Health Impact Project, Tempe

Tempe

ASU Arizona State University

Climate Action + Extreme Heat

Pew Health Impact Project, Tempe

What urban infrastructure is associated with thermal comfort and discomfort?

Four Activities:

1. ***citywide survey*** (heat and health)

Kiwanis/ The Lakes Character Area Only

2. neighborhood microclimate assessment

- playground and public space assessments,

3. participatory heat assessments

- (heat walk event), and integrate that data to inform a

4. climate action co-design workshop

- (park design), which aims to co-produce solutions with residents.

Strategy

1. Survey
2. Microclimate assessment
3. Participatory assessment

Informal public conversation Increase dialog on heat

4. Workshops

- Guidelines/ guidelines
- Standards
- Codes
- All hazards mitigation plans
- Emergency manager

Performance Measure Targets

1) In each of the city's character areas, less than 20% of residents report experiencing heat-related illness in the past 12 months.

2) In each of the city's character areas, less than 15% of residents report experiencing significant negative impacts due to high temperature in their homes in the past 12 months.

Infrastructure

- Parks and Play Spaces
- Multiuse Paths
- Arterial Walls
- Parking Lots

Microclimate Assessments

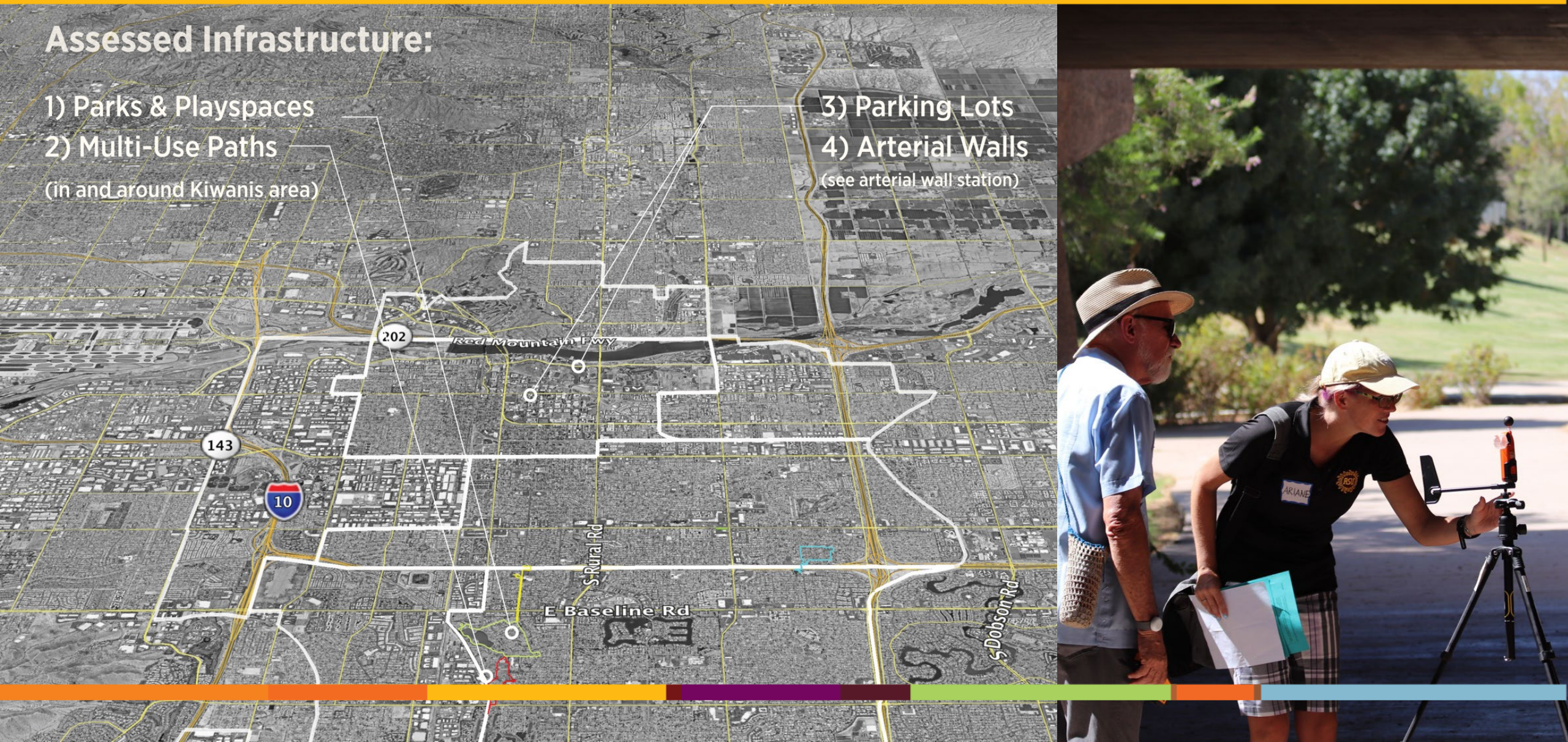
1. Arable Weather Stations, sun/shade
2. MaRTy Transect Assessment

Field Work, August – October, 2019

MaRTy Transects

Heat Walk - “Informed and hot!”

Field Work Locations



Park & Playspaces, Kiwanis Park

Mean Radiant Temperature (MRT), 8am

KIWANIS PARK PLAYSPACES:

Details of the data collection

Day: September 12, 2019

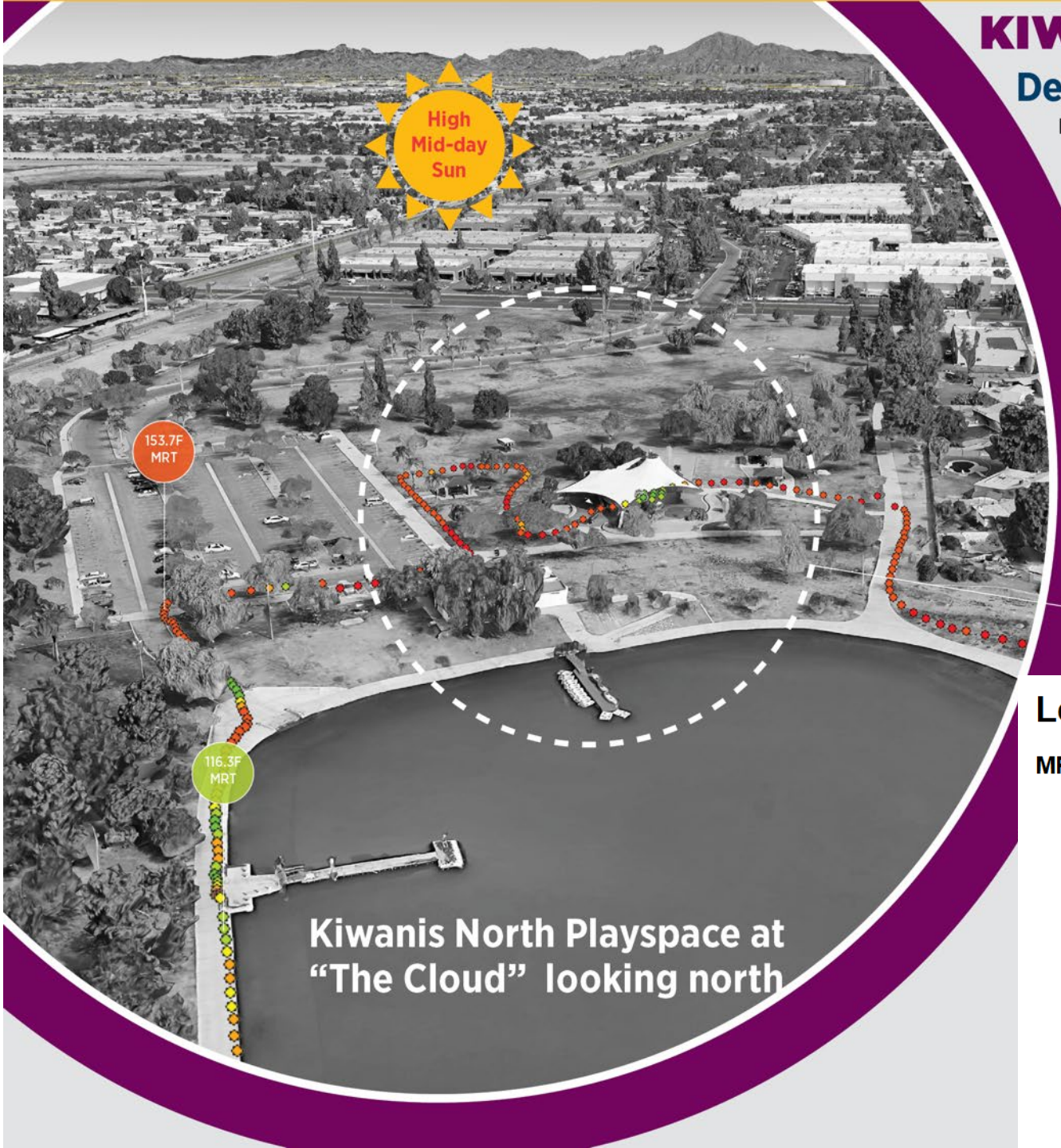
Daytime high air temperature: 102F

Morning low air temperature: 80F

Sunrise: 6:09 am

Sunset: 6:38 pm

12PM

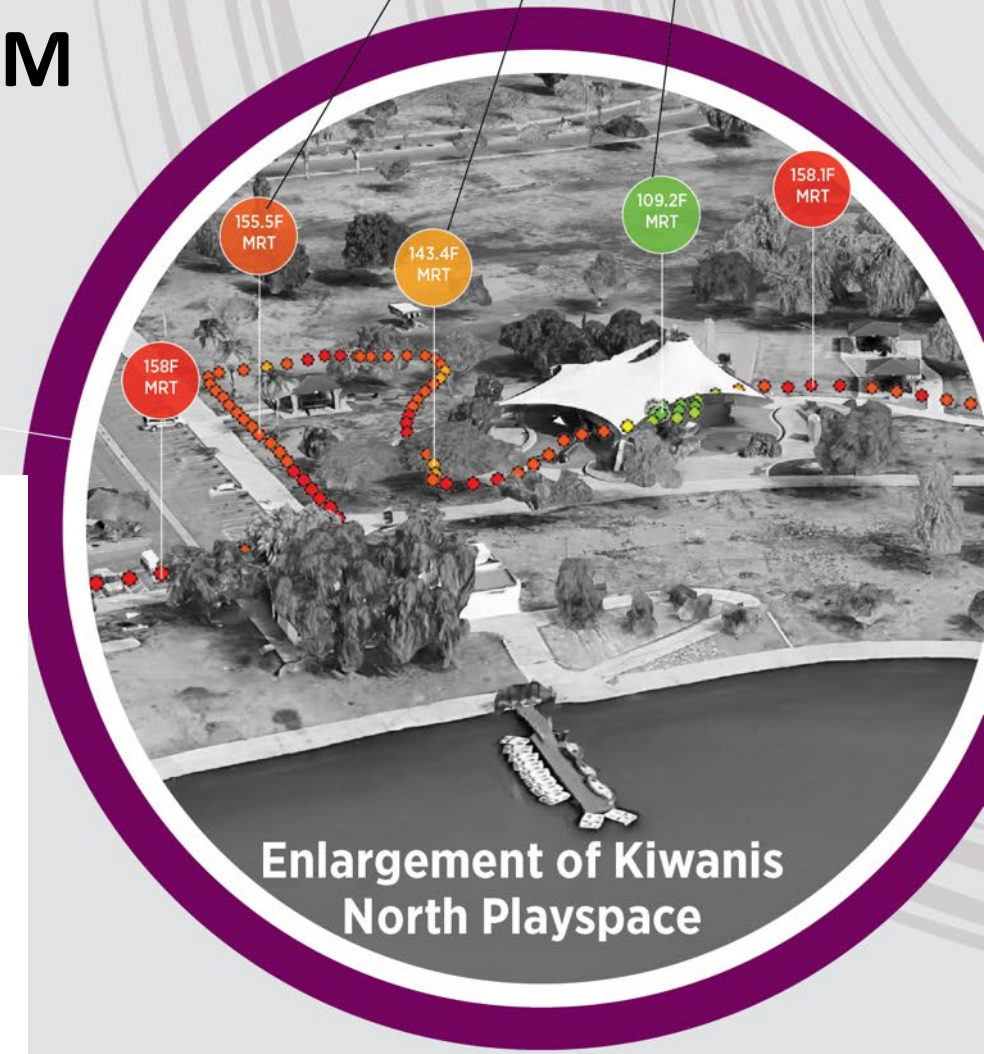


Mid-day Highlights:

155F MRT by unshaded parking

136-146F MRT under Palo Verde

106-116F MRT in shade



Legend

MRT [Deg F]

