



Smart City Reset:

Data-Driven Innovation for the Digital Economy

Julianne Romanello, Ph.D.

February 13, 2023

Smart City Reset: Outline

1. What is a Smart City?
2. Is Tulsa a Smart City?
3. Who is Responsible for Smarting Your City?
4. What's Behind the Smart City Movement?
 - New International Economic Order (NIEO)
 - Fourth Industrial Revolution (4IR)
5. How will Smart Cities Affect You? Business and Finance
6. What do We Do About It? Discussion

Smart City Reset: What is a Smart City?

United Nations



Economic and Social Council

Commission on Science and Technology for Development
Nineteenth session
Geneva, 9–13 May 2016
Item 3(a) of the provisional agenda

Smart Cities –
the means for implementing
the **Sustainable
Development Agenda.**

Smart Infrastructure –
components are **connected**
and **generate data** in order to
**optimize resource use and
performance.**

Defining a smart city

6. There is no standardized commonly accepted definition of or set of terminologies for a smart city. In 2014, an International Telecommunication Union report analysed over 100 definitions related to smart cities, and the following definition was the outcome of this analysis: “A smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects.”⁷ Several efforts are currently under way to develop comprehensive key performance indicators for smart cities. A United Nations

Smart infrastructure

8. Smart infrastructure provides the foundation for all of the key themes related to a smart city, including smart people, smart mobility, smart economy, smart living, smart governance and smart environment. The core characteristic that underlies most of these components is that they are connected and that they generate data, which may be used intelligently to ensure the optimal use of resources and improve performance. This section introduces some key components of smart city infrastructure and concludes by highlighting the need for an integrated approach in dealing with such infrastructure.

Smart City Reset: What is a Smart City?



A smart city uses information and communication technology (ICT) to improve operational efficiency, share information with the public and provide a better quality of government service and citizen welfare.

The main goal of a smart city is to optimise city functions and promote economic growth while also improving the quality of life for citizens by using smart technologies and data analysis. The value lies in how this technology is used rather than simply how much technology is available.

Smart City Profile



- An infrastructure based around technology
- Environmental initiatives
- Effective and highly functional public transportation
- Confident and progressive city plans
- People able to live and work within the city, using its resources

In May 2016, 18 UN agencies including ITU and UNECE launched the United for Smart Sustainable Cities (U4SSC) global initiative to advocate for policies promoting the use of ICTs in smart sustainable cities. This initiative focuses on integrating ICTs into urban services and building new standards to help achieve SDG 11 and has developed a set of Key Performance Indicators (KPIs) to assess progress towards smart urban development. Over 50 cities have already implemented these KPIs. U4SSC is open to all relevant stakeholders.

SDG 11: Sustainable Cities and Communities

Smart City Reset: What is a Smart City?



Smart cities use a variety of software, user interfaces and communication networks alongside the Internet of Things (IoT) to deliver connected solutions for the public. Of these, the IoT is the most important. The IoT is a network of connected devices that communicate and exchange data. This can include anything from vehicles to home appliances and on-street sensors. Data collected from these devices is stored in the cloud or on servers to allow for improvements to be made to both public and private sector efficiencies and deliver economic benefits and improvements to the lives of citizens.

Smart City Technology

- Application Programming Interfaces (APIs)
- Artificial Intelligence (AI)
- Cloud Computing Services
- Dashboards

- Machine Learning
- Machine-to-Machine Communications
- Mesh Networks

4IR

FOURTH INDUSTRIAL REVOLUTION

Smart City Reset: What is a Smart City?

Combining automation, machine learning and the IoT is allowing for the adoption of smart city technologies for a variety of applications. For example, smart parking can help drivers find a parking space and also allow for digital payment.

Another example would be smart traffic management to monitor traffic flows and optimise traffic lights to reduce congestion, while ride-sharing services can also be managed by a smart city infrastructure.

Smart city features can also include energy conservation and environmental efficiencies, such as streetlights that dim when the roads are empty. Such smart grid technologies can improve everything from operations to maintenance and planning to power supplies.

Smart city initiatives can also be used to combat climate change and air pollution as well as waste management and sanitation via internet-enabled rubbish collection, bins and fleet management systems.

Aside from services, smart cities allow for the provision of safety measures such as monitoring areas of high crime or using sensors to enable an early warning for incidents like floods, landslides, hurricanes or droughts.

Smart buildings can also offer real-time space management or structural health monitoring and feedback to determine when repairs are necessary.

Citizens can also access this system to notify officials of any problems, such as potholes, while sensors can also monitor infrastructure problems such as leaks in water pipes.

In addition, smart city technology can improve the efficiency of manufacturing, urban farming, energy use, and more.

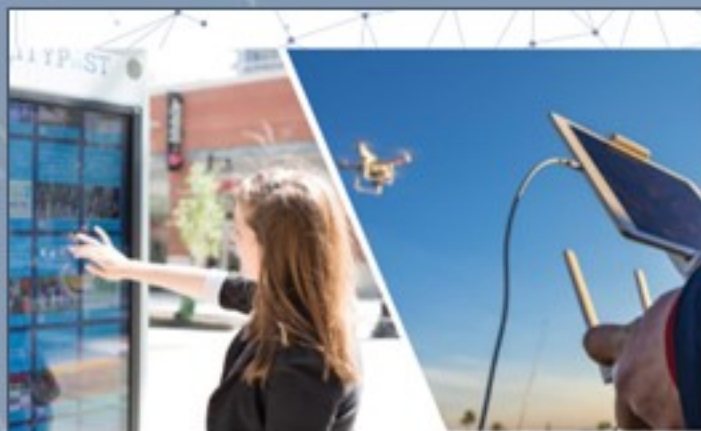
Smart cities can connect all manner of services to provide joined up solutions for citizens.



Smart City
Applications



Smart City Reset: What is a Smart City?



SMART SOLUTIONS:
Technology Serving Communities



Smart Networks of
Citizens

A Roadmap for Technology Deployment

Once a community has agreed upon its vision, strategy, and goals, a technical roadmap for the journey to becoming a smarter community is accomplished in three critical, cohesive steps.¹⁰

Data collection. The first step, as essayist and poet Ralph Waldo Emerson wrote, is to “know thy self.” This occurs when a city collects informational data about itself. The city collects data by creating electronic networks of sensors, monitors, and other machine-to-machine (M2M) or smart devices, such as utility meters, building monitors, and fueling systems.

Networked communication. Second, the city develops capabilities—from smartphones to broadband networks—that can communicate information in the form of wireless or wired networks of data about the community to its internal agencies and other collaborative partners. The Internet of Things (IoT) adds to the growing capabilities for such communication, such as smart utility, street, and building grids.

Descriptive and predictive analytics. And third, the community “crunches” the expanding data by using descriptive analytics to understand the data and what it means about the community. Leaders can then use predictive analytics to model what the future will be or what different resource allocation scenarios can alter future prospects.

Justin Cook, of IBM’s Smarter Cities Initiative, indicates that we can expect the world to be increasingly “instrumented, interconnected, and intelligent” in the future, making systems thinking essential.¹⁵ Urban systems thinking revolves around more than utilities, buildings, and roads. Citizens, their behaviors, and their level of civic engagement are central to demands on urban and global systems. Smart cities will have smart citizens.

“ Smart cities will have smart citizens.”

Imagine citizens using technologically powerful smartphones as minicomputers, enhanced with built-in artificial intelligence and remote learning, in local and global networks of citizens. These connected smart citizens will be better equipped to be citizen scientists, citizen journalists, citizen peace-keepers, and citizen environmentalists. This future level of global civic engagement and community capacity building will blend human imagination and technology in a way that has not been experienced in the history of the world.

Smart City Reset: Is Tulsa a Smart City?



**WHAT
WORKS
CITIES**
SILVER 2020

Tulsa Scales Up Data-First Innovation
2020 Certification Level: Silver

What Works Cities



MEET OUR PARTNERS

Our expert partners help local governments build the capacity and skills to use data and evidence to make more informed decisions, deliver more effective services and programs, and improve residents' lives. This support helps cities advance toward achieving What Works Cities Certification.

