FOURSQUARE ITP
INTEGRATED TRANSPORTATION PLANNING

Lawrence Transit and KU Route Redesign Study

EXISTING CONDITIONS AND MARKET ANALYSIS

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1. INTRODUCTION

Lawrence, Kansas is home to the University of Kansas and Haskell Indian Nations University. Like many communities hosting large universities, Lawrence is served by two complementary transit systems. KU on Wheels has served the University of Kansas with fixed-route services since 1971. In 2007, it became part of KU Transportation Services, after operating as a student-run system for its first 36 years. The City of Lawrence launched Lawrence Transit System in 2000 and has worked with the University of Kansas to coordinate service since 2006, including jointly funding two fixed routes beginning in 2009. Today, Lawrence Transit and KU on Wheels publish a single Transit Guide that includes information on ten city routes, eight university routes, and two jointly-funded coordinated routes. In 2019, before the COVID-19 pandemic, the two systems collectively carried approximately 3 million passengers.

FIGURE 1: LAWRENCE TRANSIT AND KU BUSES IN OPERATION

Source: Top: Journal-World File Photo, www2.ljworld.com
Bottom: Nomin Ujiyediin, Kansas News Service

As Lawrence begins to recover from the disruptions of the pandemic, the Lawrence Transit Route Redesign study provides an opportunity to take a fresh look at the existing transit network, identify the strengths and weaknesses of each route, and develop recommendations to address the changing mobility landscape in the city, including a new multimodal transfer facility at the intersection of Bob Billings Parkway and Crestline Drive.

As a first step in determining the future direction of transit in Lawrence, this memo includes three key parts:

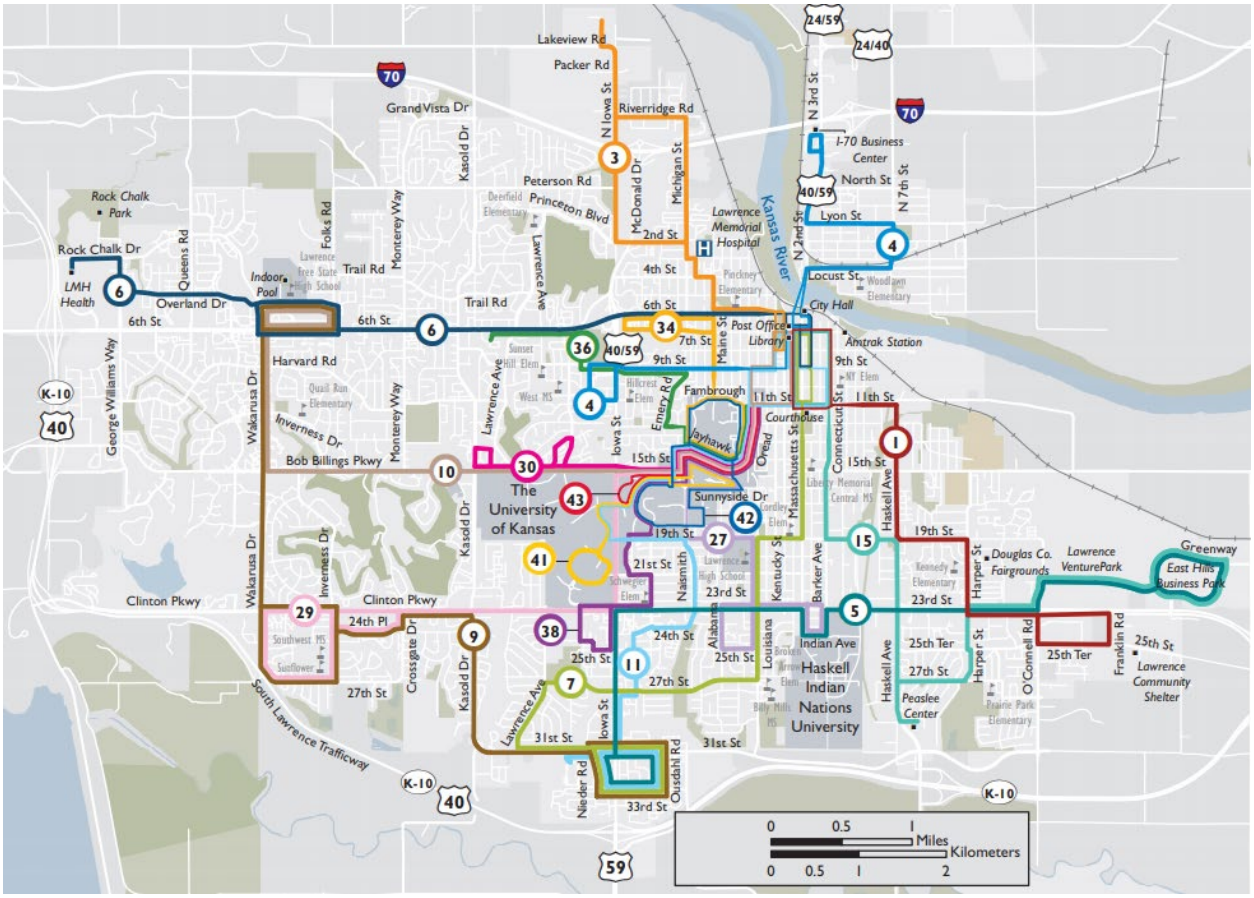
- **Existing Services**: an overview of existing transit services in the study area, including current operating characteristics.
- **Budget and Funding**: A description of current fare policies and funding sources.
- **Market Analysis**: An assessment of both the need and potential for transit service in the study area based on density and demographic characteristics as well as regional travel patterns.

2. EXISTING SERVICES

2.1. Lawrence Transit

Lawrence Transit operates bus services year-round. During regular services, Lawrence Transit operates eleven fixed routes from approximately 6:00 a.m.–8:00 p.m. Monday through Friday and ten fixed routes on Saturdays from 6:00 a.m.–8:00 p.m. Routes 11 and 29 operate the B schedule when the University of Kansas (KU) is out of session. **Figure 2** shows the system map.[1] **Table 1** summarizes the basic service characteristics for each fixed route.

FIGURE 2: COMBINED LAWRENCE TRANSIT AND UNIVERSITY OF KANSUS SYSTEM-WIDE MAP



[1] (C) 2020; City of Lawrence, Kansas, M. Seybold. https://lawrencetransit.org/routes/

TABLE 1: LAWRENCE TRANSIT FIXED-ROUTE SERVICE DESCRIPTIONS

Route	Name	Service Description	Service Span	Average Service Frequency
1	Downtown to East Lawrence	Serves east and southeast Lawrence. Destinations include Hobb's Park, industrial and commercial areas east of Downtown, East Lawrence Rec Center, Douglas County Fairgrounds, Lawrence Community Shelter, and Douglas County Jail.	**Monday–Friday:** 6:03 a.m.–7:57 p.m.	30 minutes
			Saturday: 6:03 a.m.–7:57 p.m.	30 minutes
3	Downtown to Lakeview Road	Serves northwest Lawrence. Destinations include Lawrence Memorial Hospital, businesses on Lakeview Road and North Iowa Street, residential areas along Peterson, Kasold, Riverridge, and North Michigan.	**Monday–Friday:** 6:15 a.m.–7:45 p.m.	30 minutes
			Saturday: 6:15 a.m.–7:45 p.m.	30 minutes
4	North Lawrence to 9th & Iowa	Serves North Lawrence and 9th Street. Destinations include Downtown, Ballard Community Center, Lyon Street Park, North 2nd and 3rd Street commercial areas, I-70 Business Center, DMV, and The Merc.	**Monday–Friday:** 6:03 a.m.–8:00 p.m.	60 minutes
			Saturday: 6:03 a.m.–8:00 p.m.	60 minutes
5	South Iowa to East Hills Business Park	Serves south and southeast Lawrence. Destinations include Haskell Indian Nations University, commercial areas along 23rd Street, Iowa Street, Venture Park, and East Hills Business Park.	**Monday–Friday:** 6:00 a.m. –8:00 p.m.	30 minutes
			Saturday: 6:00 a.m.–8:00 p.m.	30 minutes
6	Downtown to Rock Chalk Park	Serves the 6th Street corridor and LMH Health West. Destinations along this route include Downtown, Free State High School, and Rock Chalk Park.	**Monday–Friday:** 6:03 a.m.–7:54 p.m.	30 minutes
			Saturday: 6:03 a.m.–7:54 p.m.	30 minutes
7	Downtown to South Iowa	Serves central and south-central Lawrence. Destinations include Downtown, South Park, Liberty Memorial Central Middle School, Babcock Place, Lawrence High, Billy Mills Middle School, Holcom Park, and the commercial area at 31st & Iowa.	**Monday–Friday:** 6:02 a.m.–8:00 p.m.	30 minutes
			Saturday: 6:02 a.m.–8:00 p.m.	30 minutes
9	South Iowa to 6th & Wakarusa	Serves west and southwest Lawrence, connecting 6th & Wakarusa to 31st & Iowa. Destinations include Free State High, Southwest Middle School, Sunflower Elementary, LMH South, and commercial areas at 6th & Wakarusa, Bob Billings & Wakarusa, Clinton & Kasold, and 31st & Iowa.	**Monday–Friday:** 6:02 a.m.–7:57 p.m.	60 minutes
			Saturday: 6:02 a.m.–7:57 p.m.	60 minutes
10	Downtown to 6th & Wakarusa	Serves west and central Lawrence, connecting 6th & Wakarusa to Downtown via the KU campus. Destinations include Free State High, commercial areas at 6th & Wakarusa and Bob Billings and Wakarusa, Bob Billings, and Jayhawk Boulevard.	**Monday–Friday:** 6:02 a.m.–8:00 p.m.	30 minutes
			Saturday: 6:02 a.m.–8:00 p.m.	30 minutes

