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Smart Surfaces, Smart Cities:

Reducing Heat and Promoting Equity in Urban Areas

By Hillary Aidun

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1. INTRODUCTION

The summer of 2021 underscored that we are all affected by climate change impacts, whether in the form of heatwaves, fires, or extreme flooding. But some Americans are far more affected than others. Urban centers are hotter than rural areas due to urban heat island effect, a phenomenon caused by pavement, buildings, and other surfaces in cities that absorb and retain heat.[1] In the United States, urban heat island effect results in a temperature difference of up to 7.2 degrees between cities and their surrounding rural areas.[2] Moreover, within cities, extreme heat disproportionately harms communities of color and low-income communities.[3] As climate change continues to raise baseline temperatures and make deadly heat waves more likely to occur, addressing urban heat island effect has become an urgent issue.

For this reason, cities are increasingly interested in adopting "smart surfaces." The term refers to a set of surface technologies that allow cities to better manage sunlight and rainwater, including: (1) surfaces that reflect light such as light-colored pavements, parking lots, and rooftops (white roofs); (2) surfaces that provide shade such as trees and rooftops covered with vegetation (green roofs); (3) green infrastructure such as bioswales, raingardens, and other natural systems that reduce stormwater runoff; (4) porous surfaces that reduce stormwater

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[1] Hibbard, K.A., F.M. Hoffman, D. Huntzinger, and T.O. West, 2017: Changes in land cover and terrestrial biogeochemistry. In: *Climate Science Special Report: Fourth National Climate Assessment, Volume I* [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 277-302, doi: 10.7930/J0416V6X.

[2] *Id*. at 277.

[3] Susanne Amelie Benz and Jennifer Anne Burney, *Widespread Race and Class Disparities in Surface Urban Heat Extremes Across the United States*, EARTH'S FUTURE, July 2021; GREG KATS & ROB JARRELL, SMART SURFACES COALITION, COOLING CITIES, SLOWING CLIMATE CHANGE AND ENHANCING EQUITY 11, 31 (2021), *available at* https://smartsurfacescoalition.org/s/Smart-Surfaces-for-Baltimore-xmw6.pdf.

runoff; (5) solar photovoltaics, which convert sunshine into electricity and provide shading; and (6) combinations of different types of smart surfaces.[4] Smart surfaces reduce temperatures in the immediate term by absorbing less heat than dark and impervious surfaces. Additionally, by avoiding excessive heat, smart surfaces can achieve greenhouse gas emission reductions by decreasing the need for electricity to cool buildings. As a result, smart surfaces serve as both a climate change mitigation and a climate change adaptation measure.

While cities have many policy options for expanding smart surfaces, they also face certain legal barriers. This white paper discusses those barriers and seeks to offer potential solutions to local governments.

2. ROOFTOP SOLAR AND GREEN ROOFS

This section discusses potential hurdles to expanding smart surfaces on rooftops, including through roofs with vegetation—known as green roofs—and rooftop solar energy installations.

2.1 Building Codes: State Preemption

Some cities have adopted building codes to promote smart surfaces such as green roofs and rooftop solar. For example, in 2017 San Francisco imposed a green roof requirement by enacting the Better Roofs Ordinance, which provides that 15-30% of roof space on

[4] SMART SURFACES COALITION, https://smartsurfacescoalition.org/ (visited Sep. 7, 2021).

most new construction projects must incorporate solar panels, green roofs, or a blend of both.[5] In 2019 New York City enacted the Climate Mobilization Act, which similarly requires that every new building have a green roof or rooftop solar (allowing for certain limited exceptions).[6]

However, state law can act as a barrier to cities that want to develop their own building codes in order to promote smart surfaces. Some states, such as Michigan and Minnesota, have uniform building standards that expressly preempt municipal building codes, creating a potential barrier.[7] Other states, like Oklahoma, have uniform building standards but allow municipalities to develop local standards that are more stringent than the state ones, providing some flexibility to cities.[8] And some states have no statewide building code, providing maximum flexibility to local governments. Under each of these legal frameworks, there is significant variability; for example, a local government may have relatively wide latitude to enact local building code requirements but need state agency sign-off to do so.