RESULTS
FOR AMERICA



HARVARD Kennedy School
Government Performance Lab

**Bloomberg
Philanthropies**



JOHNS HOPKINS
UNIVERSITY

GovEx

**THE
BEHAVIORAL
INSIGHTS TEAM**

Smart City Reset: Is Tulsa a Smart City?

THE NEW
LOCALISM

BRUCE KATZ · JEREMY NOWAK

Infrastructure with a Purpose

BY BRUCE KATZ · APRIL 28, 2022

...acting to reform public authorities and other
enable smart value capture mechanisms to
public infrastructure investments yield long term
public wealth. Tulsa, Oklahoma, for example, created a new
Tulsa Authority for Economic Opportunity (TAEO) last year
modeled after European successes in Copenhagen and
Hamburg. This new authority, a product of the merging of
multiple existing authorities and entities, will own substantial
assets, including multiple parking structures and surface lots
in the downtown, large landholdings prime for redevelopment
just outside of downtown, residential lots throughout the city,
and a hangar leased by American Airlines. Excitingly, these
assets generate stable cash flow and have the potential to
generate even more revenue through smart development and
disposition, which then be reinvested into the poorest
neighborhoods in the city.

Mayor Rahm Emanuel, Tulsa Mayor Discuss the Future of Smart Cities

Email Facebook LinkedIn Twitter



(Photos via Chicago Inno)

By Katherine Davis - Associate Editor
April 23, 2018, 02:12pm CDT

Smart City Reset: Is Tulsa a Smart City?



5. GRANT FUNDS, SOURCES AND USES OF PROJECT FUNDS

The City of Tulsa is requesting \$6.5 million of the Project's total costs from BUILD funding, to supplement local, state, and federal funding sources from the City of Tulsa, MTTA, and INCOG. Receipt of a \$6.5 million BUILD grant provides the following beneficial outcomes:

- » **Technology upgrades at intersections** – \$6.5 million in BUILD grant funds will allow the City of Tulsa to implement the Project and achieve a true arterial traffic and transit management.
- » **Maximizes the impact of BRT investments** – By improving real-time bus information, as well as shortening transit travel times, this Project not only increases ridership but also improves the rider experience above and beyond the planned BRT improvements already under way.
- » **Provides a step forward to smart corridors and a smart city** – With this investment from the federal government, the City of Tulsa will be one step closer to creating a smart city, which includes realizing a vision of zero traffic fatalities by 2045. The City of Tulsa aims to be an innovation model for how a growing economy uses data to effectively manage, grow, and sustain a high-performance transportation system that is inclusive to all users.




The City of Tulsa, Oklahoma has begun the final transition to pay-by-plate parking in partnership with Flowbird Group, a global supplier of urban mobility solutions. The changeover is part of the City's plan to remove all outdated parking meters within the year, replacing them with Flowbird's Strada multi-space pay stations.

The first round of pay stations were installed in the Tulsa Arts District in July of 2018, with the main goal to progress towards a more modern, functional mobility system. Compared to the outdated meters, the Strada Pay Stations provide ease-of-use for both the customers and the City's parking division.

Smart City Reset: Is Tulsa a Smart City?

An official website of the United States government [Here's how you know](#)



U.S. Department of Transportation

[Home](#) \ [Smart City](#)

In This Section

Smart City Challenge: Tulsa, OK Vision Statement



Tulsa's Smart City Transportation Initiative

U.S. Department of Transportation
Beyond Traffic: The Smart City Challenge

U.S. Congressional District OK-01

Tulsa, Oklahoma

Submitted by:



CFDA Number: 20.200 - Highway Research & Development
Opportunity Number: DTPWA1168A0002
Competition Title: Beyond Traffic: Smart City Challenge
Date Submitted: February 4, 2014

From Tulsa's Smart City Transportation Initiative, 2016.

Visioning Tulsa's Approach

Vision Element	Tulsa's Approach	Tulsa's Unique Assets
4IR		
Urban Automation	Prepare 40 linear miles of the city for autonomous vehicles using LIDAR mapping; Prepare regulatory framework for autonomous vehicles	A grid network of streets allow for a more simplified mapping framework. A planned BRT system could be designed with autonomy in mind
Connected Vehicles	Utilize ODOT's and the State's OneOklahoma fiber network with DSRC on major corridors to create a connected network	State of Oklahoma's OneOklahoma fiber network along all state highways; public & private network presence across the City
Sensor-based Infrastructure	Use system developed by the Great Plains Transportation Institute to monitor pavement condition in connected vehicles with built-in accelerometers, feeding back to the ODOT fiber backbone	Partnership with North Dakota St. University and the State of Oklahoma's OneOklahoma fiber network along all state highways
Urban Analytics	Tulsa is poised to collect massive amounts of data where we have been lacking in the past. Adding real-time traffic monitoring and performance measurement will enable better decisions on road reconfiguration options	Tulsa has an established supercomputer supporting academic and government analytics
User-Focused Mobility	Focus on two corridors (Peoria Ave. and 11 th Street), where two BRT lines are planned to create "car-free" zones for residents living & working in the corridors	One BRT line is funded and another is anticipating voter approval in April 2016
Urban Delivery	Demonstrate smart delivery systems using new Macy's Distribution Facility	Massive \$170 million Macy's fulfillment center opened August 2015 ships orders nationwide. Largest fulfillment center in U.S.
Strategic Business Models & Partnering	Partner with Code for Tulsa brigade to create open data sources for third party applications using traffic data	Existing innovation to enterprise model as a business incubation center
Smart Grid & EV	Integrating EV charging stations into street design and parking lot design	Oklahoma has led in alternative fueled vehicles & infrastructure (primarily natural gas)
Connected, Involved Citizens	Code for Tulsa brigade, a partner on this grant, has a mission of making data more accessible to the general public	Code for Tulsa has been recognized nationally with Champions of Change awards from the White House
Architecture & Standards	Update the existing Tulsa ITS Architecture to include new BRT, ped/bike signals and counters along with the new TMC	Bus Rapid Transit in the design phase and is an opportunity to standardize data available to the public
Secure, Resilient ICT	Demonstrate potential security threats and ways to ensure personal data is secure and mechanical takeover is not possible	University of Tulsa Cybersecurity Center recognized by NSA as Center of Excellence
Smart Land Use	Tulsa's new zoning code will allow technologies to be leveraged to create car-free or car-lite zones with mixed-use zoning to support transportation investment	New zoning code adopted January 2016 enables dense, mixed-use buildings

<https://www.transportation.gov/smartcity/visionstatements/tulsa-ok>

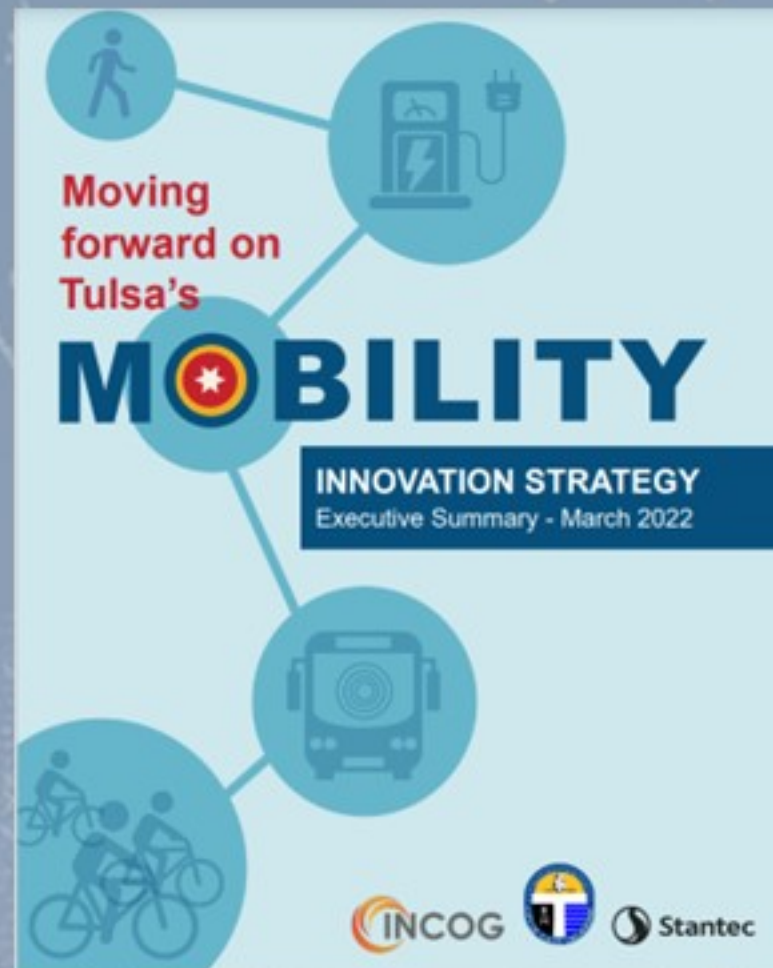
IX. Key Partners

The City of Tulsa has put together an impressive list of partners to ensure that the Smart Cities grant will succeed. Our partners have success locally, nationally and globally addressing technology issues around transportation.