Route	Name	Service Description	Service Span	Average Service Frequency
15	Downtown to Peaslee Center	Serves east and southeast Lawrence. Destinations include Hobb's Park, Peaslee & Workforce Centers, Prairie Park Nature Center, Venture Park and East Hills Business Park.	**Monday–Friday:** 6:00 a.m.–7:56 p.m.	60 minutes
			Saturday: 6:00 a.m.–7:56 p.m.	60 minutes
27	KU to Haskell Indian Nations University	Connects HINU and neighborhoods southeast of KU with KU campus.	**Monday–Friday:** 7:05 a.m.–6:21 p.m.	40 minutes

2.2. KU on Wheels

KU on Wheels operates bus services during the fall and spring University of Kansas (KU) sessions. Ten routes, routes 30-44, operate exclusively Monday–Friday and one additional route, the 11A, also operates on Saturday. Routes 11 and 29 operate on the A schedule while KU is in session. **Figure 3** shows a system map focused on KU.[2] **Table 2** summarizes the basic service characteristics for each route.

[2] Source: https://lawrencetransit.org/routes/

FIGURE 3: SYSTEM MAP WITH KU DETAIL

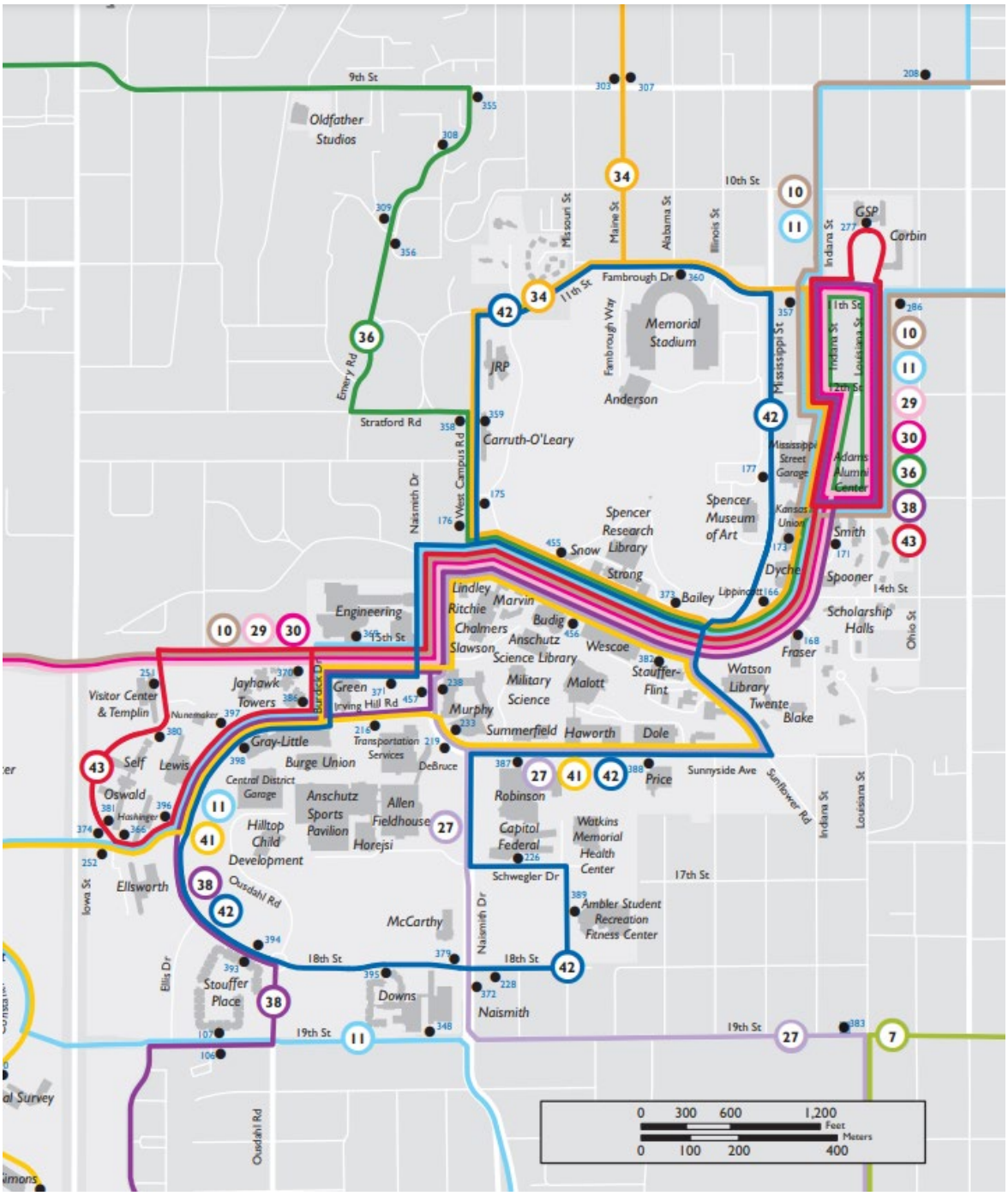


TABLE 2: KU ON WHEELS FIXED-ROUTE SERVICES CHARACTERISTICS

Route	Name	Service Description	Service Span	Average Service Frequency
30	Bob Billings & Kasold to KU	Connects apartment complexes along Bob Billings west of campus with KU.	**Monday–Friday:** 7:00 a.m.–10:30 p.m.	20 minutes
34	KU to 7th Street	Connects neighborhood and apartment complexes north of campus with KU.	**Monday–Friday:** 7:00 a.m.–10:00 p.m.	20 minutes
36	6th via Emery to KU	Connects apartment complexes on 6th and 9th streets northwest of campus with KU.	**Monday–Friday:** 7:00 a.m.–10:00 p.m.	20 minutes
38	25th & Melrose to KU	Connects apartment complexes and neighborhood south of campus with KU.	**Monday–Friday:** 7:00 a.m.–10:00 p.m.	25 minutes
41	Campus Circulator (Yellow)	Connects remote parking and research buildings west of Iowa Street with Jayhawk Boulevard and central KU campus.	**Monday–Friday:** 7:00 a.m.–5:30 p.m.	10–12 minutes
42	Campus Circulator (Blue)	Connects Central District, Rec Center, and Memorial Stadium via Jayhawk Boulevard on the KU campus.	**Monday–Friday:** 7:00 a.m.–5:30 p.m.	8–10 minutes
43	Campus Circulator (Red)	Connects Daisy Hill and North Campus residence halls to Jayhawk Boulevard.	**Monday–Friday:** 7:00 a.m.– 5:30 p.m.	7–9 minutes
44	Campus Evening Circulator	Modified combination of routes 41-43 that serves most of KU campus during the evenings.	**Monday–Friday:** 5:30 p.m.–10:30 p.m.	30 minutes

2.3. Coordinated Routes

Lawrence Transit and KU on Wheels jointly fund and operate two coordinated routes: 11 and 29. Each of these routes operates a high level of service on the "A" schedule, when classes are in session during the fall and spring semesters at KU, and a lower level of service during class breaks and the summer semester. **Table 3** summarizes the basic service characteristics for each route and schedule.