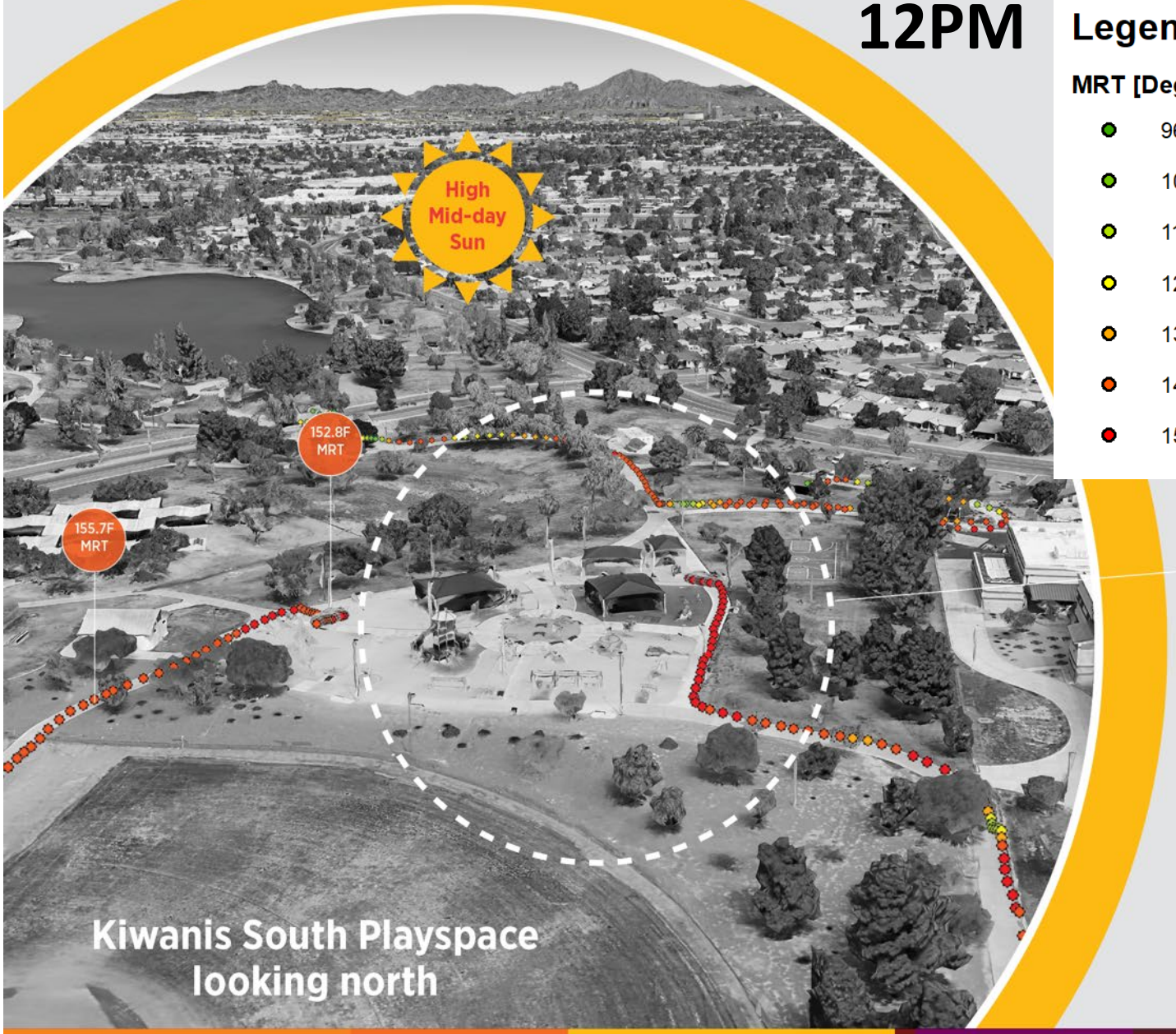
- 96.1 - 106.0
- 106.1 - 116.0
- 116.1 - 126.0
- 126.1 - 136.0
- 136.1 - 146.0
- 146.1 - 156.0
- 156.1 - 166.0

12PM

Legend

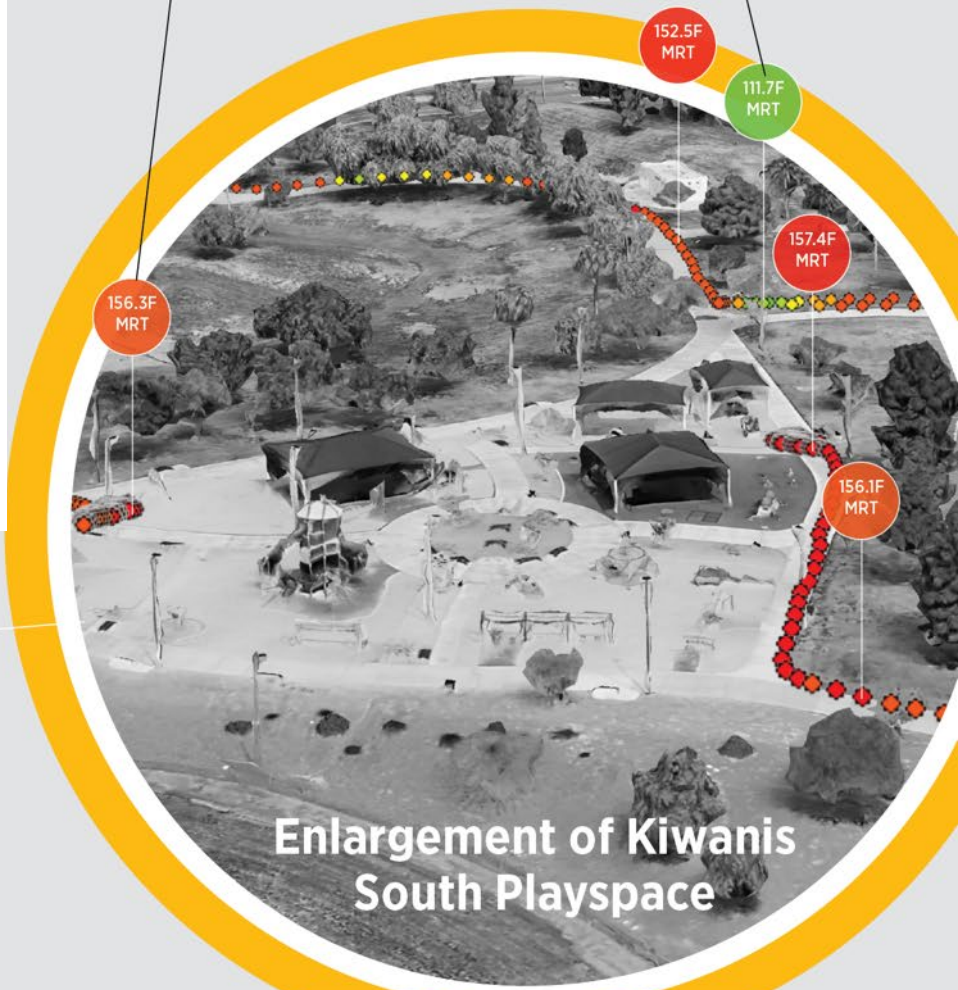
MRT [Deg F]