Summary of Partners & Roles

Partner Name	Key Role	Vision Element
100 Resilient Cities	Policy & regulatory guidance	1, 2, 4, 5, 7, 9, 12
City of Tulsa Traffic Engineering	Implementation & Traffic Management Center	All
Oklahoma Innovation Institute	Houses the Tandy Supercomputer, critical to urban analytics	4, 7, 10
University of Oklahoma Wireless Electromagnetic Compatibility & Design Center	Design of hardware and compatibility. Standards and system architecture	1, 2, 3, 10
University of Tulsa Institute for Information Security	Cybersecurity	11
Tulsa Police Department	Implementation of efforts by Police Officers	7, 11
North Dakota State University	Pavement condition monitoring and data collection	2, 3, 4, 10
INCOG (MPO)	Intergovernmental coordination and regional implementation	12
Code for Tulsa	Engaging citizens and creating crowdsource platforms	9, 10

Smart City Reset: Is Tulsa a Smart City?



From ebikes, e-trucks, and e-shuttles to automation in the air, water, and on the road, Tulsa is getting ahead of the curve by tapping into a North American autonomous vehicle market that will be worth \$400 billion by 2025. Tulsa has advanced transit, micro-mobility, e-biking, electric charging, and soon will have development and production of electric and automated vehicles. Even during the challenging times of the last two years, we laid the foundation for smarter mobility and a smarter city. These building blocks include:

- ✓ Expansion of the **bus rapid transit (BRT)** network with a second corridor.
- ✓ Launching **GoPass**, giving Tulsans options to plan and pay for travels on BRT and beyond.
- ✓ Completion of 60 new miles of **bike lanes** and more **shared bicycles**.
- ✓ Adoption of state legislation allowing for AV pilots and **robotic delivery vehicles**.
- ✓ **Advancing policy infrastructure** with a parklet ordinance; a planned commission on data governance, sharing, and privacy; and a partnership with the Government Performance Lab to leapfrog City procurement practices.
- ✓ Announcement of a new **electric vehicle company Canoo**, which will site their factory at the MidAmerica Industrial Park, and R&D and software centers in Tulsa, bringing an estimated 2,700 jobs to the region. These workers will build the electric vehicles of the future.
- ✓ Formation of an independent **economic development agency**, the **Tulsa Authority for Economic Opportunity (TAEO)**.
- ✓ Formation of an entity to manage the **Downtown Improvement District**, the **Downtown Tulsa Partnership**.
- ✓ Identification of partners for an **Innovation Challenge**.
- ✓ Planning a **Mobility Innovation Lab** designed to take emerging technology to scale.

Timeline of Smart Mobility Advancements



With the continual rise of smart technology, the familiarity with and diversity of its options will continue to expand.

Smart City Reset: Who is Smarting Us?

SUMMIT PARTNERS



CORPORATE PARTNERS



COMMUNITY PARTNERS



PROGRAMMING PARTNERS



Ken Levit

December 22, 2016 · 🌐

Nice piece focusing on George Kaiser's philanthropic work behind the foundation and its work in Tulsa.



KRISTOF.BLOGS.NYTIMES.COM

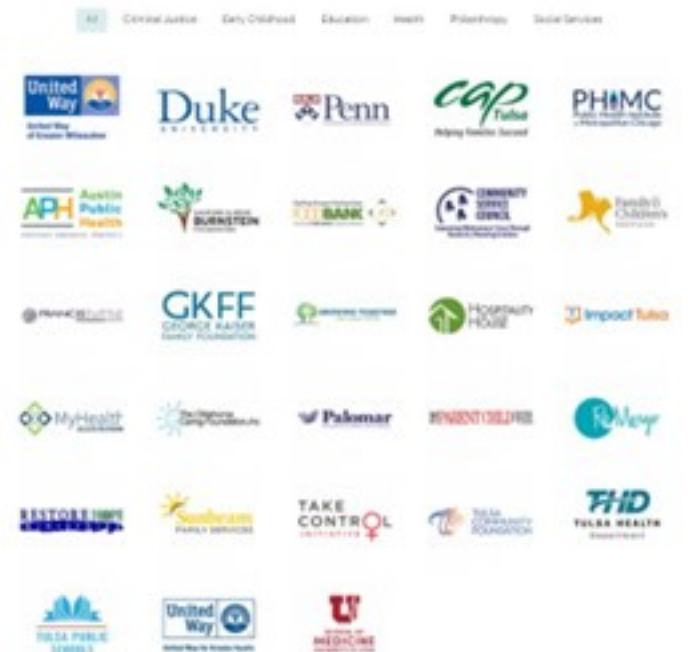
The Man Turning Tulsa Into Beta City, U.S.A. ✓

George Kaiser spends millions to get results.



of Bloomberg LP and Bloomberg Philanthropies, and three-term mayor award to G.T. Bynum, Mayor of Tulsa, Oklahoma

We work with organizations that are changing the world.



Smart City Reset: Who is Smarting Us?

INCOG-EDD Economic Development Plan

Comprehensive Economic Development Strategy (CEDS)
2008

Approved and Submitted by
INCOG Economic Development District
to
US Department of Commerce
Economic Development Administration



INCOG EDD has been created as the EDA regional planning organization with the primary task of formulating and implementing a Comprehensive Economic Development Strategy (CEDS) for the INCOG Economic Development District. A copy of the Interlocal Agreement creating the INCOG EDD is available in the Appendix to this CEDS document.

B. Board of Directors

As the INCOG EDD Board understands that the district's economic development process involves all concerned parties in the district, the INCOG EDD Board of Directors is principally composed of public officials and includes minorities, business people, and representatives of community-based organizations from the region. The membership of the Board is listed as follows:

REPRESENTING	FIRST NAME	LAST NAME	ENTITY
INCOG EXEC COMMITTEE/PUBLIC OFFICIAL	RANDI	MILLER	TULSA COUNTY
INCOG EXEC COMMITTEE/PRIVATE SECTOR/WORKFORCE	KATHY	TAYLOR	CITY OF TULSA
INCOG EXEC COMMITTEE/PUBLIC OFFICIAL	RICHARD	CARTER	CITY OF BROKEN ARROW
INCOG EXEC COMMITTEE/PUBLIC OFFICIAL	SCOTT	HILTON	OSAGE COUNTY
INCOG EXEC COMMITTEE/PUBLIC OFFICIAL	MIKE	NUNNELEY	CREEK CO MUNICIPALITIES
CHAMBER OF COMMERCE/PRIVATE SECTOR	MIKE	NEAL	TULSA CHAMBER
ECONOMIC DEVELOPMENT PROFESSIONAL/PRIVATE SECTOR	TED	FISHER	CREEK COUNTY
ECONOMIC DEVELOPMENT PROFESSIONAL/PRIVATE SECTOR	JIMMY	SEAGO	OSAGE COUNTY
CHAMBER OF COMMERCE/PRIVATE SECTOR	GARY	AKIN	OWASSO CHAMBER