Under California law, municipalities may depart from statewide building standards where divergent measures are "reasonably necessary because of local climatic, geological, or topographical conditions."[9] This language provides an opportunity for California cities to require green or white roofs or rooftop solar through their building codes. In creating a mandate that new buildings have green roofs or rooftop solar, San Francisco accordingly relied on a finding that the building code amendment was necessary due to local climatic, topological, and geological

[5] San Francisco, Ordinance No. 221-16 (2016) § 4.
[6] New York City, Local Law No. 92 (2019).
[7] M.C.L. § 125.1508a; Minn. Stat. § 16B.62, subd. 1.
[8] OK ST T. 59 § 1000.29.
[9] CA HLTH & S § 17958.5.

conditions, including San Francisco's vulnerability to sea level rise linked to greenhouse gas emissions and that San Francisco's elderly population may be threatened by higher temperatures resulting from climate change.[10] It is important to note that, in order to justify a deviation in building code, a California local government need not demonstrate that "local climatic, geological, or topographical conditions" are unique or different from statewide conditions. Rather, the deviation in building code must simply be reasonably necessary *due* to local conditions.[11] The fact that other parts of California—or even the whole state—is grappling with heat, drought, or sea-level rise does not preclude a California city from invoking its own local conditions to justify a building code that diverges from statewide standards.

In determining whether to require or incentivize smart surfaces in a local building code, therefore, a key question is what authority a local government possesses to amend the building code at the local level or to promulgate construction requirements without risking preemption by the state building code. Additionally, some local governments will face different barriers even if they are located in the same state. For example, while New York City has its own building code, most New York State municipalities must follow the state building code.[12] A careful review of applicable state law would be needed to determine the extent any one city's authority over building codes.

[10] San Francisco, Ordinance No. 221-16 (2016) § 3.

[11] *See ABS Institute v. City of Lancaster*, 24 Cal.App.4th 285, 294 (Ct. of App. 2d Dist. Cal 1994).

[12] New York State's building and fire prevention codes came into effect in 1984, preempting existing municipal codes except in any city with a population above one million people. NY EXEC. LAW § 383.

2.2 Fire Codes

In cities seeking to expand solar panels, fire codes can also pose a barrier. Fire codes impose requirements to avoid rooftop obstruction and ensure rooftop access for fire fighters, which can preclude some buildings from being able to host rooftop solar.

For example, in New York City, all solar panels on a flat-top roof must comply with NYC Fire Code Section 504.4 governing rooftop access and obstructions, including a requirement that the rooftop of every building have a six-foot clear path running from the front to the back of the building and another six-foot clear path running from side to side.[13] This requirement has presented a barrier to installing large solar systems on New York City roofs.[14] In a 2013 report, the Urban Green Council proposed amendments to the fire code that would permit certain rooftops that are the same height and physically adjoining to be consolidated for purposes of meeting the rooftop access and obstruction standards in order to allow rooftop solar to be sited.[15] Other cities may consider adopting this type of amendment to allow solar panels to be sited while ensuring fire fighter safety.

[13] NYC Fire Code §§ 504.4, 512.2

[14] URBAN GREEN, BUILDING RESILIENCY TASK FORCE, REPORT TO MAYOR MICHAEL BLOOMBERG & SPEAKER CHRISTINE C. QUINN 106 (June 2013).

[15] *Id*. at 102. The NYC Fire Code was amended in 2014, but this recommendation was not adopted. *See* NYC Fire Code § 504.4. In fact, the New York City Fire Department recently proposed new rules that, according to the Solar Energy Industries Association, would reduce the available area for rooftop solar panels by at least 40%. *See* Proposed 2021 New York City Fire Code, *available at* https://on.nyc.gov/3BTVYzH; Alexander C. Kaufman, *NYC Is More Addicted to Fossil Fuels Than Ever. Now It May Make Solar Harder To Build*, HUFFINGTON POST, July 30, 2021.