- 96.1 - 106.0
- 106.1 - 116.0
- 116.1 - 126.0
- 126.1 - 136.0
- 136.1 - 146.0
- 146.1 - 156.0
- 156.1 - 166.0



Kiwanis South Playspace looking north

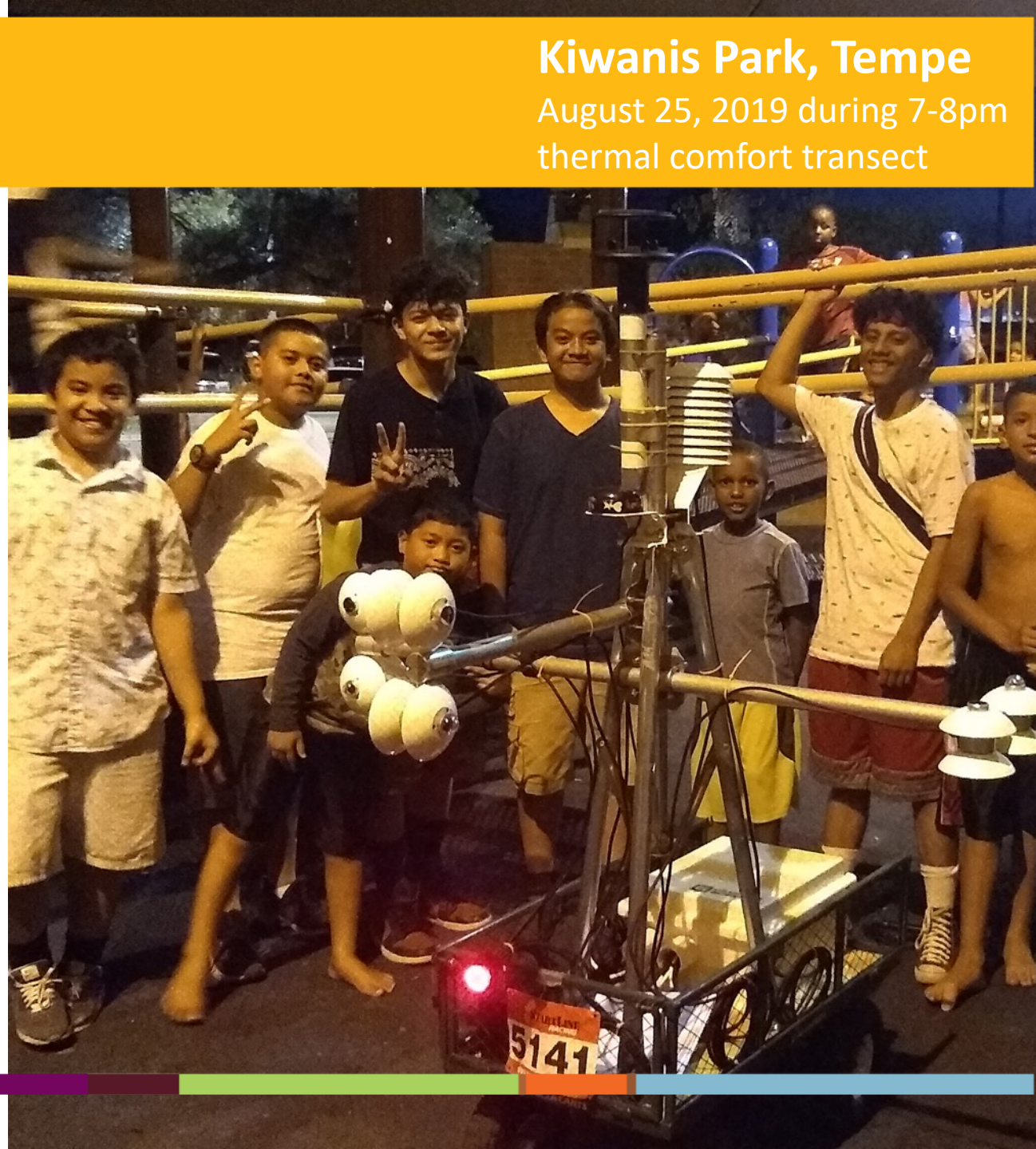
Mid-day Highlights:
+156F MRT on unshaded playground
106-116F MRT under tree shade



Enlargement of Kiwanis South Playspace

Parks & Playspaces

Kiwanis Park, Tempe
August 25, 2019 during 7-8pm
thermal comfort transect



Key points:

- Tension between accessibility and surface temperature hazards
- Trees and shade structures can reduce MRT by 30-50°F at noon
- Focus on creating more usable playspaces for more hours each day and longer season - shade
- Data collection can be an engagement activity –
  - **Informal** questions from public
  - **Formal** Heat Walk