METHODOLOGY FOR INTEGRATING STATE AND REGIONAL ECONOMIC PRIORITIES

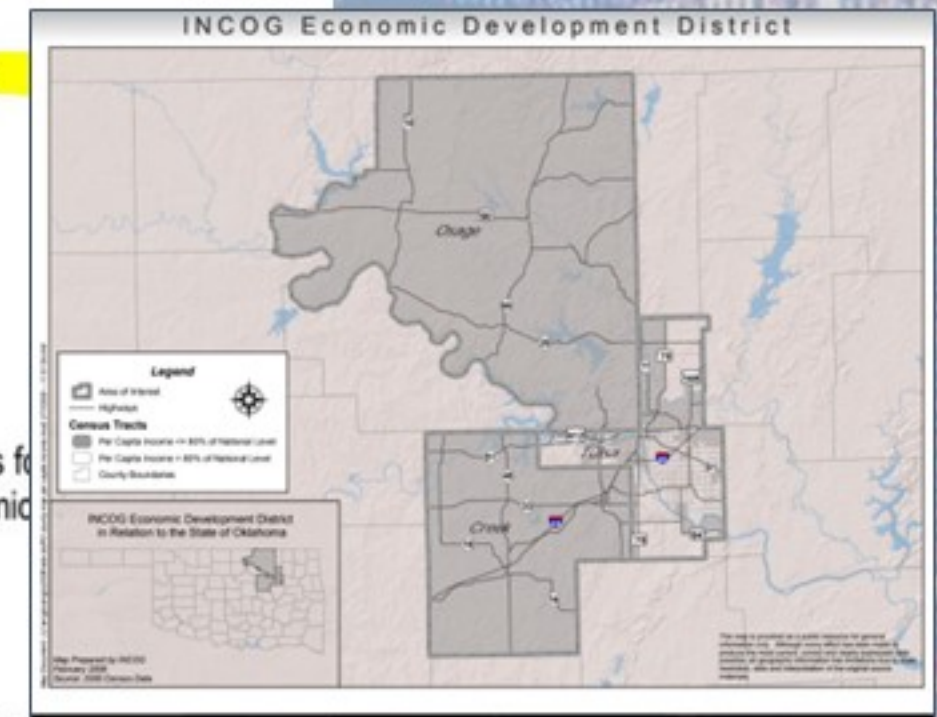
The following state/local strategic planning efforts and initiatives were analyzed for the development of the INCOG EDD Comprehensive Economic Development Strategy (CEDS)

1. Strategic Plan, Governor's Council for Workforce and Economic Development
2. Workforce Tulsa's Strategic Plan, Workforce Tulsa
3. Labor Market Assessment of Northeast Oklahoma, Wadley Donovan Group, Inc., September 10, 2002
4. Tulsa Area Labor Force Study, September 2007, Oklahoma Department of Commerce
5. Vision 2025, September, 2003, Tulsa County
6. Regional Economic Development Leadership Summit, December 2003, Tulsa Metro Chamber
7. Tulsa's Future, Tulsa Metro Chamber
8. City of Tulsa Economic Development Strategic Plan, February 2006, City of Tulsa
9. Step up Tulsa! Fall 2006, Tulsa Community Foundation
10. Destination 2030 Long Range Transportation Plan, INCOG
11. 2008-2011 Transportation Improvement Program, INCOG
12. ODOT 8-Year Construction Work Plan, ODOT

The INCOG EDD Board and staff annually reviews state and local planning initiatives for the region's Comprehensive Economic Development Strategy in the areas of economic development.

Integration with State Programs and Regional/Local Planning Initiatives

The role of INCOG as an Economic Development District (EDD) is to provide assistance to local governments and economic development agencies in securing Economic Development Administration



Smart City Reset: Who is Smarting Us?

TULSA
GROWMETROTULSA.COM

OKLAHOMA
INNOVATION INSTITUTE

Tulsa Regional **STEM** Alliance

JUNE 2018

**RESILIENT
TULSA**

An equitable, action-oriented,
and collaborative roadmap for
all of Tulsa.

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Ei

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INDICATORS**

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greater equality in Tulsa

**United
Way**

Tulsa Area United Way

**COMMUNITY
SERVICE
COUNCIL**

onevoice
REGIONAL LEGISLATIVE AGENDA
2020 STATE PRIORITIES

LEGISLATIVE BENEFACTORS

WorkforceTulsa
growing talent growing opportunity



Smart City Reset: Who is Smarting Us?

TULSA'S ECONOMIC DEVELOPMENT FRAMEWORK

Providing an Organizational Structure and Strategy for the City and its Authorities, Boards, and Commissions

December 2020

HR&A

ZAKERION

RESOLUTE

MAYOR'S OFFICE OF ECONOMIC DEVELOPMENT (MOED)

- Primary municipal economic development body in Tulsa.
- Manage strategies to grow Tulsa's population, quality jobs, workforce, businesses, and tourist footprint.

MAYOR'S OFFICE

- Includes appointed staff for Mayor G.T. Bynum
- Select staff manage Tulsa's affordable housing, planning, education, and equitable development strategies, as well as other key City programs.

ECONOMIC DEVELOPMENT COMMISSION (EDC)

- Advises on Fund 130 (EDC Fund) allocation.
- Contract oversight for economic and tourism development efforts with external entities.

TULSA DEVELOPMENT AUTHORITY (TDA)

- Purchase, manage, and sell properties to support neighborhood development
- Have Eminent Domain powers
- Issue sector plans for residential and commercial revitalization

TULSA INDUSTRIAL AUTHORITY (TIA)

- Manage newly established TIF districts for the City
- Formerly more involved in issuing bonds and brownfield remediation
- Lease Airport Hangar

TULSA PARKING AUTHORITY (TPA)

- Manage and maintain parking assets
- Can issue revenue bonds

TULSA PUBLIC FACILITIES AUTHORITY (TPFA)

- Primary issuer of revenue bonds
- Lease and manage capital improvement for major City assets

Roundtables

Philanthropy

Alison Anthony
Ranee Charney
Nancy Curry
Michael DuPont
Elizabeth Frame Ellison
Phil Lakin
Ken Levit
Bill Major
Josh Miller
Heather Palacios
Stacy Schusterman
Jeff Stava
Kathy Taylor

Real Estate Development

Bruce Bolzle
Chris Bumgarner
Thomas Carlson
David Charney
Mike Cotrill
Patrick Fox
Steve Ganzkow
Nathan Garrett
Gordy Guest
Ross Heyman
Dave Kollman
Terry McGee
Burlinda Radney
Warren Ross
Jeff Smith
Casey Stowe
Steven Watts
Will Wilkins
Debra Wimpee

Workforce Development

Carlisha Williams Bradley
Lauren Brookey
Pamela Fry
Leigh Goodson
Rachel Hutchings
Brian Paschal
Andrea Pemberton
Karen Pennington
Vanessa Portillo
Rue Ramsey
Kuma Roberts
Jeffrey Smith
Art Tyndall
Sabrina Ware
Scott Williams

Economic Development Ecosystem

Sherry Gamble-Smith
Elian Hurtado
Jessica Lozano
Jeff Moore
Bill Murphy
Brandon Oldham
Andrew Ralston
Janet Smith
Jennifer Springer
Kinnee Tilley
Kor Xiong

Neighborhood Development

Jennifer Barcus-Schafer
Tracie Chandler
Reggie Ivey
Luisa Krug
Maria Elena Kuykendall
Tim Newton
Justin Pickard
Greg Robinson
Ed Sharrer
Jessica Shelton
Marcia Bruno Todd
Kirk Wester

Business Environment

Jaime Barraza
Steve Bradshaw
Chet Cadieux
Zac Carman
Glen Cole
Carlin Conner
Michael Dunn
Chuck Garrett
Jake Henry
Francisco Ibarra
Sid McAnnally
Erik Olund
Kayse Shrum
Daniel Sigala
Casey Sparks

Small Business & Entrepreneurship

Francisco Anaya Jr.
Wanda Armstrong
Libby Billings
Angela Byers
Venita Cooper
Brandon Jackson
Devon Laney
Jessica Molina
Elizabeth Nave
Elliot Nelson
LaToya Rose
Colleen Almeida Smith
Janet Smith
Rose Washington
Bridget Weston

Other Interviews

Economic Development Commission

Shelley Cadamy
Monte Caplan
Elliot Nelson
Cassie Reese-Tipton
Warren Ross
Mark Tedford

Legal Interviews

Leslie Batchelor
Jot Hartley
Eric Nelson
Jeff Sabin
John Weidman

Tulsa Development Authority

Thomas Boxley
Carl Bracy
Steve Mitchell
Demauri Myers
Nancy Roberts
Carol Young

Tulsa Industrial Authority

Joan Parkhurst

Tulsa Parking Authority

Jennifer Griffin
Brian Kurtz

TULSA
GROWMETROTULSA.COM

Smart City Reset: What's Behind this Movement?