2.3 Landmark/Historic Preservation Laws

In some cities, landmark or historic preservation requirements can also be a barrier to rooftop solar. New York City again provides a useful example. New York's Landmarks Preservation Commission rules treat solar panels as "mechanical equipment," and as such, impose strict standards on whether and to what extent solar panels can be visible.[16] The Landmarks Preservation Commission has recognized New York City's climate goals and the need to increase rooftop solar, but under its rules, considers many applications for rooftop solar permits on a case-by-case basis because panels are more than minimally visible.[17] In Washington, D.C., solar advocates have also encountered roadblocks in historic districts. In October 2019 the D.C. Historic Preservation Review Board denied a proposal from a homeowner to locate solar panels on the front of his roof.[18] Following public protest, however, the Board later revised its guidelines to allow for front-facing solar panels.[19]

Officials in city agencies working to promote rooftop solar specifically, or smart surfaces generally, may wish to coordinate with their counterparts in landmarks preservation agencies. This collaboration would help to ensure that preservation requirements do not interfere with efforts to expand smart surfaces. Moreover, cities may consider amending relevant preservation rules to allow for solar panels to be more easily sited in historic districts. For examples, cities like

[16] NYC LANDMARKS PRESERVATION COMMISSION GUIDANCE, SOLAR PANELS, *available at* https://bit.ly/3yCkcME.

[17] *Id*.

[18] D.C. Historic Preservation Review Board Public Hearing of Oct. 3, 2019, *available at* https://bit.ly/3DHVqyi.

[19] D.C. Historic Preservation Review Board Public Hearing of Dec. 19, 2019, *available at* https://play.champds.com/dczoning/event/72.

New York that currently treat solar panels as mechanical equipment could consider amending their landmark preservation rules to provide specific standards and procedures for solar panels. This would obviate the need for a case-by-case determination on each permit application and streamline the process of siting rooftop solar.

3. PAVEMENT

This section discusses potential hurdles to cities seeking to expand smart surfaces on paved areas such as streets and parking lots, including by promoting reflective pavements, porous pavements, trees, and green infrastructure like rain gardens and bioswales. The section addresses issues regarding city jurisdiction over public roads and streets, and the challenges associated with regulating private land such as the potential for takings claims.

3.1 Public Streets and Roads: City v. State Jurisdiction

Cities can and do capitalize on their street networks to expand smart surfaces. Some cities have increased smart surfaces by requiring vegetation or green infrastructure on public streets. For example, Tucson's Green Streets policy requires that all new publicly funded roadway development and re-development projects meet a 25% tree canopy cover and a 25% shrub and grass cover standard.[20]

[20] City of Tucson, Arizona, Department of Transportation, Engineering Design Active Practices Guidelines (updated Aug. 6, 2013), *available at* https://bit.ly/3y5syfP.

Cities have also started to use streets to promote smart surfaces by increasing reflective or porous pavements. In 2015 the Los Angeles Bureau of Street Services (StreetsLA) initiated the installation of solar reflective "Cool Pavements" across the city's fifteen City Council Districts.[21] Additionally, in New Orleans, "any public works project involving the permanent installation of paving on public property, including without limitation parking lanes, sidewalks, parking lots, and pedestrian pathways, shall utilize porous or permeable paving materials," with limited exceptions.[22]

Of course, cities may only make such improvements and impose such requirements on streets under their jurisdiction. A "street" is generally defined as a road or way that is open to vehicular traffic within a municipality, and the term is typically not applicable to roads and highways outside of municipalities.[23] States ordinarily have primary authority over control of public highways, roads, and bridges, but where allowed by statute, a state can delegate responsibilities for public roads to political subdivisions, including cities.[24] Typically state statutes grant cities police power that includes the authority to change or alter city streets.[25] The grounds for such change or alteration might require a determination that it serves the public interest and convenience.[26] Depending on the relevant statutory authority, therefore, cities might need to issue findings regarding the benefits of smart surfaces prior to launching a program like

[21] FALAK FATIMA ZAIDI, COOL PAVEMENT EVALUATION, SUN VALLEY, LOS ANGELES 6 (June 2020).