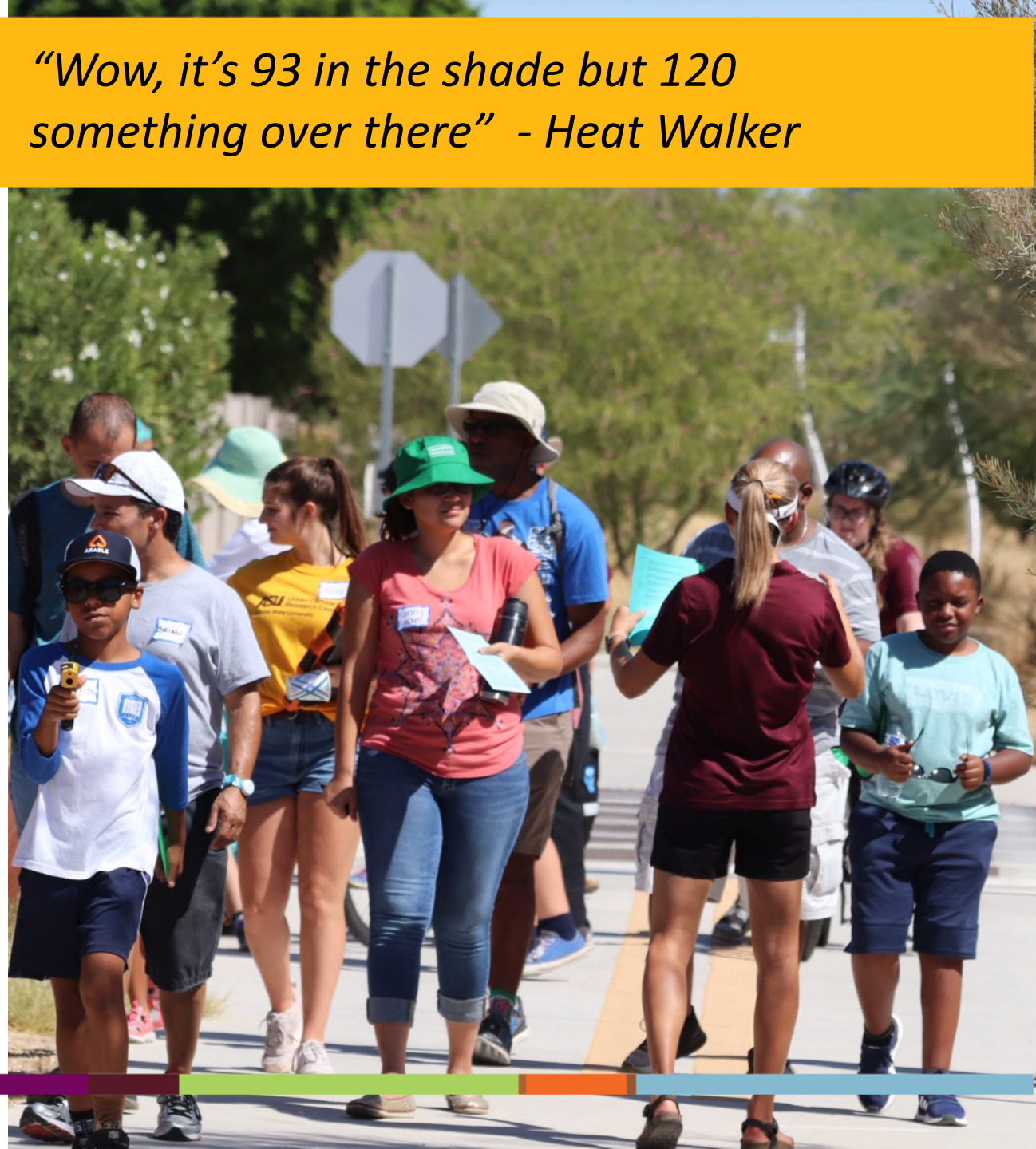

COMMUTE TIMES
Morning Commute (8am):
+140F MRT on unshaded College Ave
125-135F MRT on El Paso Path
95-105F MRT on El Paso Path
El Paso Path
8AM
Legend
MRT [Deg F]
85.1 - 95.0
95.1 - 105.0
105.1 - 115.0
115.1 - 125.0
125.1 - 135.0
135.1 - 145.0
145.1 - 155.0
Morning Commute Highlights (8am):
85-95F MRT on many parts of Western Canal Path
+140F MRT on unshaded All American Way
Details of the data
Day: September 12, 2019
Sky Harbor daytime high air temperature: 102F
Sky Harbor morning low air temperature: 80F
Sunrise: 6:09 am
Sunset: 6:38 pm
Multi-Use Paths
Kiwanis Park
Kiwanis Park
105.2F MRT
86.4F MRT
137F MRT
131.1F MRT
142.9F MRT
128.7F MRT
104.1F MRT
88.6F MRT
85.64F MRT
146.6F MRT
College Ave
E Sesame St
S All American Way
E Paseo Way
E Woodman Dr
S College Ave
E Gemini Dr
E Julie Dr
Western Canal
Guadalupe Rd
All American Way

Multi-Use Paths

"Wow, it's 93 in the shade but 120 something over there" - Heat Walker

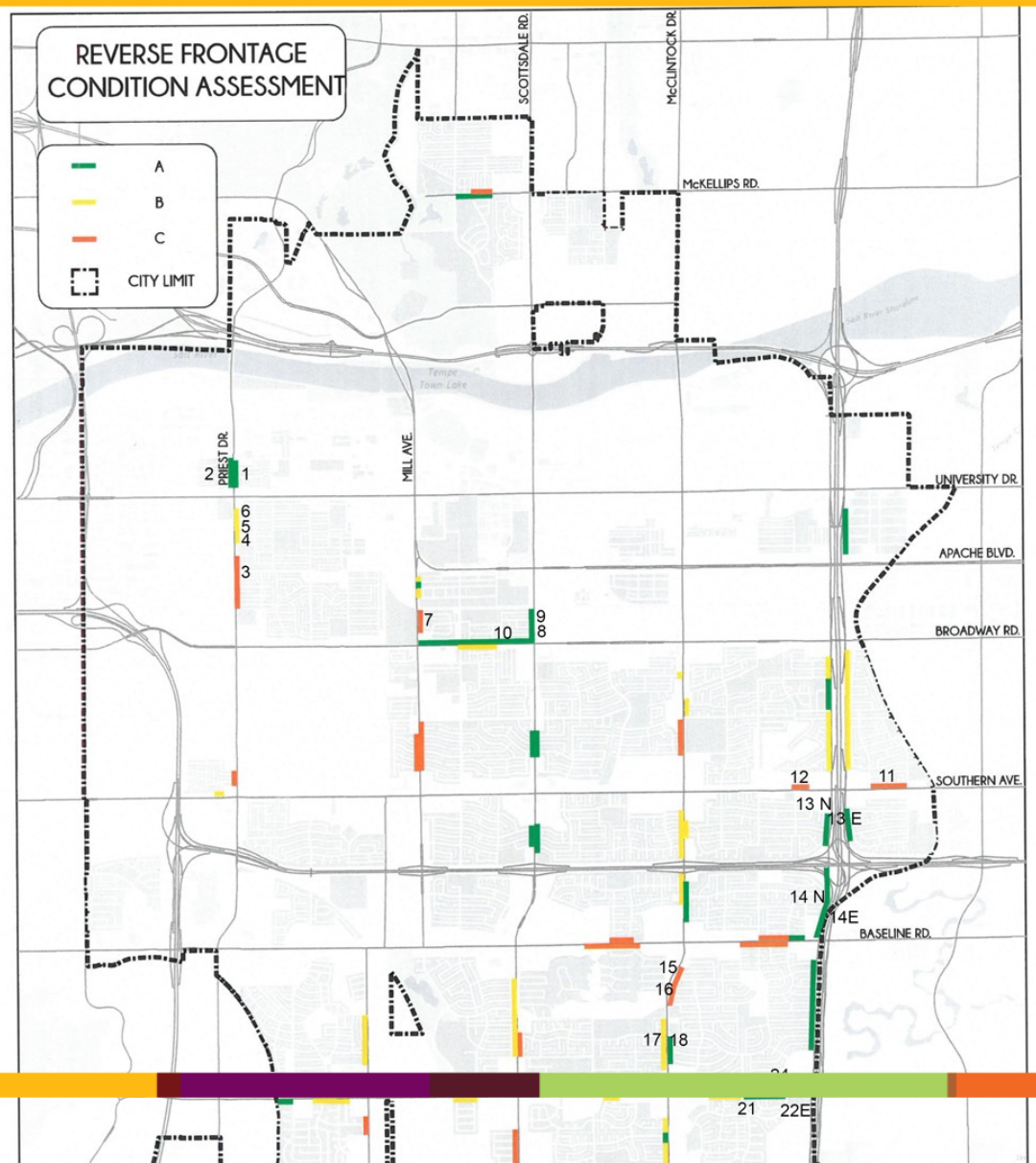
Key points:

- At 8am commute time, shaded parts of North-South Western Canal path were up to 60°F cooler (MRT) than sun soaked All American Way
- East-West El Paso Path MRT was 10-40°F cooler than adjacent College Ave
- Heat walks help align thermal experience, MRT, and surface temperature data and promote learning



Arterial Walls

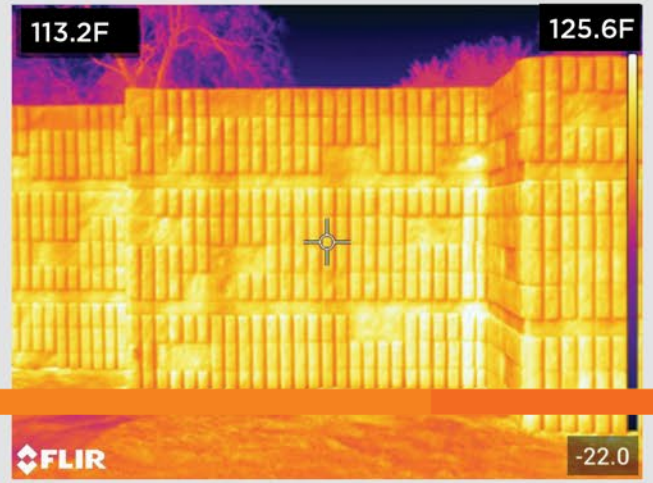
Mostly Central and Northern Tempe



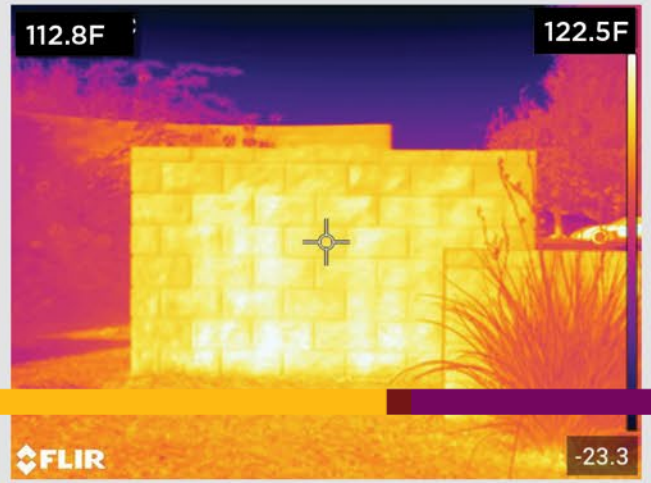
Surface Temperatures

0900
10.12.2019

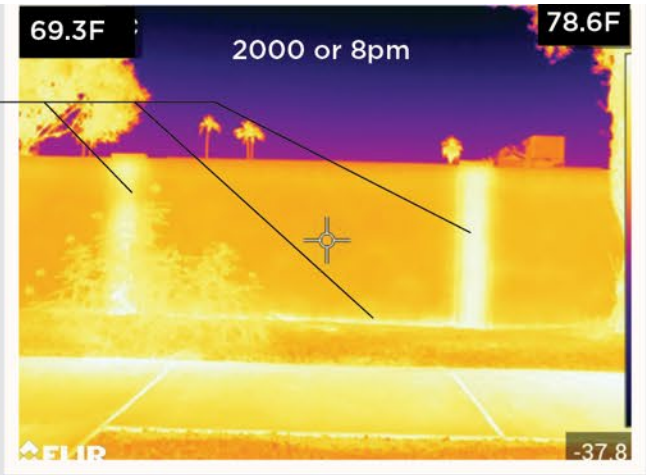
9 - East-facing wall



2 - East-facing wall



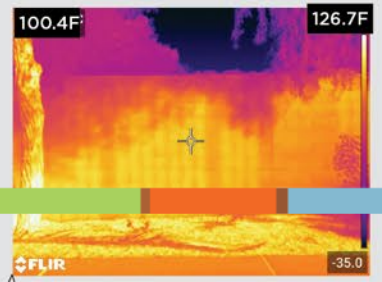
Structural concrete columns and ground beams, due to increased density and thermal capacity, showed highest night time temperatures