TABLE 3: COORDINATED ROUTES SERVICE CHARACTERISTICS

Route	Name	Service Description	Schedule	Service Span	Average Service Frequency
11	South Iowa to KU to Downtown	Serves central and south-central Lawrence, connecting downtown to 31st & Iowa via the KU campus. Destinations include East Lawrence, Jayhawk Boulevard, Daisy Hill, and residential and commercial areas south of 23rd Street.	A	**Monday–Friday:** 6:00 a.m.–8:00 p.m. 8:00 p.m.–10:30 p.m.	 30 minutes 60 minutes
				Saturday – see "B" schedule (next row)	
			B*	**Monday–Friday:** 6:30 a.m.–4:00 p.m. 4:00 p.m.–8:00 p.m.	 30 minutes 60 minutes

Route	Name	Service Description	Schedule	Service Span	Average Service Frequency
29	27th & Wakarusa to KU	Connects residential areas in southwest Lawrence with the KU campus. Destinations include residential areas along Clinton Parkway, 27th & Wakarusa, 24th Place, commercial area at Clinton & Kasold, and LMH South.	A	**Monday–Friday:** 7:00 a.m.–6:00 p.m. 6:00 p.m.–10-:30 p.m.	20 minutes 60 minutes
			B	**Monday–Friday:** 7:20 a.m.–6:20 p.m.	40 minutes

* Route 11 B schedule was severely impacted by the pandemic, operating a 90-minute schedule in 2020-21. All data in this analysis used the previous schedule (shown here), and route 11 will return to that schedule in August 2021, before this study is completed.

2.4. Additional Transportation Services

In addition to fixed route service offered by Lawrence Transit and KU on Wheels, there are several other regional, paratransit, and on-demand service offered in the area. They are:

- ADA Services
  - **T Lift**: Provides paratransit services within Lawrence city limits to riders who cannot use fixed route transit because of a disability.
  - **JayLift**: Provides transportation within Lawrence city limits to KU students, staff, and faculty who have disabilities.
- Social Services
  - **Babcock Bus**: The Lawrence-Douglas County Housing Authority provides transit to residents of Babcock Place and Peterson Acres by donation.
  - **Bert Nash Center:** Provides transportation to Bert Nash clients for medical, shopping, or employment related trips.
- Senior Services
  - **Independence, Inc.**: Provides on-demand transportation to the elderly and persons with disabilites. Transportation is also open to the general public.
  - **Senior Resource Center for Douglas County, Inc.** (SRC): provides Dougles County residents age 60 and over with demand-response transportation.
- Late Night Services
  - **Night Line**: Provides scheduled demand-response service from 8:00 p.m.–6:00 a.m. within Lawrence city limits.
  - **SafeRide**: This demand-response service provides KU students a ride home from anywhere within Lawrence city limits from 10:30 p.m.–2:30 a.m.
- **K-10 Connector**: When KU classes are in session, RideKC, Kansas City's transit provider, operates the K-10 Connector. The 510 K-10 Connector connects KU with the KU Edwards Campus in Overland Park.

2.5. Passenger Amenities and Transit Facilities

2.5.1. Bus Stops and Amenities

Lawrence Transit has 315 bus stops, including 50 with shelters and benches and 35 with benches only. KU on Wheels includes 53 bus stops. 13 have shelters and benches, and 13 more have benches only.

2.5.2. Passenger Information

Passenger schedules, system maps, and a trip planner tool are available online at the Lawrence Transit website, https://lawrencetransit.org/. In addition to online resources, two mobile tools are available. A free bus app called "MyBusLawrence" can be downloaded and provides real-time bus location data. A text messaging service is also available that allows users to text a bus stop number and receive a reply with the next bus arrival times.

2.5.3. Transit Center

One of the Lawrence Transit Route Redesign goals is to develop service improvement recommendations to ensure a smooth integration of the new Multimodal Transfer Facility that is being developed at the southeast corner of Bob Billings Parkway and Crestline Drive. The 2018 *Lawrence Bus Transfer Location Analysis* studied five potential transfer locations that would improve the efficiency of the transit system. The report provided a comparative analysis that evaluated sites based on:

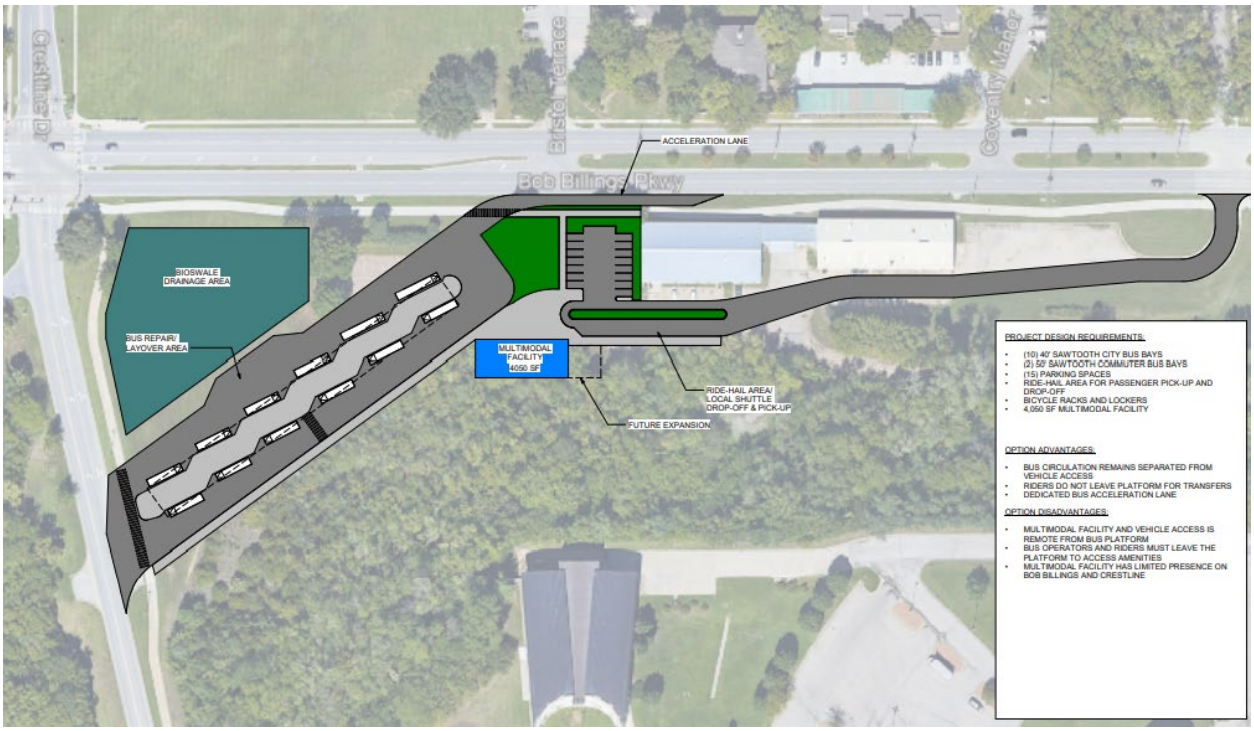
- Travel time, with 30-minute trips preferred.
- Centralized location, preferably central to University of Kansas and shopping districts.
- Accommodates an indoor facility, with a lot size of two and a half acres.
- Accommodates fleet operations, ease of ingress/egress and bus maneuverability on-site.
- Located outside of residential neighborhoods along an arterial street or land use buffer.
- Cost-effective to acquire property, preferably owned by the City or other public institution.
- Ease of constructability, with utilities present and clear of structures or other development.

The 2018 report identified the southeast corner of Bob Billings Parkway and Crestline Drive as a potential location for the transfer facility. KU and the City of Lawrence signed an agreement in July 2020 to develop a bus transfer center in the open green space at the corner and potentially use some or all of the building and parking footprints to the east. **Figure 4** depicts one of the draft concepts for the site.[3] Currently, the site has no transit activity. This system redesign will restructure service to utilize the Bob Billings & Crestline site as a transfer center and reduce the role the Lawrence Public Library (707 Vermont Street) has as a transfer hub. Today, the Lawrence Public Library is Lawrence Transit's main transfer hub. The proposed location's size would support the growth of the transit system and may include amenities such as:

- Enhanced markers or signage to indicate an entrance to campus.
- Saw-tooth style transit bays with one-way traffic flow.
- Indoor areas for operators and transit users that may include restrooms, a waiting area, and a public meeting space.