[22] New Orleans Home Rule Charter, Ch. 146, Art. II, Div. I § 146-73.

[23] *Am. Metal Works, LLC v. Waverly*, 77 N.E.3d 442 (Ohio Ct. App. 4th Dist. Pike County 2017); 39 Am. Jur. 2d Highways, Streets, and Bridges § 4 (Aug. 2021).

[24] 39 Am. Jur. 2d Highways, Streets, and Bridges §§ 24, 51 (Aug. 2021).

[25] *Reding v. Wagner*, 86 S.W.3d 386 (Ark. 2002); 39 Am. Jur. 2d Highways, Streets, and Bridges § 89 (Aug. 2021).

[26] *See, e.g., Argo Inv. Corp. v. State, By and Through Dept. of Transp.*, 674 P.2d 620, 622 (Or. 1984).

the Los Angeles "Cool Streets" initiative. These include improved public health, lower utility bills, and increased economic activity associated with tourism, among others.[27]

Some states retain ownership and control of city streets even where the local government is responsible for day-to-day maintenance.[28] Additionally, even where state law grants authority over city streets to local governments, officials must distinguish between city streets and state-controlled highways that happen to be located within city limits. The Supreme Court of Rhode Island, for example, has cautioned that the state maintains "its statutory power to construct and maintain state sidewalks fortuitously found within municipal borders."[29] In states where local governments do not have authority over city streets, cities might need to work with their state governments to undertake smart surfaces programs, for example, through construction projects authorizing the city to make improvements to local streets.[30]

Another key principle is that cities generally lack the authority to convey public property to private parties.[31] Therefore, cities seeking to increase tree cover or green infrastructure on city

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[27] *See* KATS & JARRELL, *supra* note 3 at 13, 14, 18.

[28] *See, e.g.*, *State v. Butte-Silver Bow County*, 220 P.3d 1115, 118 (Mont. 2009) ("Under Montana law, the State, not the City, has ownership and control of all city streets, with local government as the trustees.") (quoting *Montana-Dakota-Utilities Co. v. City of Billings*, 80 P.3d 1247, 1254 (Mont. 2003) (internal citations and alterations omitted).

[29] *Pullen v. State*, 707 A.2d 686, 698 (R.I. 1998).

[30] *See, e.g.*, *State ex rel. City of Helena v. District Court of First Judicial Dist.*, 536 P.2d 1182, 1184 (Mont. 1975) (recognizing, under Montana law, construction agreement between state and city regarding project on city streets).

[31] *See, e.g.*, *Infanger v. City of Salmon*, 44 P.3d 1100, 1104 (Idaho 2001) ("Under Idaho law . . . a city has no authority to convey a portion of a city street. In Idaho, city streets from side to side and end to end belong to the public and are held by the municipality in trust for the use of the public."); *Sloan v. City of Greenville*, 111 S.E.277, 283 (S.C. 1959) ("[S]ince a municipal corporation holds and controls its streets, in trust, for the use and benefit of the general public, it is without authority to convert such streets of any other use.)"; *see also* 39 Am. Jur. 2d Highways, Streets, and Bridges § 29 (Aug. 2021) (explaining that a street "is held in trust by the state or local government for the public use").

streets must consider the potential need to retain ownership of those streets, even if installation projects are undertaken by private entities.

