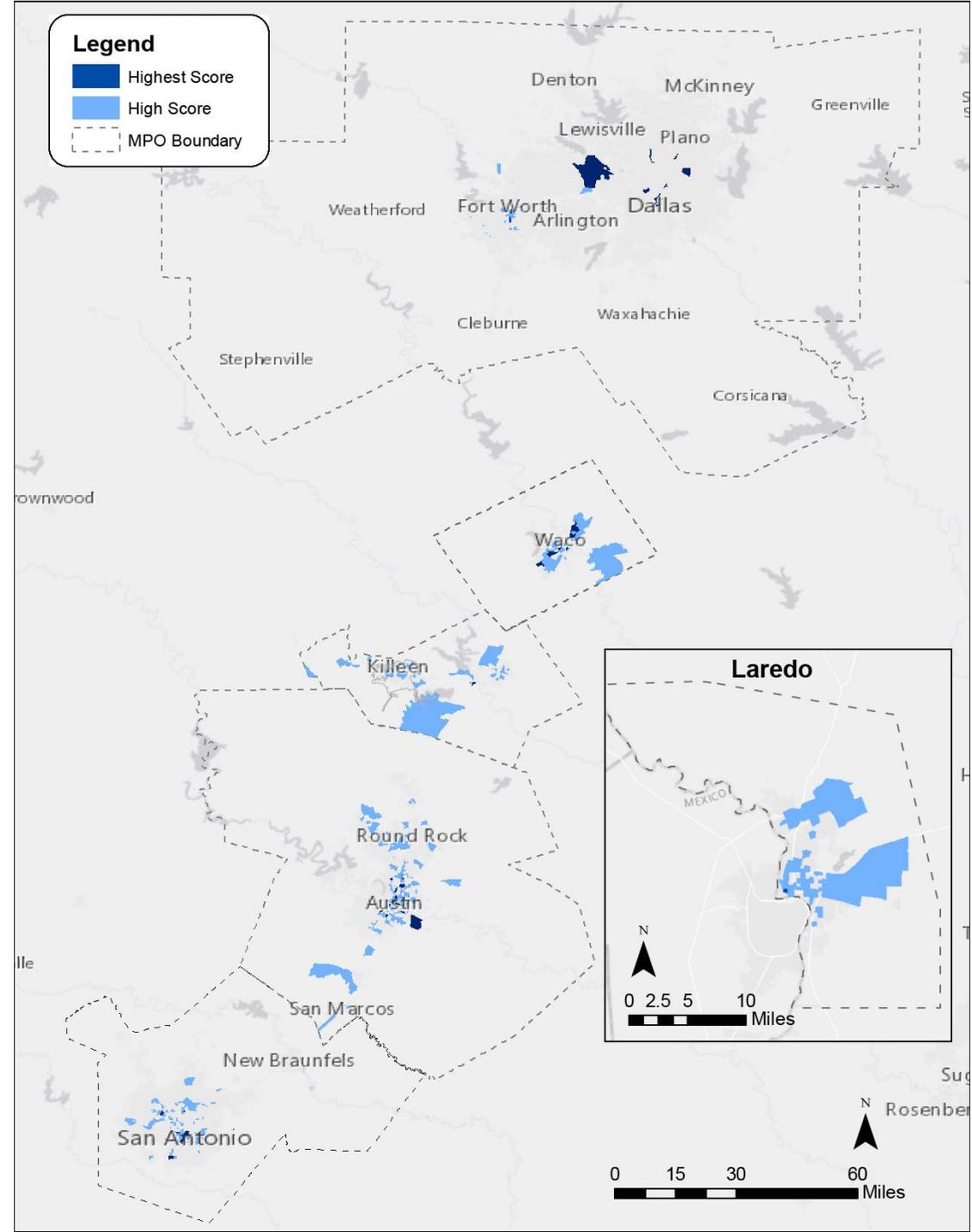
Environmental Considerations

- Feature coverage (Floodplain, wetland, historic sites, etc.)