The New International Economic Order (NIEO)

- Establishing the NEW INTERNATIONAL ECONOMIC ORDER:
 - 1974: UN Resolution to Create the NIEO
 - 1992: Agenda 21
 - 2015: 2030 Agenda → 17 Sustainable Development Goals

- The NIEO is about MEASURING AND MANAGING RESOURCES
 - Economic Growth
 - Environmental Protection
 - Social Cohesion



SUSTAINABLE DEVELOPMENT

- COMPREHENSIVE PLANS are Frameworks for Implementing the Measured and Managed Economy (Sustainable Development) through **SMART CITY POLICY AND TECHNOLOGY.**

7. The present Declaration on the Establishment of a New International Economic Order shall be one of the most important bases of economic relations between all peoples and all nations.



Transforming our world: the 2030
Agenda for Sustainable Development

Smart City Reset: What's Behind this Movement?

The Fourth Industrial Revolution



- A fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.
- Billions of people connected by mobile devices, with unprecedented processing power, storage capacity, and access to knowledge.
- Emerging technology breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.

<https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>

Smart City Reset: What's Behind this Movement?

The NIEO and the 4IR

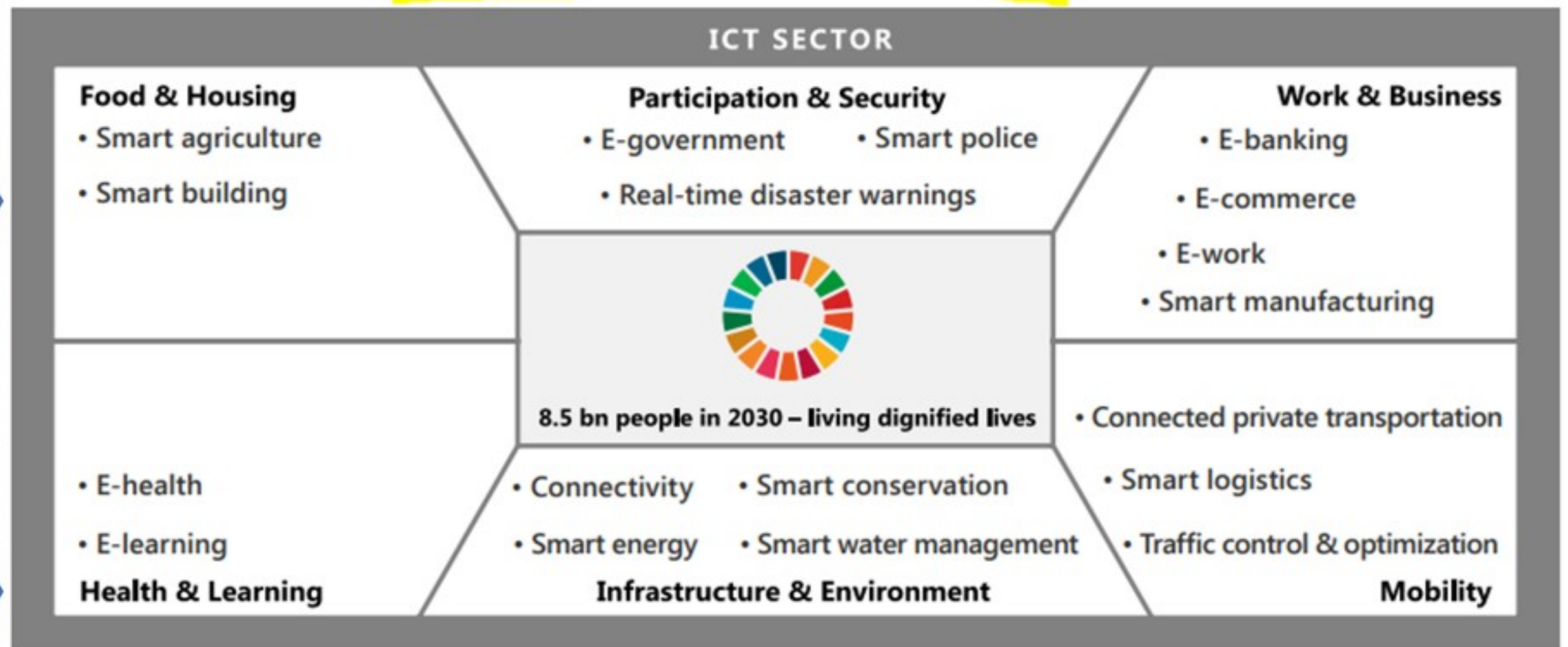
The NIEO is about
MEASURING AND
MANAGING RESOURCES

- Economic Growth
- Environmental Protection
- Social Cohesion

COMPREHENSIVE PLANS
are Frameworks for
Implementing the NIEO

- ICT Digitalization
- 4IR Technologies

EXHIBIT 2: Overview of analyzed digital solutions across all areas of life contributing to SDGs



Transforming our world: the 2030
Agenda for Sustainable Development

4IR

FOURTH INDUSTRIAL REVOLUTION

Smart City Reset: What's Behind this Movement?



The Digitally-Enabled NIEO is based on exchanging SOCIAL VALUE rather than MONEY/PRICES.

In 2010, the World Business Council for Sustainable Development (WBCSD) released Vision 2050, a landmark piece of work that laid out a pathway to a world in which nine billion people are able to live well, within planetary boundaries, by mid-century.

In other words, capitalism itself needs to be reoriented to serve a new purpose: not simply the pursuit of financial profits and economic efficiency, but the pursuit of true value, preserving and enhancing natural, social and financial capital. This is as much about long-term business success as it is about sustainability.

"... Profits are not, in today's capitalism, a reliable indicator of societal contribution because too many social and environmental costs and benefits are unaccounted for in financial valuations."

- WBCSD,
"Reinventing Capitalism,"
2020.

Smart City Reset: What's Behind this Movement?



Prioritizing “True Value Creation,” Positive Outcomes, and the UN SDGs

A reinvented capitalism focused on true value would lead to three outcomes that are critical for achieving the speed and scale of transformation required to deliver Vision 2050:

- 1**
More well-run companies, making better decisions, that deliver the necessary product, service and business model innovations that contribute to a flourishing society.
- 2**
Capital markets properly value inclusive, sustainable business practices, rewarding the companies with the greatest positive social and environmental impact.
- 3**
As a result, more capital is mobilized towards businesses, assets and solutions that deliver the Sustainable Development Goals (SDGs), including the transition to a 1.5°C world.

SMART CITY TECHNOLOGIES ENABLE THE TRANSFORMATION TO THE NIEO ECONOMY OF “TRUE VALUE” via IMPACT-TRACKING CAPACITY.

The Fourth Industrial Revolution and the NIEO

- DATA, DATA, DATA from the Internet of Things
- SMART CITIES are installed with Infrastructure Improvement Funding
- MASSIVE UNEMPLOYMENT due to Automation, and other Disruptions
- URBAN DENSIFICATION follows Supply Chain Consolidations
- NEW VALUE STREAMS emerge from increased capacity to Measure and Manage *everything*.
- GLOBALLY ALIGNED SMART CITIES make it possible to Track Progress toward “Positive Social Outcomes.”
- IMPACT INVESTING MARKETS grow with Surveillance, Simulation, and Storage capacities.

Vision PlaniTulsa 2022: the Impact on Our City

- No cars
- Licenses, Taxes, and Assessments proliferate
- No single-family homes
- Smart buildings, roads, and outdoors
- Community development funds manage public assets
- Public-Private Partnerships decide policy
- Digital Twin required to access basic city services
- Targeted Industries promote the 4IR, receive special incentives
- Transition to electric
- E-governance
- Migration Surges
- Credits at the Company Store

The Transportation Sector is the Paradigm for Building Back Better



“Sustainable transport—with its objectives of universal access, enhanced safety, reduced environmental and climate impact, improved resilience, and greater efficiency—is central to sustainable development.”