3.2 Limitations on Zoning Authority

Cities can also use their zoning authority to promote smart surfaces on private property, like parking lots and private streets. For example, the Lexington-Fayette County Zoning Ordinance establishes standards and procedures for countywide tree protection and planting in new developments and re-developments.[32] The City of Phoenix Zoning Ordinance provides that streets without on-street parking must have landscaping strips with vegetation such as trees or bioswales.[33]

A city's authority to enact zoning must be exercised in accordance with state and local law, and zoning restrictions must bear a substantial relation to public health, safety, or general welfare.[34] As noted above, it is not difficult to demonstrate a connection between smart surfaces and public health, safety, and the general welfare. Cities can recognize this relationship in legislative findings or other statements accompanying a zoning ordinance or zoning revision imposing smart surfaces requirements.

[32] Lexington-Fayette County Zoning Ordinance, Article 26.

[33] City of Phoenix Zoning Ordinance Ch. 12 § 1207(I)(2)).

[34] *Vill. of Euclid v. Ambler Realty Co.*, 272 U.S. 365, 395 (1926); *Trustees of Union College v. Schenectady*, 690 N.E.2d 862, 863 (1997); *Square Lake Hills Condominium Ass'n v. Bloomfield Tp.*, 471 N.W.2d 321, 324 (Mich. 1991).

In some states, local zoning authority flows from a city's inherent police powers.[35] In others, however, a city's power to zone is delegated from the state legislature.[36] Additionally, one state might contain cities with inherent police powers—known as "home rule" municipalities—and others that possess only the authorities delegated to them by statute—known and "non-home rule municipalities."[37]

Where a city's zoning authority is delegated rather than an inherent function of its police power, it is more likely to face preemption by state law. For example, under Illinois law, a non-home rule local government "may regulate in a field occupied by state legislation when the Constitution or a statute specifically conveys such authority," [38] but even where a local government has the authority to regulate in a particular area, "ordinances enacted under those powers that conflict with the spirit and purpose of a state statute are preempted by the statute."[39] Determining the extent of a city's zoning authority will require discerning whether that authority is inherent or delegated by statute, and if the latter, the reach of any existing relevant state law.

Additionally, some states have specific statutory limitations on local governments' zoning authority. For example, Michigan's Zoning Enabling Act provides:

> A zoning ordinance or zoning decision shall not have the effect of totally prohibiting the establishment of a land use within a local unit of government in the presence of a demonstrated need for that land use within either that local unit of government or the surrounding area within the

[35] *Vill. of Euclid*, 272 U.S. at 395.
[36] *See, e.g.*, *Village of Sugar Grove v. Rich*, 808 N.E. 2d 525, 530 (Ill. App. 3d 2004).
[37] *Id*.
[38] *Id*.
[39] *Hawthorne v. Village of Olympia Fields*, 790 N.E.2d 832, 842 (Ill. 2003).

> state, unless a location within the local unit of government does not exist where the use may be appropriately located or the use is unlawful.[40]

"[A]n ordinance need not completely exclude a use on its face to violate [Michigan's Zoning Enabling Act]. It may merely make the use a practical impossibility."[41] Michigan cities must therefore be sure that any zoning provision to promote smart surfaces does not have the effect of precluding a lawful land use.

In addition, it is possible that certain zoning requirements could be considered takings under the Fifth Amendment of the U.S. Constitution. A taking occurs when the government encroaches on or occupies private land for its own proposed use.[42] Takings are permissible, but require just compensation to the property owner.[43] Takings challenges to smart surfaces initiatives are likely to fall within two categories: regulatory takings or exactions.

A regulatory taking occurs where the government, through lawmaking or other governmental restriction, deprives a property owner of "all economically beneficial use" of their property.[44] Where the use of smart surfaces eliminates the possibility of economically viable development on a particular lot courts might find a taking has occurred. However, regulatory takings are relatively rare, and successful challenge requires "government regulation of private property . . . so onerous that it is tantamount to a direct appropriation of the property."[45]

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[40] MCL 125.3207.