[3] Source: Wendel, https://lawrencetransit.org/wp-content/uploads/2021/06/Multimodal-Transfer-Facility-Bob-Billings-concepts.pdf

FIGURE 4: CONCEPTUAL LAYOUT OF PROPOSED LAWRENCE BUS TRANSFER LOCATION AT BOB BILLINGS PARKWAY AND CRESTLINE DRIVE



3. BUDGET AND FUNDING

3.1. Revenues and Expenses

In FY 2019, Lawrence Transit's total expenditures were $7,326,502, with $7,223,272 in operating expenses and $103,230 in capital expenses. In FY 2020, Lawrence Transit's total expenditures rose to $9,108,200, with $7,163,300 in operating expenses and $1,944,900 in capital expenses, the latter of which were primarily vehicle replacements. **Figure 5** and **Figure 6** show Lawrence Transit's Operating and Capital Revenue Sources, respectively, in 2020. The majority of Lawrence Transit's operating revenue comes from local and federal funding sources, with very modest portions coming from the state and fares. However, Lawrence Transit's capital revenues are primarily from the state (over three-quarters) and federal government, with only a very small portion of capital revenues coming from local funding.

FIGURE 5: LAWRENCE TRANSIT OPERATING REVENUE SOURCES, FY 2020

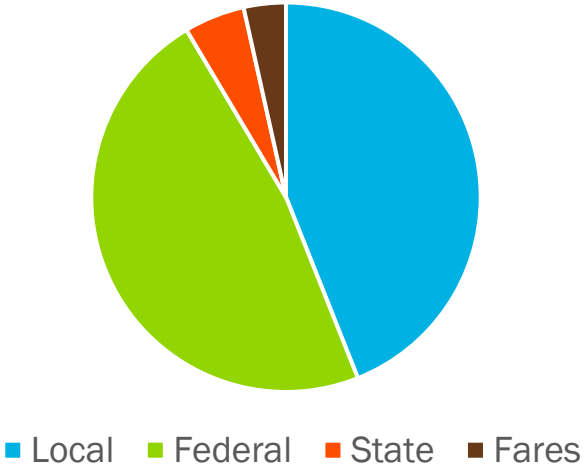
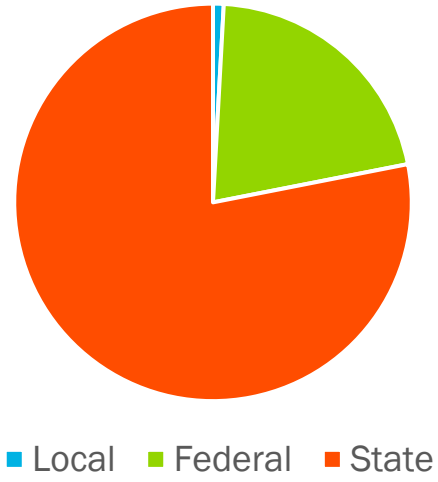


FIGURE 6: LAWRENCE TRANSIT CAPITAL REVENUE SOURCES, FY 2020



In FY 2019, KU on Wheels' total expenditures were $4,549,804, with $3,111,728 in operating expenses and $1,438,076 in capital expenses. In FY 2020, KU on Wheels' total expenditures were $5,000,598, with $3,644,426 in operating expenses and $1,280,907 in capital expenses. The majority of KU's operating and capital revenues come from student fees, which are charged on a per student, per semester basis. If KU's revenues from student fees do not exactly equal expenditures, the difference is carried over into the next fiscal year.

3.2. Fares

Table 3 shows fare and pass options for the Lawrence Transit system. Any fares collected on KU buses are passed through to Lawrence Transit, but as indicated in **Table 4**, KU Card holders can ride routes on either system without paying a fare.

TABLE 4: LAWRENCE TRANSIT FARES AND PASSES

	Regular	Reduced*	T-Lift**
One-way fare	$1.00	$0.50	$2.00
Night Line fare	$2.00	-	-
Day Pass	$2.75	$1.35	-
10-Ride Punch Card	$10.00	$5.00	$20.00
Monthly Pass	$34.00	$17.00	$68.00
K-12 Semester Pass	$10 for four months		-
KU Card	Free		
Children (5 & under)	Free		
Transfers	Free		

*Applies to students (without Semester Pass) in kindergarten through 12th grade, Haskell Indian Nations University students, seniors (ages 60+), and persons with disabilities.

**Paratransit; requires certification.

In 2019, Lawrence Transit reported $439,972 in farebox revenue, with $294,781 coming from fixed-route service and $145,191 from T-Lift. In 2020, due to the COVID-19 pandemic, farebox revenues dropped to $249,004, with $168,166 from fixed-route and $80,838 from T-Lift.

3.3. Financial Indicators

Table 4 shows the performance of Lawrence Transit's two modes (fixed-route bus and demand response) and KU on Wheels with respect to key financial productivity metrics.

TABLE 5: FINANCIAL PRODUCTIVITY METRICS FOR LAWRENCE TRANSIT AND KU ON WHEELS, FY 2019

Metric	Lawrence Transit - Fixed-route	Lawrence Transit - T-Lift	KU on Wheels	National Average
Cost per vehicle revenue hour	$60.07	$60.51	$89.71	$85.11 (Fixed-route bus, unweighted average) $63.62 (Demand response, unweighted average)

Metric	Lawrence Transit - Fixed-route	Lawrence Transit - T-Lift	KU on Wheels	National Average
Cost per passenger mile	$1.49	$7.25	$2.09	$1.90 (Fixed-route bus)[4] $5.63 (Demand response)
Cost per passenger trip	$4.37	$28.99	$1.88	$5.24 (Fixed-route bus) $42.85 (Demand response)
Fare revenue per passenger trip	$0.27	$1.77	n/a	$0.98 (Fixed-route bus)[1] $2.86 (Demand response)
Farebox recovery ratio	6%	6%	n/a	21% (Fixed-route bus) 7% (Demand response)

Lawrence Transit and KU on Wheels have costs per vehicle revenue hour and costs per passenger trip that are considerably below national averages; the two agencies' use of purchased transportation as well as labor rates in Kansas being lower than the national average may contribute to this difference. KU on Wheels' cost per passenger mile is slightly above the national average, while Lawrence Transit's is below.

Lawrence Transit's fare revenue per passenger trip is significantly below the national average for demand response and, notably, nearly four times lower than the national average for fixed-route bus. Along with a farebox recovery of less than a third the national average, these data indicate that Lawrence Transit collects a significantly smaller portion of its revenues, especially for fixed-route service, from fares compared to peer agencies with similar service levels. This may be in part due to the number of KU passengers on city routes.

[4] Includes only agencies that are Full Reporters to the NTD.

4. MARKET ANALYSIS

More than any other factor, density determines the effectiveness and efficiency of public transportation. Places with higher concentrations of people and/or jobs tend to have higher transit ridership. At the same time, most transit agencies have a mandate to provide comprehensive service in the communities they serve and to provide mobility for residents with no other means of transportation. The purpose of this Market Analysis is to both identify the strongest transit corridors in the City of Lawrence and to highlight areas with relatively high transit need. Thus, the Market Analysis consists of two key components: Transit Potential and Transit Need.

While Transit Potential is an analysis of population and employment density, Transit Need focuses on socio-economic characteristics such as income, automobile availability, age, and disability status that are indicative of a higher propensity to use transit. Transit use is also influenced by the built environment. In particular, certain land uses—such as retail centers, civic buildings, multifamily housing, educational institutions, medical facilities, and major employment centers—tend to generate transit trips at a relatively higher rate. As such, these ridership generators are included in the maps describing Transit Potential and Transit Need. Additionally, the City of Lawrence is home to two colleges, the University of Kansas and Haskell Indian Nations University, both of which are currently served by fixed-route transit and outlined in maps in this section.