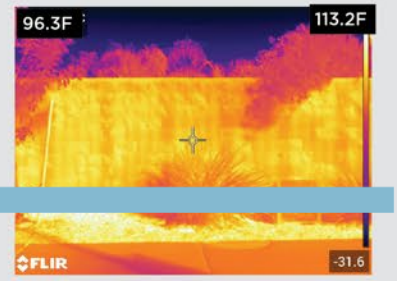
0900
10.19.2019

24 - South-facing wall

20 - South-facing wall



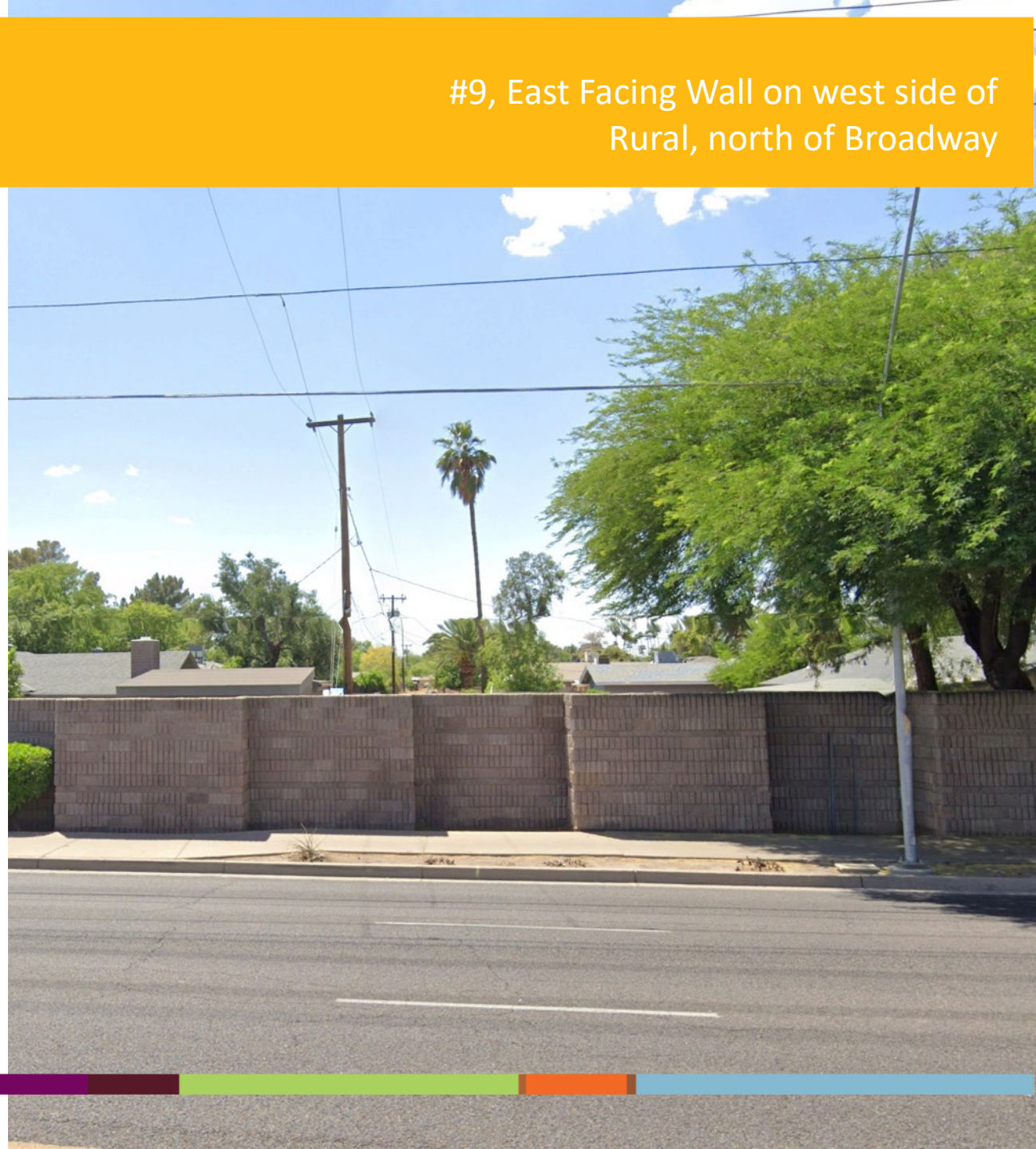
19 - South-facing wall



Arterial Walls

Key points:

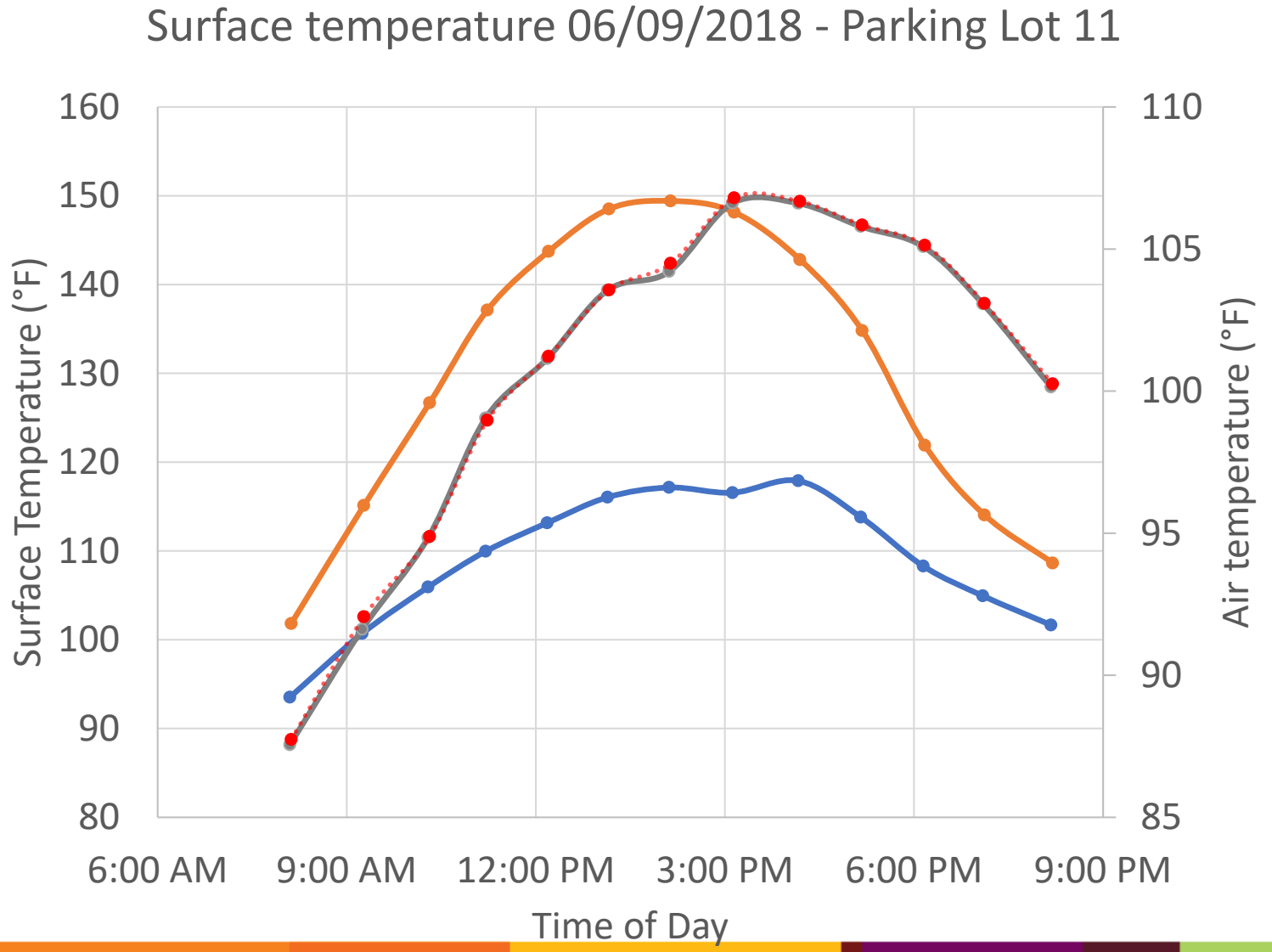
- Shade, thermal capacity, and orientation impact on surface temperatures
- Thermal performance varied depending on hour of day
- Structural concrete columns and ground beams showed highest night time temperatures
- The effect of wall surface roughness, as in smooth versus rough masonry, was not thermally visible.