Transport is vital for promoting connectivity, trade, economic growth and employment. Yet it is also implicated as a significant source of green-house gas emissions. Resolving these trade-offs are essential to achieving sustainable transport and, through that, sustainable development.

Innovations, driven by new technologies, evolving consumer preferences and supportive policy-making, are changing the transport landscape. While science holds tremendous potential for hastening the transformation to sustainability, some new technological innovations also come with the risk that they could further entrench inequalities, impose constraints on countries in special situations, or present additional challenges for the environment.



SUSTAINABLE TRANSPORT, SUSTAINABLE DEVELOPMENT

INTERAGENCY REPORT | SECOND GLOBAL SUSTAINABLE TRANSPORT CONFERENCE



Transformation towards sustainable transport calls for integrated approaches that bring together multiple stakeholders around shared objectives. Such approaches should promote holistic, end-to-end analysis of different dimensions, including vulnerability risks and environmental impacts, that can help in the systemic identification and development of integrated solutions. Sustainable solutions are often multimodal in that they integrate the relative advantages of different transport modes in an optimal fashion. Implementation frequently calls for the coherent deployment of instruments from different fields: governance; science, technology, and innovation (STI), economy and finance; and individual and collective action.



Retail Redevelopment and Development Fund

The Retail Redevelopment and Development Fund is a Revolving Loan Fund (RLF) intended to provide low-cost capital to retail entrepreneurs and developers. For retail entrepreneurs, the loans can be used to fund tenant improvements, purchase equipment, etc. For developers, the loans are intended to encourage the redevelopment and development of commercial properties and incentivize the proliferation of Transit Oriented Development (TOD). Individuals or businesses who use the funds must open a business or redevelop/develop property along the Bus Rapid Transit (BRT) lines or in one of the 13 priority locations identified in the City of Tulsa Retail Market Study and Strategy.

The loan terms are recommended to the City of Tulsa by the Tulsa Economic Development Corporation (TEDC), who administers the program. Because developers and entrepreneurs can use the RLF,

Mixed-use Zoning Incentive Program - An initiative to encourage pedestrian and transit oriented redevelopment along Peoria and Route 66 Bus Rapid Transit corridors.

chapter 3 transportation

Cities across the United States have made significant progress in diversifying the transportation options available to residents. In recent years, many have begun to recognize the deficiencies in our transportation systems as well as the negative externalities associated with high levels of automobile use. Things such as poor air quality, lack of physical activity, automobile congestion, and high rates of collision fatalities are all by-products of an overly auto-dependent urban environment.

planitulsa
tulsa's comprehensive plan

Goal 4

Transportation investments support the land uses they serve and increase access to places that Tulsans need to visit.

Land use decisions drive the need for transportation infrastructure. Property owners expect accessibility from the street network, public transit service, and adequate parking for their employees and customers. These and other transportation options should be designed in ways that conveniently facilitate access to destinations. Conversely, where significant transportation investments have occurred or will occur, such as the bus rapid transit (BRT) routes on Peoria Ave. and 11th St., land use planning should be responsive and maximize access to and from the existing service route.

Strategy 4.1

Establish Transit-Oriented Development (TOD) areas where high levels of transit service exist or are planned.

Strategy 4.2

Ensure land use decisions are consistent with the transportation infrastructure context.

Strategy 4.3

Establish standards for streetscaping projects that enhance safety, aesthetics, and promote placemaking.

Strategy 4.4

Ensure that parking enhances the use of a site or corridor while considering the needs of people using other forms of transportation.

Strategy 4.5

Ensure a high degree of connectivity in new development, and seek to restore connectivity when possible throughout the city.



planittulsa
tulsa's comprehensive plan

Transit-Oriented Development

In order for development that surrounds transit facilities to change in ways that make

it “transit-oriented”, it is essential that the land use planning for these areas reflect this desired outcome. In 2018, in preparation for the implementation of the Peoria Aero BRT, a Land Use Framework was prepared that identified properties along the BRT alignment that were suitable for rezoning to “Mixed Use” zoning classifications. Those properties that were identified were incentivized by a fee waiver by City Council for a potential rezoning application. This approach has been replicated along the upcoming Route 66 BRT alignment, and new guidance for the type of development that is desirable in these areas is reflected in the Transit-Oriented Development section of the planitulsa Development Review Guide.

In addition to fee waivers for rezoning applicants, other incentive opportunities will be available to property owners along the BRT

engagement efforts, residents of Tulsa provided a great deal of input, which recommendations of the eight adopted plans listed above. Key ideas heard present include:

• Bus and wait times should be reasonable.

• Transit structure projects and private utilities should be improved to lessen traffic congestion.

• Transit station access should be prioritized in transportation planning.

• Public input indicated about bike lanes and other bike infrastructure.

- Public engagement should be increased when bicycle infrastructure projects are being planned and implemented.
- Public transit should have a regional approach to connect Tulsa with surrounding suburbs.
- All pedestrian infrastructure and bus stops should be ADA accessible.
- Traffic calming is needed in certain neighborhoods and areas of the city.
- Business access is a concern when bicycle lanes are added to a commercial corridor.
- The timing of signals in the city should minimize wait times at intersections.

CONNECTED 2050

The Tulsa Regional
Transportation Plan

Developed by
INCOG



In the summer of 2021, the ETC Institute conducted a regional scientific transportation survey for INCOG.* The respondents indicated overall results concluded 74% were very willing or somewhat willing to improve sidewalk and other pedestrian facilities, and 56.4% surveyed were very willing or somewhat willing to improve bike facilities.

Several trails, side-paths and other pedestrian connections are under construction or reconstructed, and/or updated. The GO Plan Trails and On-street facilities map is attached to the Connected 2050 plan in the Appendix of Maps.

Stakeholder Priorities

The 2015 GO Plan process included public involvement through focus groups and stakeholder meetings. An inventory of local comprehensive plans, policies, requirements, and the identification and assessment of existing facilities was also conducted. Several key recommendations originated from the public outreach effort, and they are listed as follows in order of priority:

1. Ridership/Usage

Acquiring adequate data is a priority to design facilities that accommodate all citizens, apply for funding for projects, and identify potential opportunities for incremental change.

2. Safety

Improving safety for citizens should be done by addressing the presence of wide lanes and associated safety hazards, educating law enforcement in each community on cyclist and pedestrian laws, and communities implementing a policy like "Vision Zero" that gets policy makers involved.

3. Equity

Designing infrastructure in a way that makes bike and pedestrian modes of transportation a viable choice for those that may not be able to drive, do not have access to a private automobile and/or that reside in areas that are identified as areas of persistent poverty and/or historically disadvantaged communities.

4. Connectivity

Connect people by working with transit and other micro-transit solutions to create "last-mile" connections, multi-modal options, and implement well designed safe crossings near schools, intersections, and destinations with high pedestrian counts.

5. Livability

Create livable areas by increasing land use diversity and density, make the right-of-way attractive to other uses, and seek to mitigate minimum parking requirements.

6. Public Health

Encourage active lifestyles by designing infrastructure to be user-friendly for bike/pedestrian uses, work with the Tulsa Health Department to educate the public on the link between the built environment and public health.

Funding

A combination of federal, state, and local funding opportunities is available for local public agencies, and community-based organizations such as the River Parks Authority and This Machine. These federal, state, and local funding opportunities include:

1. Transportation Alternatives Program (TAP)
2. Surface Transportation Block Grant Program (STBGP)
3. Congestion Mitigation and Air Quality Improvement Program (CMAQ)
4. Carbon Reduction Program (CRP)
5. Federal discretionary grant programs
6. Local public agency voter approved funding
7. Non-profit foundations and other community-based organizations



TDA – Vision and Prospect

The Tulsa Development Authority (TDA) promotes economic development through renewing and developing attractive, healthy and safe public and private places and green spaces throughout the Tulsa community where people want to live, work and play. With Downtown development thriving, TDA will increasingly face towards the north, east and west of Downtown to sustain its legacy of *Keeping Tulsa Strong*.