4.1. Transit Potential

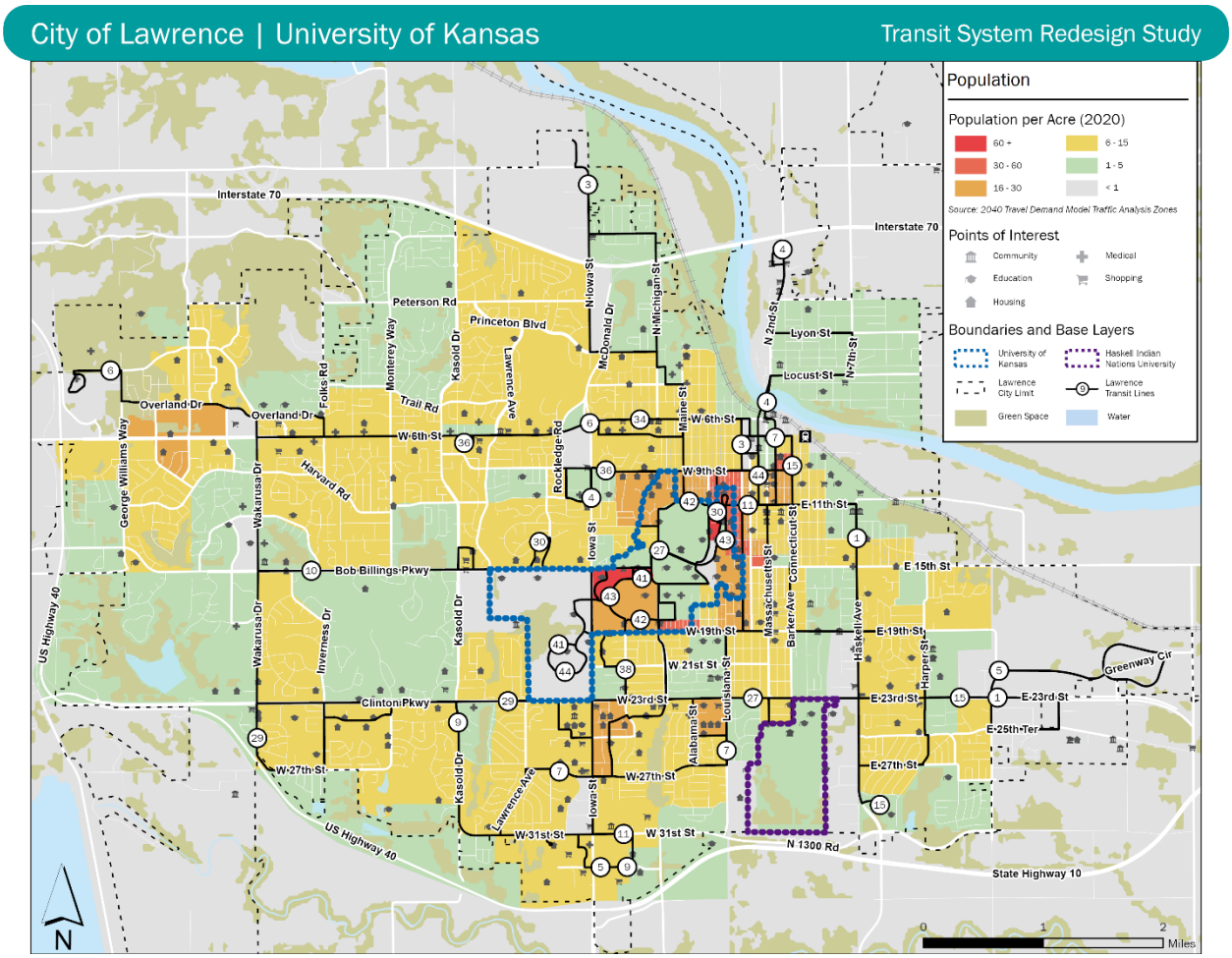
Transit service is generally most effective in areas with high concentrations of residents and/or jobs. The following Transit Potential analysis uses the 2020 population and employment projections from the Lawrence Transit Travel Demand Model (T2040). The geographic divisions used for this analysis are Transportation Analysis Zones (TAZ).

4.1.1. Population Density

Public transportation is most efficient when it connects population and employment centers where people can easily walk to and from bus stops. Transit's reach is generally limited to within one-quarter mile to one-half mile of the transit line, or a 10-minute walk. For this reason, the size of a transit travel market is directly related to an area's population density. Typically, a density greater than five people per acre is needed to support base-level (hourly) fixed-route transit service. **Figure 7** shows the population density of Douglas County. Yellow areas indicate places where fixed-route service could be feasible; areas that are orange or red have the potential to support more frequent service.

Douglas County at large has low population density unsupportive of traditional fixed-route transit; however, pockets of transit-supportive densities are prominent throughout the City of Lawrence, concentrated most heavily around the University of Kansas (KU) campus, but also along Iowa St (US-59), West 6th Street, East 23rd Street, along Massachusetts Street, and in the area surrounding Lawrence Memorial Hospital.

FIGURE 7: POPULATION DENSITY

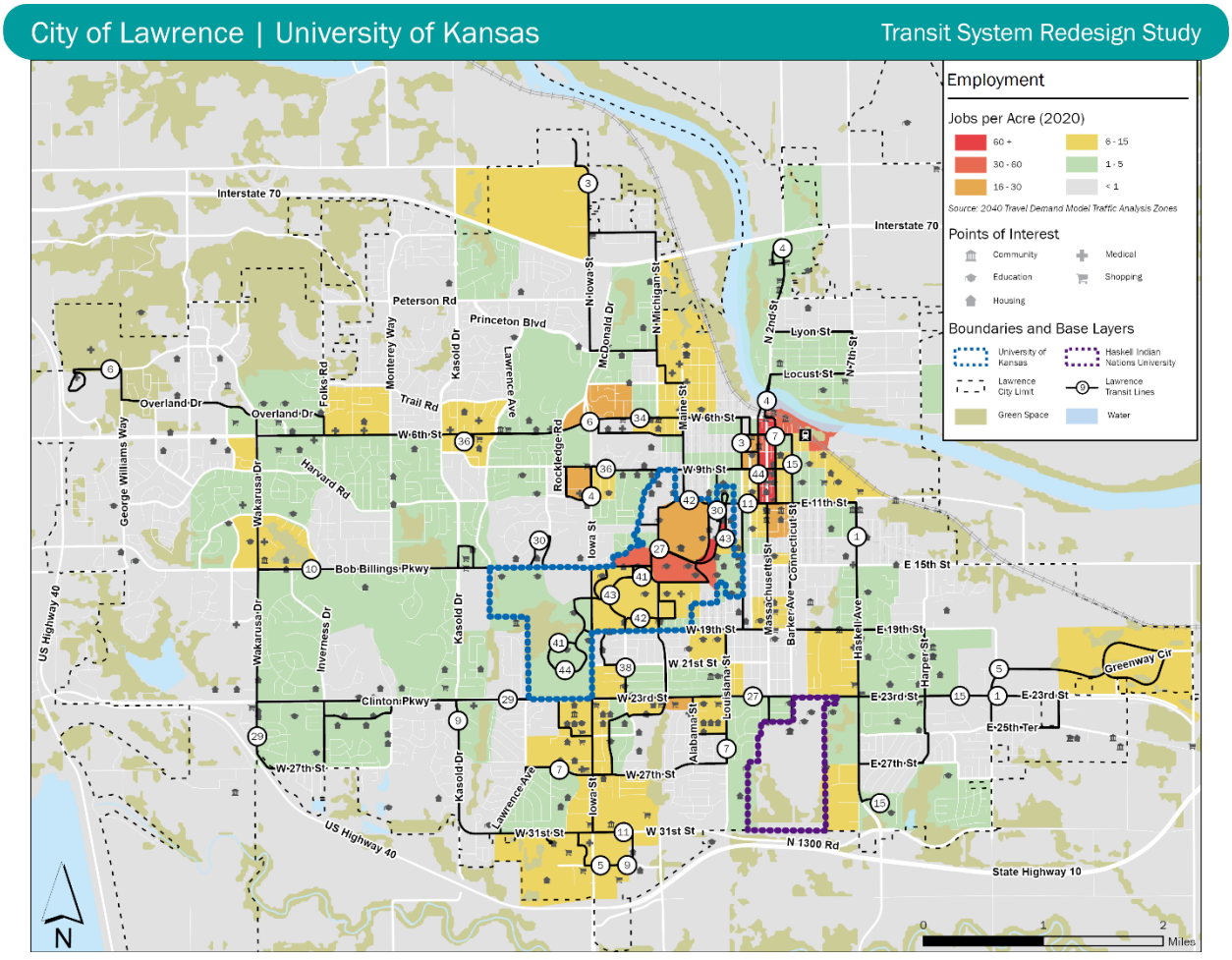


4.1.2. Employment Density

Given that traveling to and from work accounts for the largest single segment of transit trips in most markets, the location and number of jobs in a region are also strong indicators of transit demand. Transit that serves areas of high employment density also provides key connections to job opportunities. Like population density, an employment density greater than five jobs per acre can typically support base-level fixed-route service. This density corresponds with the yellow, orange, and red areas in **Figure 8.**

In Lawrence, job concentration is highest in Downtown Lawrence around the Massachusetts Street commercial corridor and around the University of Kansas. Additionally, there are some pockets of job density on the south side of the city along Iowa Street (US-59) between 23rd Street and Kansas State Highway 10.