[41] *Landon Holdings, Inc. v. Grattan Tp.*, 667 N.W.2d 93, 102 (Mich. App. 2003).

[42] *Palazzolo v. Rhode Island*, 533 U.S. 606 (2001).

[43] *Kelo v. City of New London, Conn.*, 545 U.S. 469 (2005).

[44] *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1019 (1992).

[45] Kate Madden, *Denver's Green Roof Initiative: Is it Susceptible to Developer Challenge?*, 95 DEN. L. REV. 133, 135 (2018) (quoting *Lingle v. Chevron*, 544 U.S. 528, 537 (2005)).

A compensable exaction taking can occur where a government places a condition on its approval of a property development, such as the grant of a permit application.[46] However, no taking has occurred, and no compensation is needed, where the government's condition bears an "essential nexus" to a legitimate government interest and is roughly proportional to the projected impact of the proposed development.[47] As discussed, smart surfaces promote legitimate government interests such as improving public health. Additionally, smart surfaces requirements could be designed to be proportional to the projected impact of a proposed development: for example, a requirement tailored to mitigate the potential heat impacts of a new street. Therefore, a development approval condition requiring the use of smart surfaces need not constitute a compensable extraction taking.

In sum, cities generally have broad zoning authority, which can be leveraged to increase smart surfaces on private property. However, there may be potential conflicts with state law or other restrictions imposed by their states; and in some contexts policy might give rise to the possibility that certain actions will require just compensation.

4. PUBLIC PROCUREMENT

Cities might also seek to expand smart surfaces through their own contracts with goods and services suppliers, for example, by only hiring contractors who use reflective or permeable

[46] Determination Whether Exaction for Property Development Constitutes Compensable Taking, 8 A.L.R.7th 7 (citing *Nollan v. Cal. Coastal Comm'n*, 483 U.S. 825 (1987); *Dolan v. City of Tigard*, 512 U.S. 374 (1994)).

[47] *Id.*; *see also* Madden, *supra* note 45 at 135.

pavement for improvements on public streets. However, in some instances public procurement requirements can pose a barrier to this approach.

It is generally considered to be in the public interest that public contracts be submitted to competitive bidding. As a result, most jurisdictions are subject to requirements prescribing competitive bidding and providing that public authorities must contract with the lowest bidder, or the lowest responsible bidder.[48] (The "lowest responsible bidder" is the bidder offering the lowest bid that complies with all applicable requirements.[49]) Competitive bidding requirements can present a hurdle for smart surfaces projects because the materials used to construct smart surfaces often carry a relatively high upfront cost even though cities using smart surfaces can achieve significant cost savings in the long term.[50]

Competitive bidding requirements often flow from state constitutions and statutes, and are therefore not subject to change by local action.[51] However, in the absence of a controlling constitutional or statutory provision, public policy does not require that a local government grant contracts to the lowest bidder.[52] As a consequence, cities that are not in states that impose competitive bidding requirements can focus on their own public procurement policies to ensure that such requirements will not interfere with efforts to expand smart surfaces. For example, cities may consider using best value procurement methods—as opposed to lowest cost procurement

[48] *See, e.g.*, *Wallace C. Drennan, Inc. v. Sewerage & Water Bd. Of New Orleans*, 798 So.2d 1167, 1177 (La.App. 4 Cir. 2001); *Shaeffer v. City of Lancaster*, 754 A.2d 719, 724 (Pa. Cmwlth. 2000); *Kimbrell v. State*, 132 So.2d 132, 136 (Ala. 1961); *Spitcaufsky v. State Highway Com'n of Missouri*, 159 S.W.2d 647, 651 (Mo. 1941); *see also* 64 Am. Jur. 2d Public Works and Contracts § 25 (Aug. 2021).

[49] *Wallace D. Drennan*, 798 So.2d at 1171.

[50] *See* KATS & JARRELL, *supra* note 3 at 17-18.