#9, East Facing Wall on west side of Rural, north of Broadway

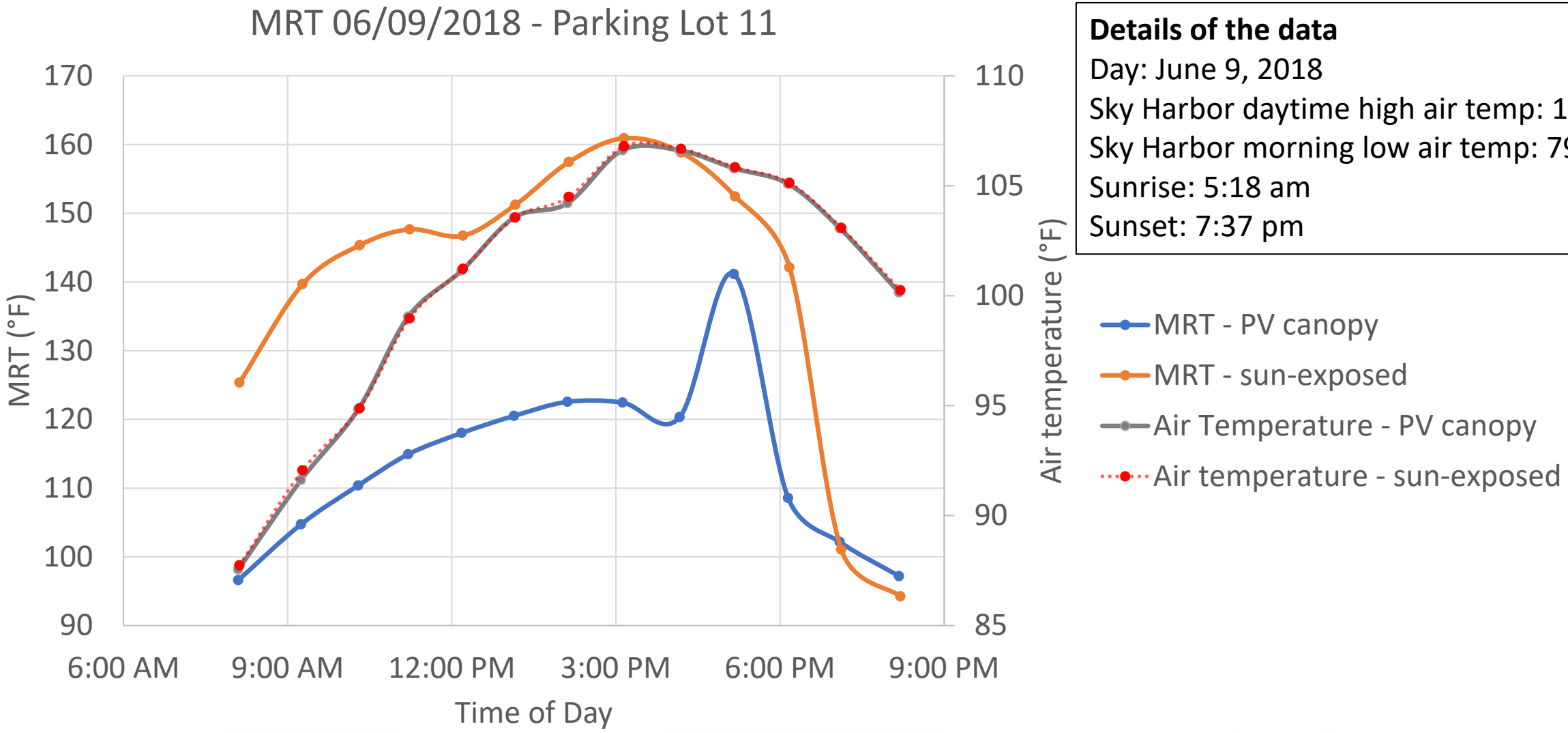
Parking Lots

Surface Temperatures



Details of the data
Day: June 9, 2018
Sky Harbor daytime high air temp: 108F
Sky Harbor morning low air temp: 79F
Sunrise: 5:18 am
Sunset: 7:37 pm

Mean Radiant Temperatures



Details of the data
Day: June 9, 2018
Sky Harbor daytime high air temp: 108F
Sky Harbor morning low air temp: 79F
Sunrise: 5:18 am
Sunset: 7:37 pm

Parking Lots

Key points:

- Lot 11 has strong differences between sun-exposed and PV shaded areas for mean radiant temperature (MRT) of up to 40F.
- Lot 11 shows also strong differences in the surrounding surface temperature underneath the instrument (up to 30F).
- Lot 11 – differences for surface temperature and MRT are much slower or non-existent during the night hours

Conclusions

- Aligning research with City challenges and priorities requires common understanding of the challenge between city and academic partners including intention in how findings will be used to guide policy
- Data can be integrated into existing City GIS database to map thermal performance of infrastructure at different times of days and seasons
- Extreme heat's subjective nature is different from other hazards (e.g. flooding) and thus thermal comfort and experience is a critical piece to integrate into any policy to improve resilience to extreme heat