Since its early beginnings in July 1959 as the Tulsa Urban Renewal Authority, TDA has a long history of facilitating renewal and redevelopment throughout Tulsa. For several decades, TDA came under common management with the City of Tulsa. In 2008, it returned to independent management with its own Executive Director and staff.

TDA was chartered with the initial focus of removing slum and blight in deteriorating neighborhoods. Today with changes and updates in the statutes granting its powers and authorities, its scope has expanded to include economic and community development.

As an Economic Development partner, TDA collaborates with multiple entities, including the City of Tulsa elected officials and staff, as well as planning commissions, economic development entities, funding entities, the local, State and Federal governments, businesses of all sizes, community leaders and real estate developers to fulfill economic development plans that spur Tulsa's economy.

Its main historic economic and community development initiatives have focused in and around the City's core downtown areas. During these productive years, TDA has grown in its capacity, capability and partnerships to spur the redevelopment of areas, which Tulsans benefit from and enjoy. Notable projects include the Williams Center, OSU-Tulsa campus, Langston University - Tulsa, the Brady Arts District, the Village at Central Park, Downtown housing, Kendall-Whittier District, Greenwood Historic District, N. Peoria corridor, Lansing Business Park, Driller Stadium, among others. Please refer to "TDA Notable Development Projects" on page 18 for a broader listing of projects, which TDA has facilitated.

TDA's current strategic planning effort accompanies its updated Sector Plans for both north Tulsa and Kendall-Whittier districts. TDA's 2015 Annual Report also accompanies TDA's current strategic planning effort.

Further, plans developed by the City of Tulsa including its 2010 City-wide, comprehensive plan ("PlaniTulsa") and the Small Area Plans, as well as existing and new Sector Plans commissioned by TDA, all contribute to redevelopment plans that TDA will pursue through 2021.

TDA is dedicated to the continual enrichment of our communities and the enhancement of our quality of life through neighborhood revitalization and redevelopment.

Working hand in hand with government, business and residential stakeholders, TDA plays an important role in economic development to create a better hometown and a better future for all of us. TDA's primary mission is to improve targeted, deteriorating areas that offer potential for successful commercial, retail and residential redevelopment. TDA's work begins with identification of these areas through its Sector Plans in coordination with City of Tulsa plans including PlaniTulsa and Small Area Plans.

TDA is a public body corporate and the only authority granted the ability to exercise eminent domain in Tulsa. With the various powers granted by Oklahoma Statutes in Title 11.Cities and Towns: Section 38: 101-123, TDA's scope of authority ranges from single lot development to full urban renewal development. Its broad powers include acquiring, assembling and selling property to private entities for redevelopment, as well as providing or contracting for streets, roads, public utilities, off-street parking facilities, parks, playgrounds, hotels, apartments, housing and other public improvements.

Serving as the City's Development Authority, TDA facilitates redevelopment in a catalytic way for Tulsa. TDA's primary activities in executing redevelopment plans include the following:

1. Commission Sector Plans to augment City-wide and Small Area Plans by establishing boundaries and prioritizing focus areas;
2. Purchase lands, properties and buildings for redevelopment, rehabilitation and new construction;
3. Assemble and sell surplus land and properties owned by TDA, and assist in selling those owned by City of Tulsa, to create opportunities for revitalization;
4. Restore land values by removing dilapidated buildings;
5. Improve streetscapes;
6. Provide mezzanine financing, funding and incentives such as low interest loans where feasible in order to attract developers;
7. Manage Tax Increment Finance Districts to improve infrastructure;
8. Administer Housing Development funds to drive new residential projects;
9. Collaborate with private redevelopers to underwrite and advance projects that meet the City's needs for new housing, retail services and industrial and commercial office spaces;
10. Approve developers' architectural plans and any subsequent plan changes in accordance with planning guidelines; and
11. Assure that developers complete approved projects in a reasonable time.

IMO and ICAO and for railways, intermodal transport, and inland waterways through UNECE. Non-governmental technical bodies, such as the Society of Automotive Engineers International (SAE International), the Institute for Electrical and Electronics Engineers (IEEE), and the International Organization for Standardization (ISO) also publish and establish standards which, while advancing sustainability, can facilitate inter-operability and cross-border technology adoption.

INTEGRATED PLANNING

Sustainable transport objectives are anchored in transport planning. If they are to live up to their potential for delivering on the SDGs and climate action, however, coordinated efforts across different ministries are needed for their implementation. Such coordination may also be required across geographic jurisdictions, for example between urban and provincial/national authorities, or between national governments in a particular multi-country region.

In many countries, transport ministries themselves are divided across modal lines. Institutional capacity must therefore be built to support integrated transport planning that covers all the dimensions—social, economic, and environmental—of sustainable transport, as well as incorporates issues relating to all modes of transport.

Most transport infrastructure is long-lived. Decisions taken in the short run have long-term implications, and are typically hard to reverse. Even across different transport modes, decisions can be closely interconnected—for example, inter-city train use becomes more attractive if there are suitable regional and local mobility options at either end. **Strategic decisions need to be made about the build-out of transport networks over time to accommodate long-run trends (see chapter 2.2), such as growing populations and increased urbanization, in ways that are economically justified, socially inclusive, and environmentally sustainable. These decisions will include the choice of modal mix, the siting of infrastructure with its various components (including future EV charging stations),**

and the design features of infrastructure which is able to cope with intensifying climate change and can be integrated into compact and inclusive public spaces that are accessible to all.

Short- and long-term transport targets should be clearly defined and aligned with the SDGs and climate action goals. Planning should take into account a full lifecycle analysis. **Land-use planning should also be integrated and aligned with the objectives of the transport planning process.**

Transport planners and policymakers must also decide on appropriate means of raising the revenues needed to maintain and expand transport infrastructure and services, as well as the appropriate instruments required to foster the intermodal shifts desired at the pace needed. The science–policy interface, as well as data availability and collection, should be strengthened: this will enable well-informed decisions to be made. Institutional mechanisms are needed which ensure that mobility plans at the sub-national level can be consistent and coordinated with the integrated national sustainable transport plans.

The socio-environmental impacts of different transport decisions should be considered in light of poverty eradication, quality-of-life improvements, inequality reduction, and the mitigation of negative environmental impacts. Such considerations are fundamental to policy and investment decisions. Examples of relevant approaches include the amended European Union Directive on Environmental Impact Assessment,³³⁷ which requires climate change impacts to be taken into account as part of environmental impact assessments for large infrastructure projects; the Climate Change Policy Framework for Jamaica,³³⁸ which provides for cross-sectoral mainstreaming of climate change considerations; and ISO Standard 14090,³³⁹ which provides a consistent, structured, and pragmatic framework that enables organizations to prioritize and develop effective and efficient adaptation measures tailored to the specific climate change challenges they face. Of particular relevance is the most recent ISO standard ISO 14091 from 2021 which provides

potential impacts of climate change.³⁴⁰ Regarding health, the World Health Organization's Health Economic Assessment Tool (HEAT) is a harmonized method for quantifying the health benefits of cycling and walking, which can help inform urban planning decisions and support for different modes of travel.³⁴¹

Potential risks related to transport infrastructure and services need to be evaluated and the capacity established to monitor and address these challenges. For example, tools for risk-based compliance monitoring and enforcement (CME) can address safety issues and thereby support decision-making. One example is the development of the GloBallast e-learning portal of the IMO³⁴² and Risk Assessment Tools related to marine biosafety. In areas where there are no insurance and risk reduction systems, investment in these institutions is imperative. Incentivizing risk reduction is also important: this, among other things, requires resilience to climate impacts and other natural and economic shocks and chronic stressors to be placed at the centre of transport infrastructure planning and the development of transport networks.