[51] *See supra* note 48.

[52] *Griswold v. Ramsey County*, 65 N.W.2d 647 (Minn. 1954); 64 Am. Jur. 2d Public Works and Contracts § 27 (Aug. 2021).

methods—which take into account total costs and benefits of the procured goods or services.[53] Under this approach, cities could assign value to the impacts of heat mitigation, such as tourism dollars and health benefits.

Even cities that are subject to statewide competitive bidding requirements have some opportunities for flexibility. In many instances competitive bidding mandates only attach to bids of a certain size.[54] Cities can therefore promote smart surfaces through relatively small or pilot projects without running afoul of competitive bidding issues. Additionally, some state competitive bidding laws provide exceptions where a producer can be considered the "sole source" of a good or service that a public authority needs.[55] However, uniqueness alone may not be sufficient to qualify a producer as a "sole source"—the good or service offered must also be substantially related to its intended purpose.[56] In cities where applicable laws allow contracts to be given to "sole source" providers, it is possible that a city could show a particular need for a smart surfaces project that could only be met by a specific contractor.

5. POLICIES TO REMEDY RACIAL DISCRIMINATION

[53] *See* JOHN M. WALTON, ET AL., THE INSTITUTE FOR PUBLIC PROCUREMENT, BEST VALUE IN GOVERNMENT PROCUREMENT (2013).

[54] *See, e.g.*, NYC Code Tit. 9 Ch. 3 § 3-08; *Knights of the Iron Horse v. City of Deroit*, 2 N.W.2d 466 (Mich. 1942).

[55] *See, e.g.*, *Accela, Inc. v. Sarasota County*, 993 So.2d 1035, 1041 (Fla. Dist. Ct. of App. 2008); *Gen. Elec. Co. v. City of Mobile*, 585 So.2d 1311, 1315 (Ala. 1991) (citing Ala. Code § 41-16-51(a)(11)).

[56] *See Gen. Elec. Co.*, 585 So.2d at 1315.

The harms of urban heat island effect are visited disproportionately on communities of color.[57] Cities may therefore choose to target those communities when developing smart surfaces policies. However, such targeted policies could invite legal challenges under the Fourteenth Amendment to the U.S. Constitution. Classifications based on race are subject to "strict scrutiny" under the Fourteenth Amendment, a standard of review that requires showing a "compelling governmental interest" and a governmental response "narrowly tailored" to serve to that interest.[58] A full analysis of how this standard would apply to race-conscious smart surfaces policies is beyond the scope of this paper, but, in short, any policy aimed at addressing historical discrimination must be supported by evidence of racial discrimination, such that the local government can show a "compelling governmental interest," and "narrowly tailored" to the purpose of remedying that discrimination. In the context of a race-based smart surfaces program, therefore, data will likely be needed to demonstrate the need for such a program to address racially inequitable impacts, for example, the disparate impacts of urban heat island effect caused by redlining.[59]

6. CONCLUSION

Smart surfaces offer a powerful means to address both climate change impacts such as heat and urban sources of greenhouse gas emissions. Cities have a number of policy tools at their

[57] *See supra* note 3.

[58] *Parents Involved in Community Schools v. Seattle School Dist. No. 1*, 551 U.S. 701, 720 (2007).

[59] *See, e.g.*, Brad Plumer and Nadja Popovich, *How Decades of Racist Housing Policy Left Neighborhoods Sweltering*, N.Y. TIMES, Aug. 24, 2020.

disposal to expand smart surfaces both on public streets and on private property. However, legal hurdles such as state preemption, limitations on zoning authority, and public procurement requirements do exist. Promoting smart surfaces requires an understanding of the relevant state and local frameworks and coordination with relevant state agencies to navigate those hurdles. Additionally, where local policies—such as fire codes or landmark preservation regulations—stand in the way, cities have an opportunity to foster collaboration across local agencies to reap the full benefits of smart surfaces.