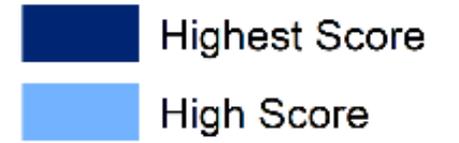


Existing and Future Land Use/Available Land

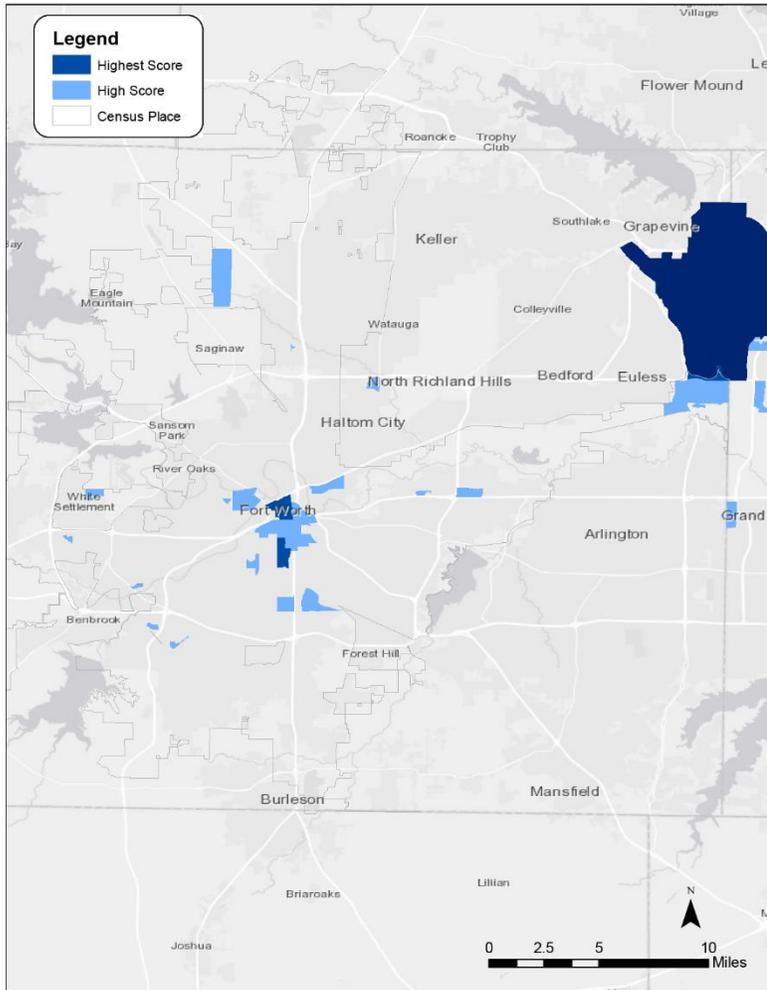
- Land use compatibility



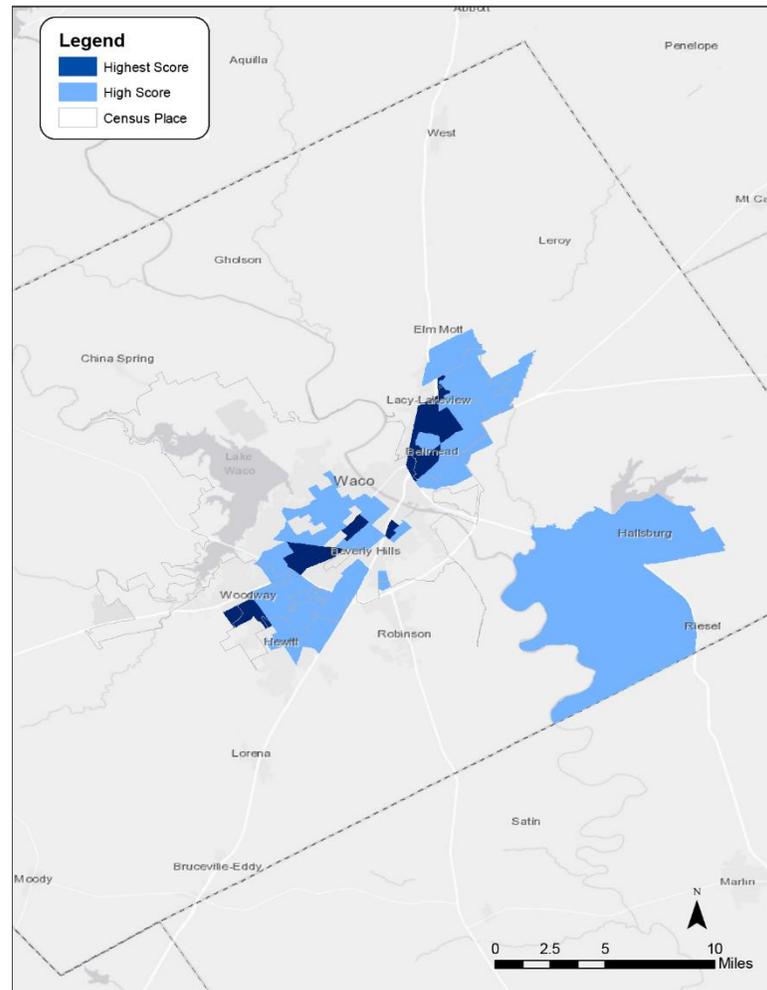
STATION ANALYSIS



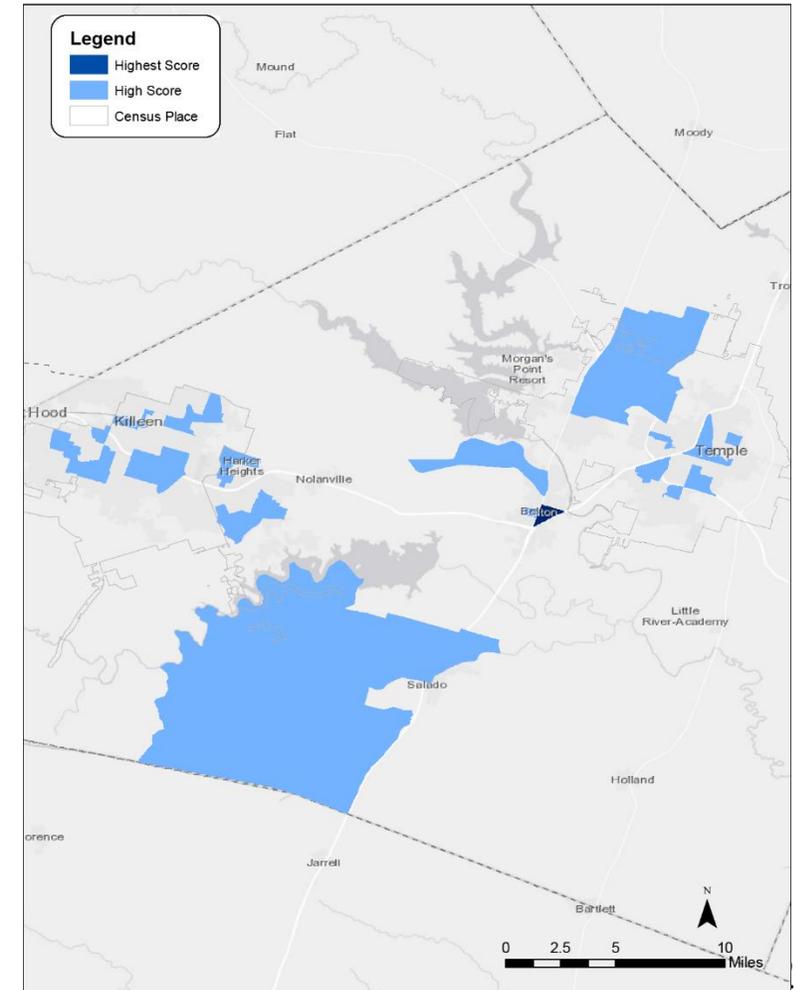
NCTCOG- Fort Worth



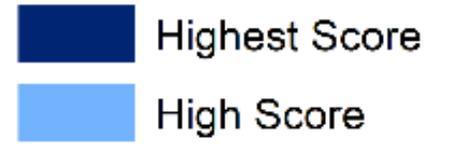
WMPO- Waco