Adopting a results-oriented, people-centred approach can lead to better integration, as seen in several different approaches to urban development that incorporate varied transport options. New concepts, such as the '15-minute city' where residents have access to everything they need within a short radius, can help boost quality of life while reducing transport demand, as long as they are designed for inclusivity. Another concept is Transit Oriented Development (TOD)³⁴³ which can help to create dynamic, multi-purpose communities, served by public transit, that accommodate a mix of commercial, residential, entertainment, and public spaces within walking distance of transit stations. TODs bring compact, mixed-use development within walking or cycling distance of high-capacity public transport, thus lowering reliance on individual vehicles, minimizing travel costs, and improving the quality of life in many cities. Box 19 presents an example of integrated planning at the local level, leading to a Sustainable Urban Mobility Plan (SUMP).

BOX 19

Integrated planning at the local level: UN-Habitat-supported Sustainable Urban Mobility Plan (SUMP) for Ruiru, Kenya³⁴⁴

Rapid and often unplanned and uncoordinated growth of towns and cities has seriously compromised existing transport systems and increased the challenges of creating future sustainable transport systems, especially in developing countries. The mobility demands of such areas need to be addressed in a sustainable way. A Sustainable Urban Mobility Plan (SUMP) is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles. A SUMP is characterized by an integrative approach to the following: provision of competitive modes of transport; minimizing emissions, air and noise pollution; support for and creation of an enabling environment for non-motorized, active modes of transport, such as walking and cycling; promotion of the economic development of a city; and affordability for users and taxpayers.³⁴⁵ SUMP is a transport planning approach that prioritizes people over any particular mode of transport and has the potential to make better use of existing transport infrastructure.

UN-Habitat, in collaboration with the University of Nairobi, developed a SUMP to support the town of Ruiru, near Nairobi, one of Kenya's fastest growing towns. An implementable plan was created and backed by the consensus of all stakeholders, including government, local businesses, and residents. The SUMP targeted improvements in walking and cycling facilities with the overall objective of making the town accessible for all. Among other things, it included the provision of dedicated lanes for non-motorized transport, the improvement of street infrastructure, and the definition and securing of crossing levels.

According to the most recent (2017–2018) figures, transport is the largest recipient of public sector climate investment (\$94 billion), with domestic, bilateral, and multilateral development finance institutions (DFIs) accounting for the biggest share. The overwhelming share of private finance flowed to renewable energy generation, with only 15% destined for low-carbon transport. As private motor vehicle manufacturers increasingly ramp up production of electric vehicles, that picture is also likely to change markedly.³⁵⁹

These flows do not include those related to climate change adaptation. For the most vulnerable developing countries, such flows are expected to dominate, and resilience-building costs are likely to contribute significantly in many cases to overall transport infrastructure project costs. For these costs, multilateral banks and funds, like the Green Climate Fund and the Adaptation Fund under the UNFCCC, can be important sources of support (see Box 21). The countries most in need of such support, however, report finding it administratively complicated and time-consuming to access the funds. These concerns will need to be addressed as a matter of priority.

Domestic public financing

Domestic public investment for transport is estimated to be 50 times larger than multilateral and bilateral ODA combined, with most of such spending still focusing on roads.³⁶⁰ To ensure a shift towards (multimodal) sustainable transport, the inclusion of sustainable transport projects within relevant national development plans, and consequently national budgets, is crucial as an integral part of national efforts to implement the 2030 Agenda. Governments need to devise long-term sustainable transport plans, factoring in the long lives of much transport infrastructure, lock-in effects, and the need to transition towards more sustainable transport options in the medium term. Such plans could apply the avoid–shift–improve approach, as well as ensure that complementary levers such as policies and behavioural change are also in place to ensure efficient investment.³⁶¹ The planning of sustainable transport systems should include risk and impact assessments, including those

on environmental, social, and health impacts. Box 22 gives an overview of public financing during the COVID-19 pandemic.

All fiscal policies related to sustainable transport, such as subsidies, taxation, pricing, and market-based charges, should be integrated within a coherent national fiscal framework, with the aim of steering supply and demand towards a sustainable transport system while ensuring equitable and affordable access by the public. Market-based instruments can provide economic incentives for preferred behavior and decreased usage of emission-generating transport options. These include: direct road use charges (e.g., road tolls; congestion charging); vehicle registration and ownership charges; parking regulations and fees; high occupancy tolling (HOT lanes) on high-traffic roads; land value capture^{362,363} and other 'indirect beneficiary-pays' measures. Their impact is also dependent, however, on the availability of low-cost public transport options to encourage mode switching as often as possible.

Government spending on inefficient subsidies that cause market distortions, such as fossil fuel subsidies, should be reduced and phased out. The elimination of such subsidies should, however, take fully into account the specific need to minimize the negative impacts on the poor and other population groups.³⁶⁴

PUBLIC PROCUREMENT

Public procurement wields enormous power in directing production: it accounts for an average of 12% of GDP in OECD countries and up to 30% of GDP in many developing countries. Leveraging this purchasing power by promoting public procurement that prioritizes sustainability, in accordance with national policies and priorities, can play a key role in achieving the SDGs. Sustainability-based procurement will impact, and can drive, investments in public transport. Ultimately, sustainable procurement can improve product quality, lower prices, and stimulate further investment. Sustainability standards need to be instituted for public procurement related to transport projects.

Effective collection and management of large quantities of data collected in real time from multiple devices is, for example, crucial to the smooth and safe operation of intelligent transport systems.

TECHNOLOGY COOPERATION

Science, technology, and innovation (STI) are key to achieving sustainable transport. Innovative transport technology can, for example, alleviate some of the negative impacts of transport (e.g., by increasing transport safety or by decreasing GHG and other emissions). Developing countries, however, often face cost constraints (e.g., high upfront costs) as well as technical capacity challenges in introducing the latest technologies.⁴¹¹ The 'digital divide', while narrowing, remains wide.

For developing countries to absorb, develop, and scale up key STIs related to sustainable transport, the international community should significantly enhance technological cooperation with low-income developing countries, notably with countries in special situations. Sustainable transport is considered to be one of most promising areas for successful technology cooperation using South-South and triangular channels.⁴¹² Paragraph 70 of the **2030 Agenda for Sustainable Development** announced the launch of a 'Technology Facilitation Mechanism' (TFM) to support the implementation of the SDGs. This would facilitate multi-stakeholder collaboration and partnerships through the sharing of information, experiences, best practices, and policy advice among different stakeholders, including in relation to sustainable transport.⁴¹³

Coherent, enabling legal, policy, financial and institutional frameworks at the national, regional, and international levels should be established to facilitate technology transfer and diffusion. At the national level, STI policies and systems need to be integrated into national strategies and action plans for sustainable development. A strengthened science-policy-society interface can ensure that scientific research, technology development, and policy address the needs of society in a timely manner while simultaneously responding to current and future sustainability challenges.⁴¹⁴

DATA

Gathering and analyzing sound and reliable data and statistics, and making these available for transport planning, risk assessments, and long-term monitoring, is very important. Real-time data can be very informative in terms of indicating mobility patterns and demand and also transport mode preferences. Such data can also be used to inform the viability of some technologies and to fine-tune planning. Data generation can be encouraged by **establishing standardized data reporting requirements for all transport service providers, including transportation network companies (TNC), public transport operators, and bike- or car-share companies.** In addition, centralized data repositories and data collection guidelines at the national and metropolitan levels can facilitate data access by different stakeholders and **increase the use of data to support decision-making, including with regard to encouraging the use of more sustainable transport.** These steps should be combined with personal data protection regulations, including processes that handle personal data with the appropriate safeguards and ensure that personal or other potentially sensitive data are not shared without explicit informed consent. **Comprehensive monitoring and evaluation methodologies for sustainable transport should be established by national and local governments, linking tracking frameworks, targets, and indicators, where appropriate, to the SDGs. Regular stock of progress towards the transport-related SDG targets and other transport goals also needs to be taken and policies and practices adjusted accordingly. Support is needed for governments to build monitoring and evaluation capacities at all levels.**

When navigating global crises, such as the COVID-19 pandemic, **access to near real-time data becomes critical for making sound decisions. There is thus a growing reliance on alternative high-frequency data that can be used as proxies to estimate wide-ranging economic variables. Supported by technological advances, such as automatic identification system (AIS) data, and improved data collection techniques and reporting by industry, transport data are becoming an important source of high frequency statistics and market intelligence.**^{415,416,417}