FIGURE 8: EMPLOYMENT DENSITY



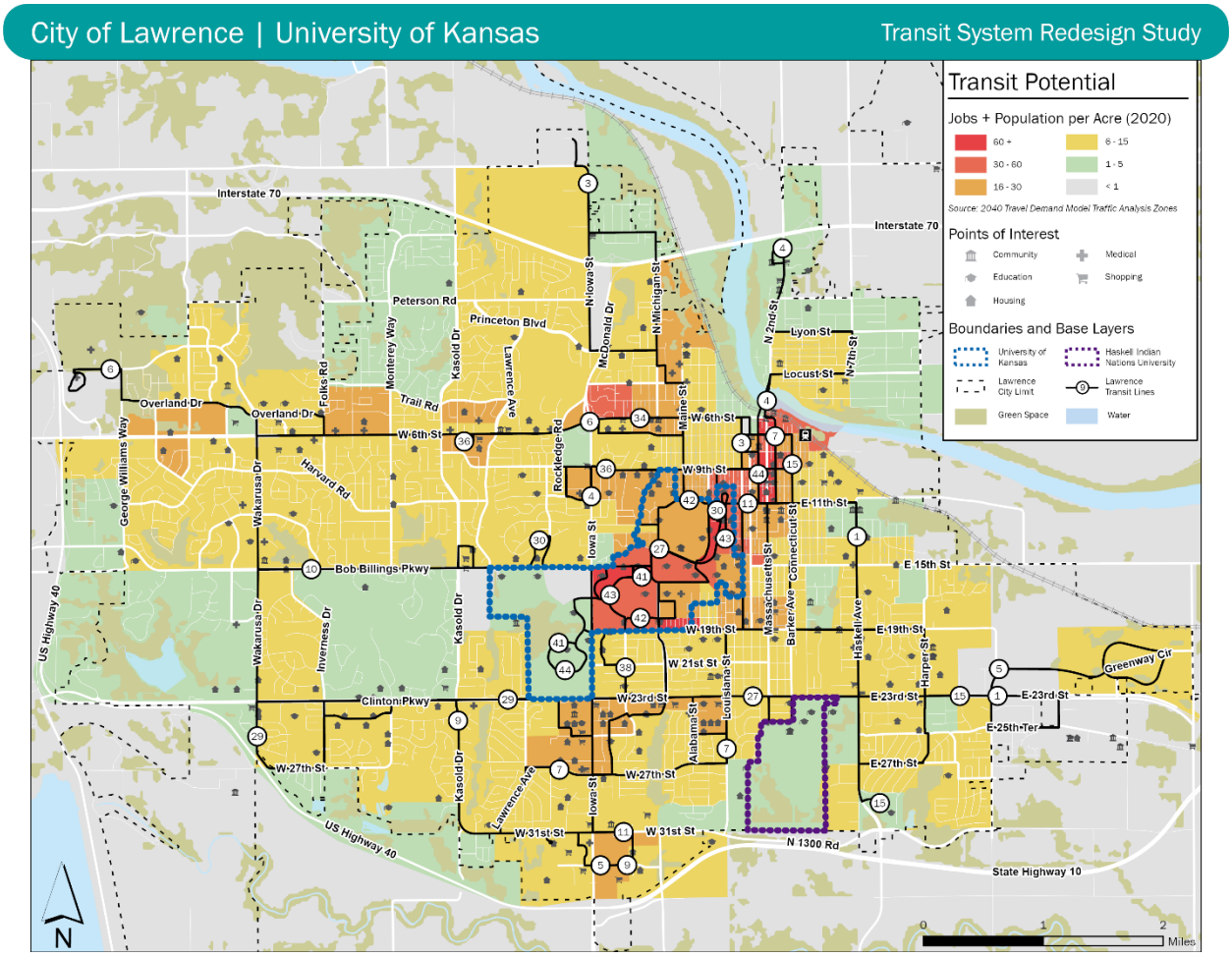
4.1.3. Transit Potential

Transit Potential, depicted in **Figure 9**, combines the population and employment densities for each TAZ shown previously to indicate fixed-route service viability in the study area. In Lawrence, the areas of highest transit potential are concentrated primarily between the University of Kansas and the Massachusetts Street corridor in Downtown Lawrence. These places also stood out as areas with high concentrations of jobs and population as well in the previous sections. When combining the two metrics, however, many more places appear to be potentially supportive of fixed-route transit services, most notably along Iowa Street/US-59 south of 23rd Street & Iowa, where there are high concentrations of retail jobs and multi-family housing developments. Additionally,

several locations along West 6th Street, West 23rd Street, Kasold Drive, and the Lawrence Memorial Hospital area all appear to have densities supportive of fixed-route transit.

Additional factors, such as land use and intersection density, can impact the feasibility of fixed-route transit services. Many of the yellow areas on the map in **Figure 9**, such as the neighborhoods between West 6th Street and Harvard Road, have transit-supportive population and employment densities but may still be inefficient for fixed-route services. In areas like these, it is worth considering other interventions, such as on-demand microtransit, to provide efficient service.

FIGURE 9: TRANSIT POTENTIAL



4.2. Transit Need

Above all, public transportation is a mobility tool. Certain population subgroups have a relatively higher propensity to use transit as their primary means of local and regional transportation. These groups include:

- **People without access to an automobile**, whether it be by choice or due to financial or legal reasons, often have no other transportation options besides using transit.
- **Persons with disabilities**, many of whom cannot drive and/or have difficulty driving.
- **Low-income individuals**, typically because transit is less expensive than owning and operating a car.
- **Youth/young adults** who are either too young to drive, or have in recent years shown a greater interest in transit, walking, and biking than in driving.
- **Older adults**, who as they age, often become less comfortable or less able to operate a vehicle.

The maps in this section show the relative densities of each of these five high-transit-propensity population subgroups by Census block groups in Douglas County to help determine where the need for transit service is greatest.