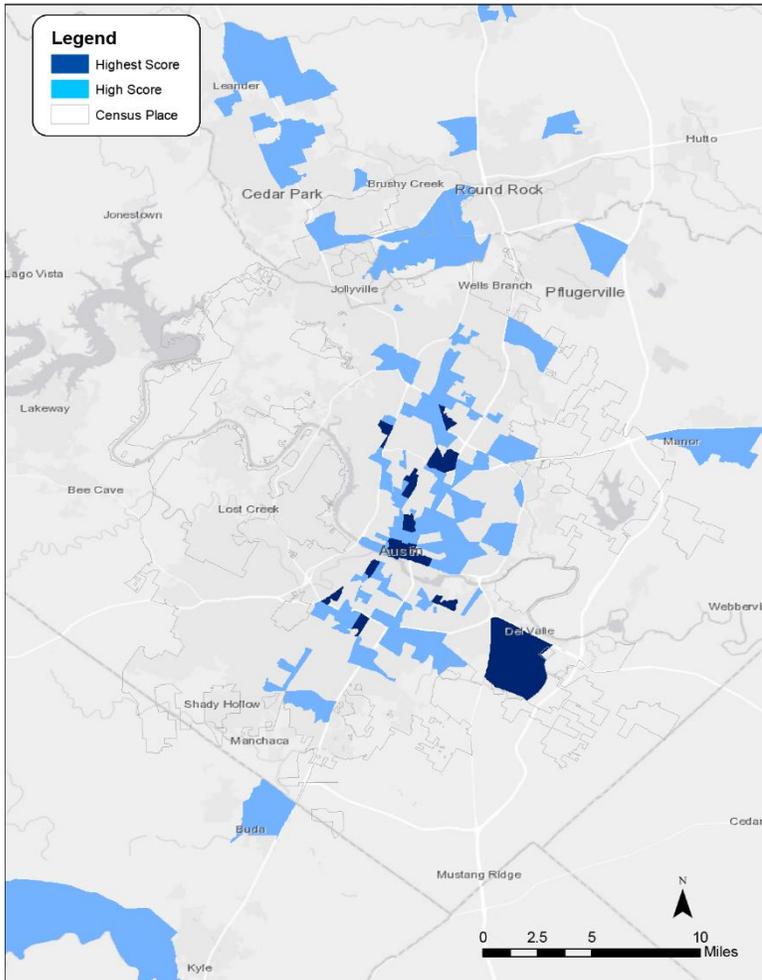
KTMPO- Killeen- Temple



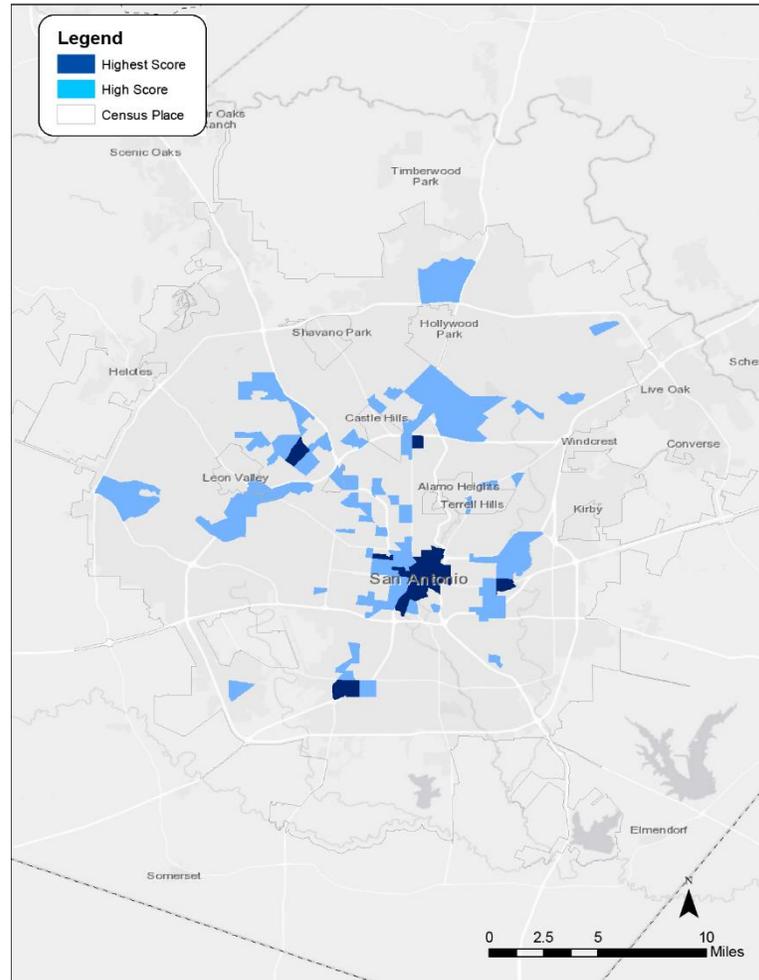
STATION ANALYSIS



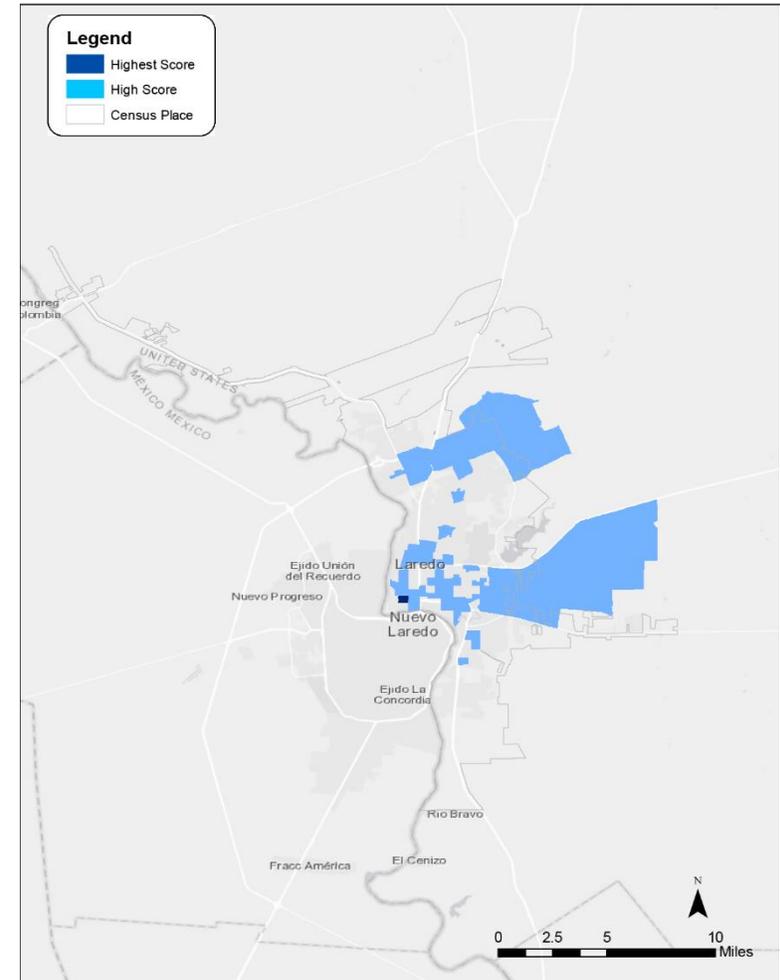
CAMPO- Austin



AAMPO- San Antonio



LMPO- Laredo

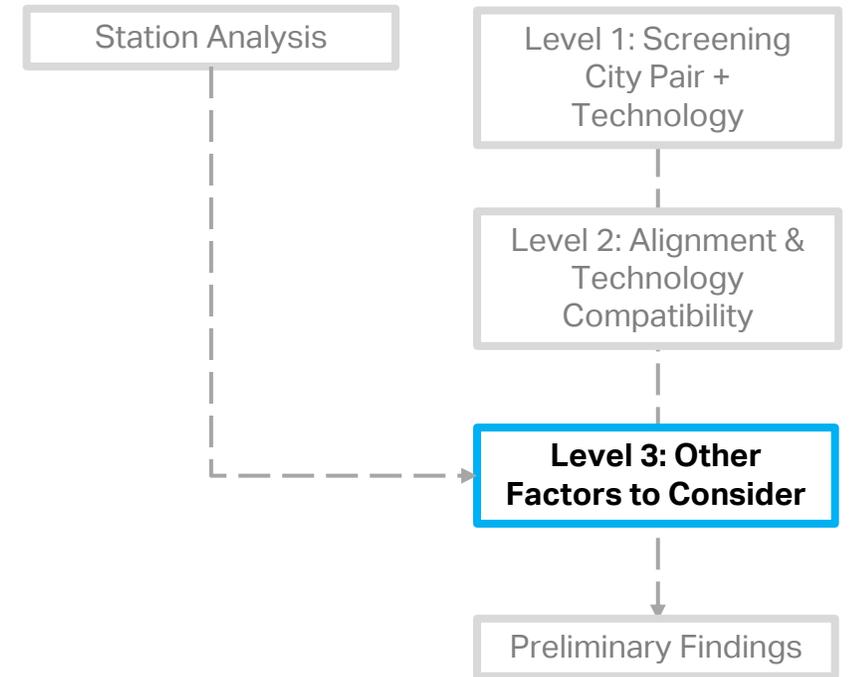


STATIONS AND SEGMENT CONNECTIVITY

Station Assessment Limitations:

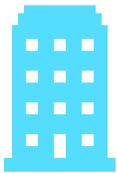