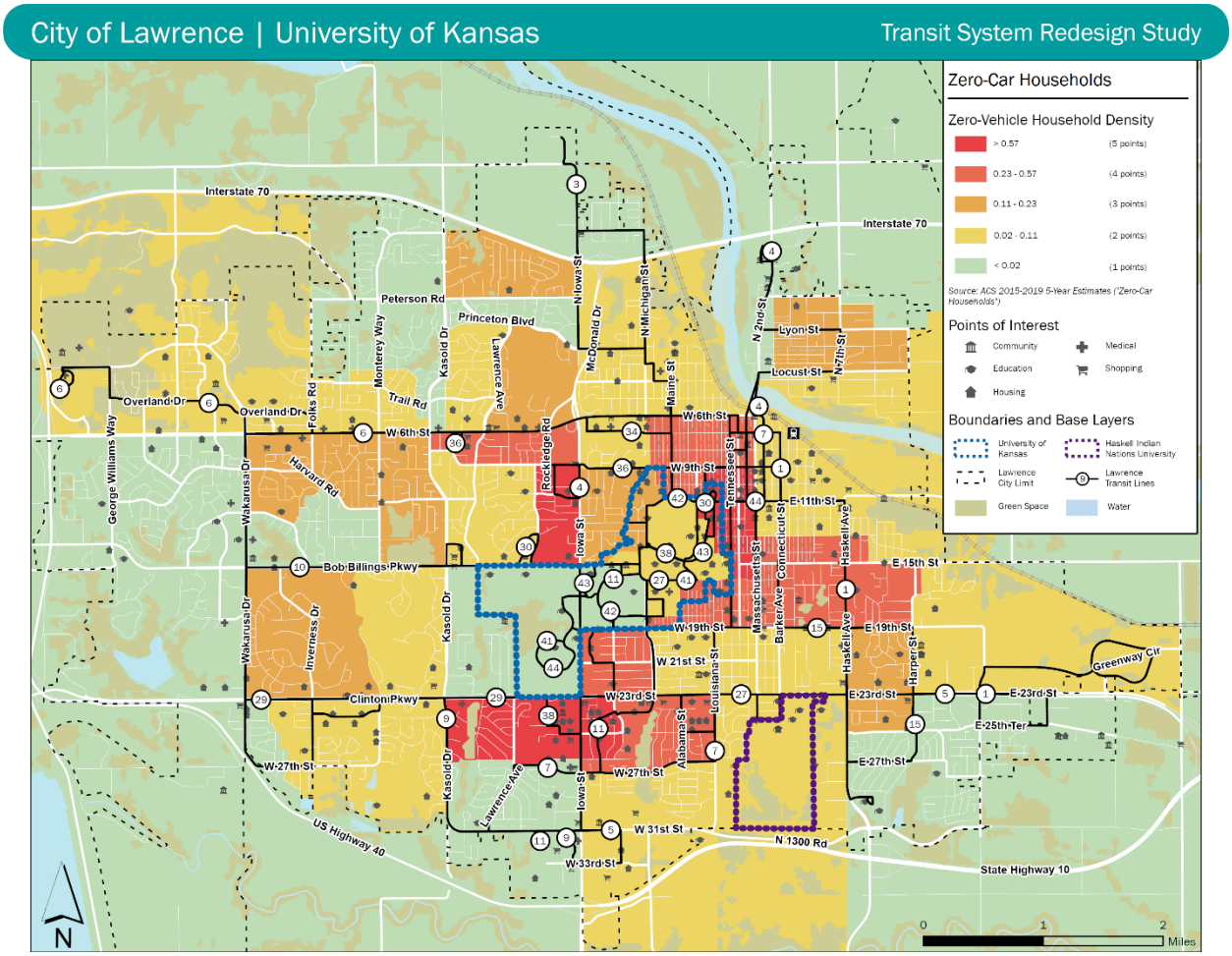
With density ranges differing for each demographic analysis, the maps utilize a Jenks Natural Breaks classification method to assign each block group to one of five density categories. For each analysis, depending on the natural break category into which it falls, a score from 1 (lowest density) to 5 (highest density) is assigned to each block group. Following the analysis of each individual factor, the Transit Need Index map (**Figure 15**) shows the composite Transit Need score for each block group based on the sum of its scores in each preceding analysis. For example, if a block group falls in the highest density category for each of the five demographic analyses, it will end up with a Transit Need Index value of 25 (5+5+5+5+5). The lowest possible Transit Need Index score is 5 (1+1+1+1+1).

While the Transit Potential analysis highlights areas of Lawrence with actual densities to support fixed-route service, Transit Need is a relative measure that estimates the need for transit compared to other block groups. There is not, however, a specific Transit Need Index score or value that represents a threshold for supporting fixed-route service. Instead, Transit Need should be considered alongside Transit Potential. If two areas have similar and sufficient Transit Potential, the area with higher Transit Need should be prioritized for service. Conversely, in some locations, while the density of transit-dependent population groups may be relatively high, if the total population and/or employment density are still quite low, the potential to generate substantial fixed-route transit ridership will also remain low.

4.2.1. Zero-Vehicle Household Density

Figure 10 shows zero-vehicle household density throughout the City of Lawrence. Relative to Douglas County, the highest concentrations of zero-vehicle households are most prevalent around the University of Kansas campus, Downtown, and along Iowa Street (US-59), particularly at the West 9th Street and West 23rd Street intersections.

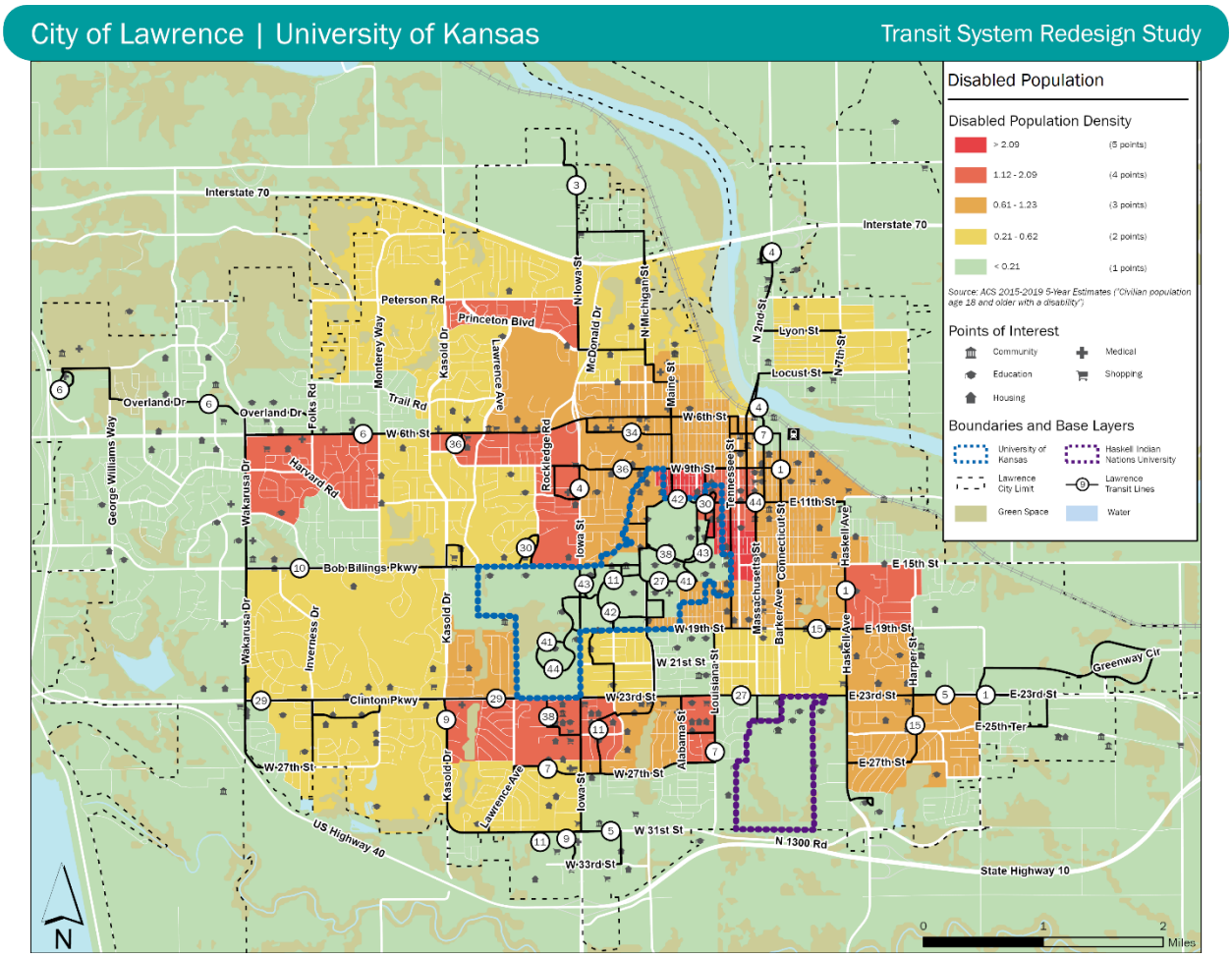
FIGURE 10: ZERO-VEHICLE HOUSEHOLD DENSITY



4.2.2. Population with Disabilities Density

Figure 11 shows the density of people living with a disability. The highest concentrations of people with a disability are found adjacent to the University of Kansas campus along Tennessee and Kentucky Streets. Additional areas with high densities of populations with a disability can be found in West Lawrence along West 6th Street and Clinton Parkway and West 23rd Street at Iowa Street. Additional concentrations of residents with a disability can be found in the Quail Run neighborhood where existing transit provides service to arterial roads only and would require riders to walk to access transit.