- Station areas presented are **generalized locations** that do not identify specific site or parcel selections.
- **Appropriate approaches** for high-speed transit technologies would be **dependent on specific station site** in further study.

LEVEL 3: OTHER FACTORS TO CONSIDER



LEVEL 3: OTHER FACTORS TO CONSIDER

- **Level 3:** Develop a discussion and ranking of difficult to quantify criteria applicable to technologies.
- **Outcomes:** Provide an additional qualitative assessment of technologies in relation to the outcomes of **Level 2**.



Station Location Benefits

- Urban vs. suburban location
- Freight co-benefit of station location



Operational

- Required area for ancillary facilities
- Reliability
- O&M costs
- Technology Maturity



Interoperability

- Compatibility with existing technologies



Regulatory

- Regulatory environment
- Public and institutional plan consistency
- Public support



Convenience

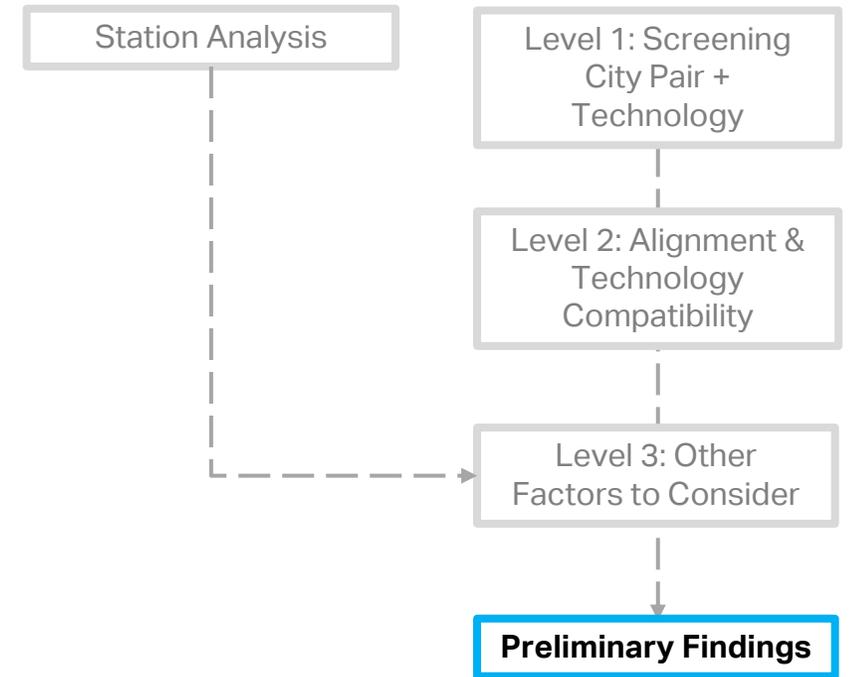
- Passenger experience
- Travel efficiency



Safety & Resilience

- Vehicle and track safety measures

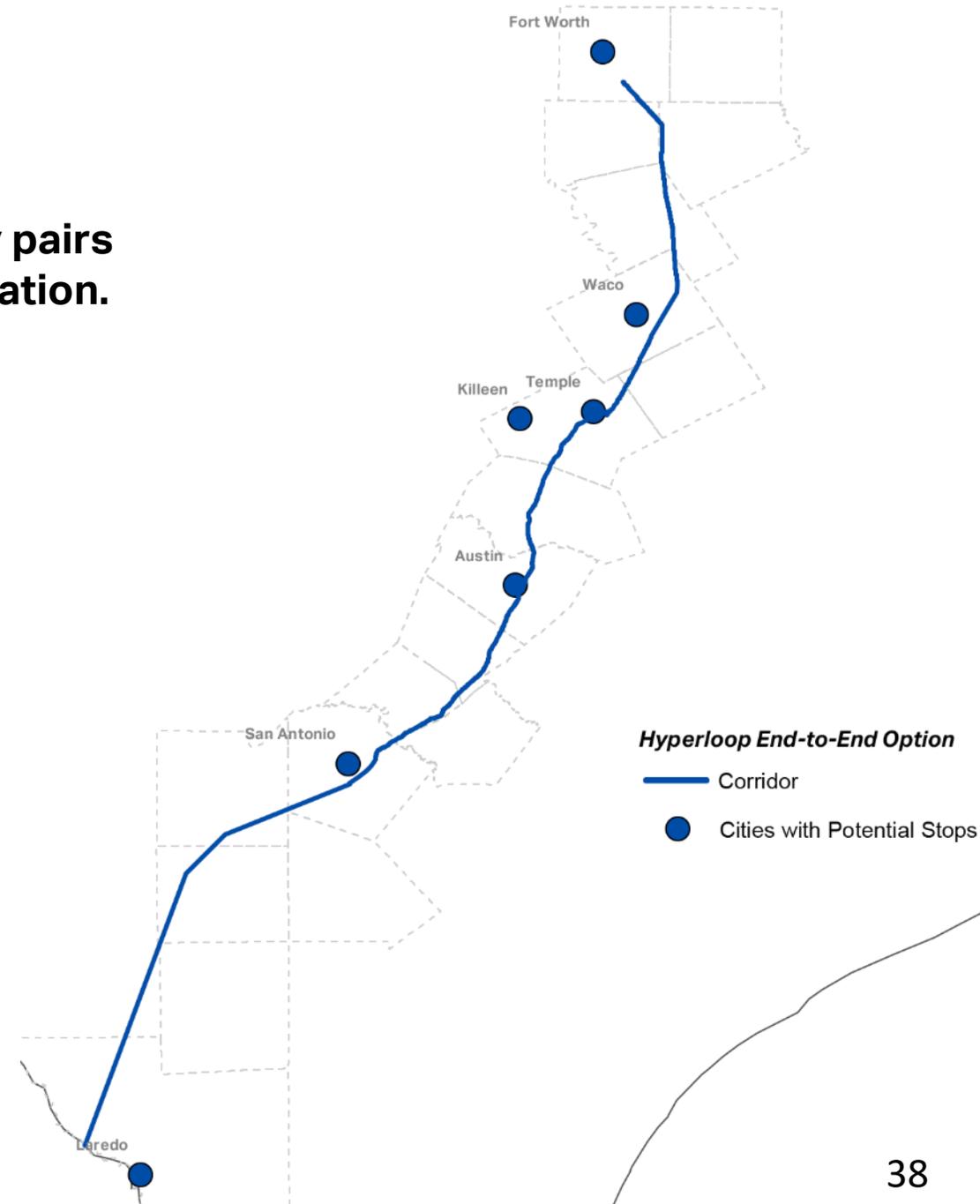
PRELIMINARY FINDINGS



PRELIMINARY FINDINGS

After screening, Hyperloop stopping at all identified city pairs ranked as the highest technology and alignment combination.

- **Hyperloop potential stops:**
 - Fort Worth
 - Waco
 - Killeen/Temple
 - Austin
 - San Antonio
 - Laredo
- **Alignment generally follows:**
 - Traveling south from Fort Worth to Waco generally following a Utility Corridor.
 - From Temple to San Antonio, generally following IH-35.
 - From San Antonio to Laredo in a greenfield corridor.



FEEDBACK

- What are your thoughts about the findings?
- Questions about the analysis methodology?



Questions & Answers

Thank you