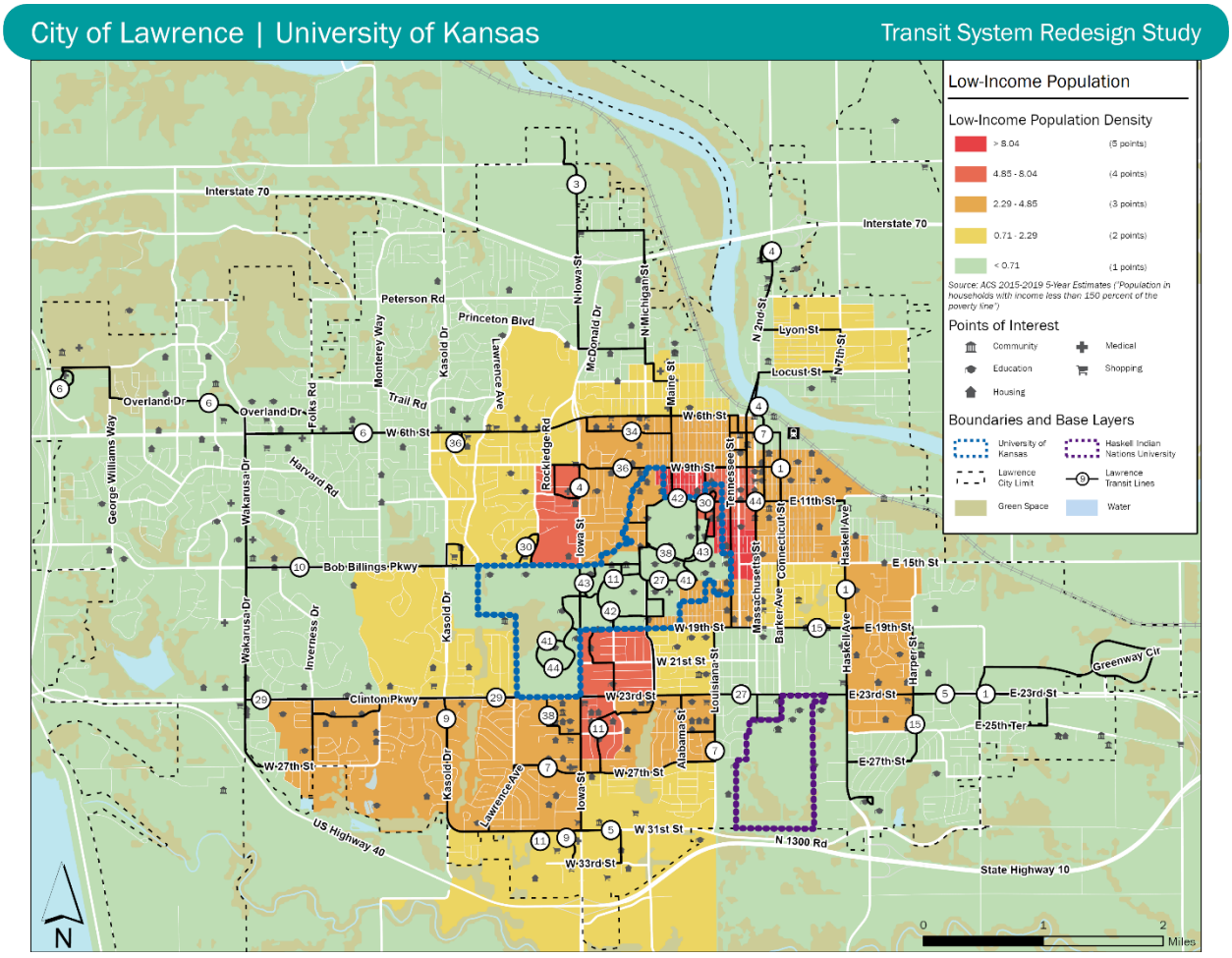
FIGURE 11: POPULATION WITH DISABILITIES DENSITY



4.2.3. Low-Income Population Density

Figure 12 shows the density of low-income households throughout Lawrence. Low-income households are defined as those earning less than 150 percent of the federal poverty line. Low-income households are concentrated most densely around the Oread neighborhood and east of Iowa Street along West 23rd Street. Additionally, part of the Sunset Hills neighborhood between Crestline Drive and Iowa Street appears to have relatively more low-income households than Iowa Street.

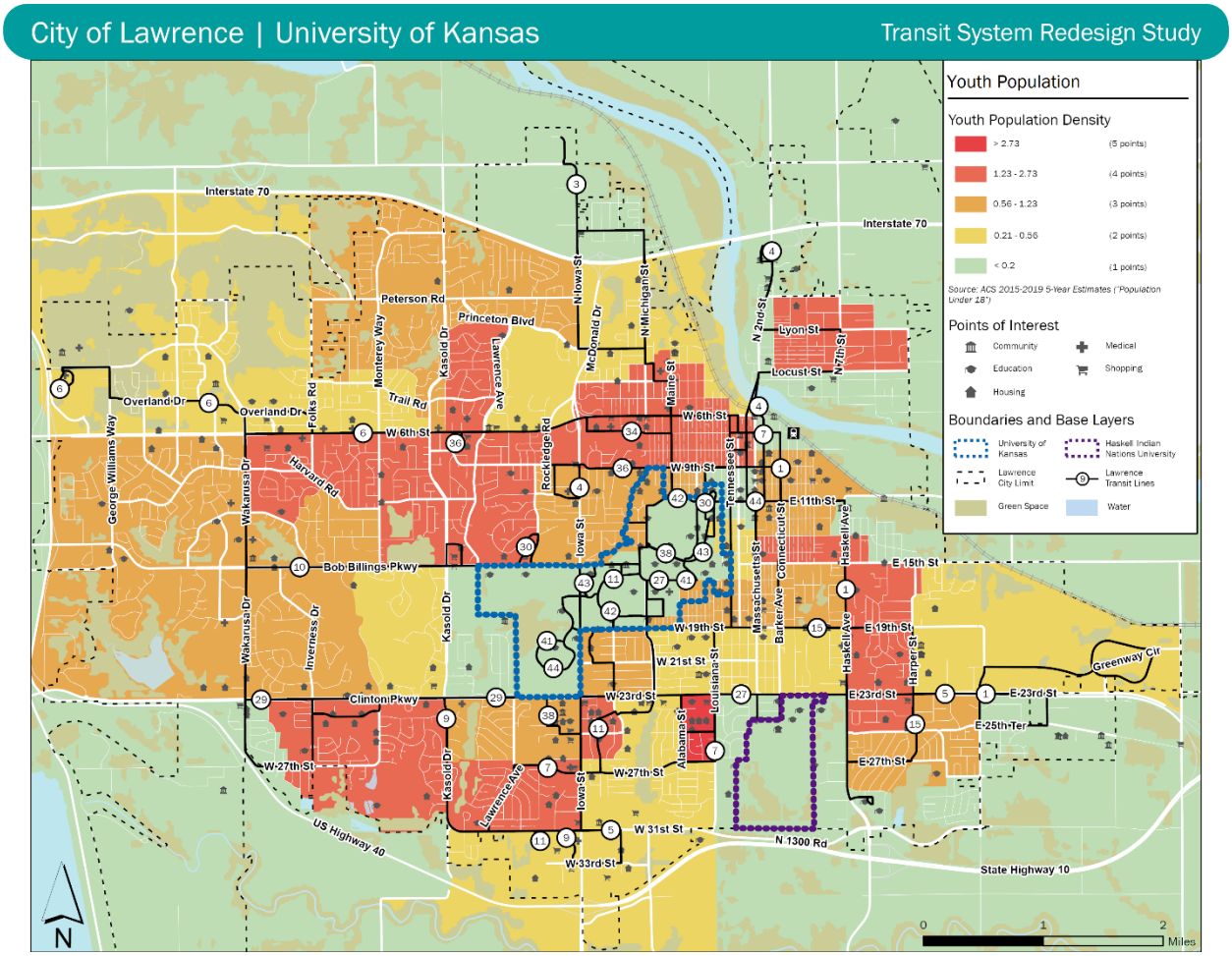
FIGURE 12: LOW-INCOME POPULATION DENSITY



4.2.4. Youth Population

Figure 13 shows the density of the youth population of Lawrence. Generally, the city of Lawrence has a very high youth population density, relative to Douglas County, so high concentrations of youth appear prevalent throughout the city. Unlike many of the previous transit need demographics, the youth population is not most highly concentrated in the area immediately surround the University of Kansas. Rather, youth population density is highest in the neighborhoods of Lawrence, particularly in the Quail Run, Perry Park, and Sunset Hills neighborhoods of West Lawrence, south of Clinton Parkway and west of Kasold Drive, and in the Old West Lawrence Neighborhood near Downtown.

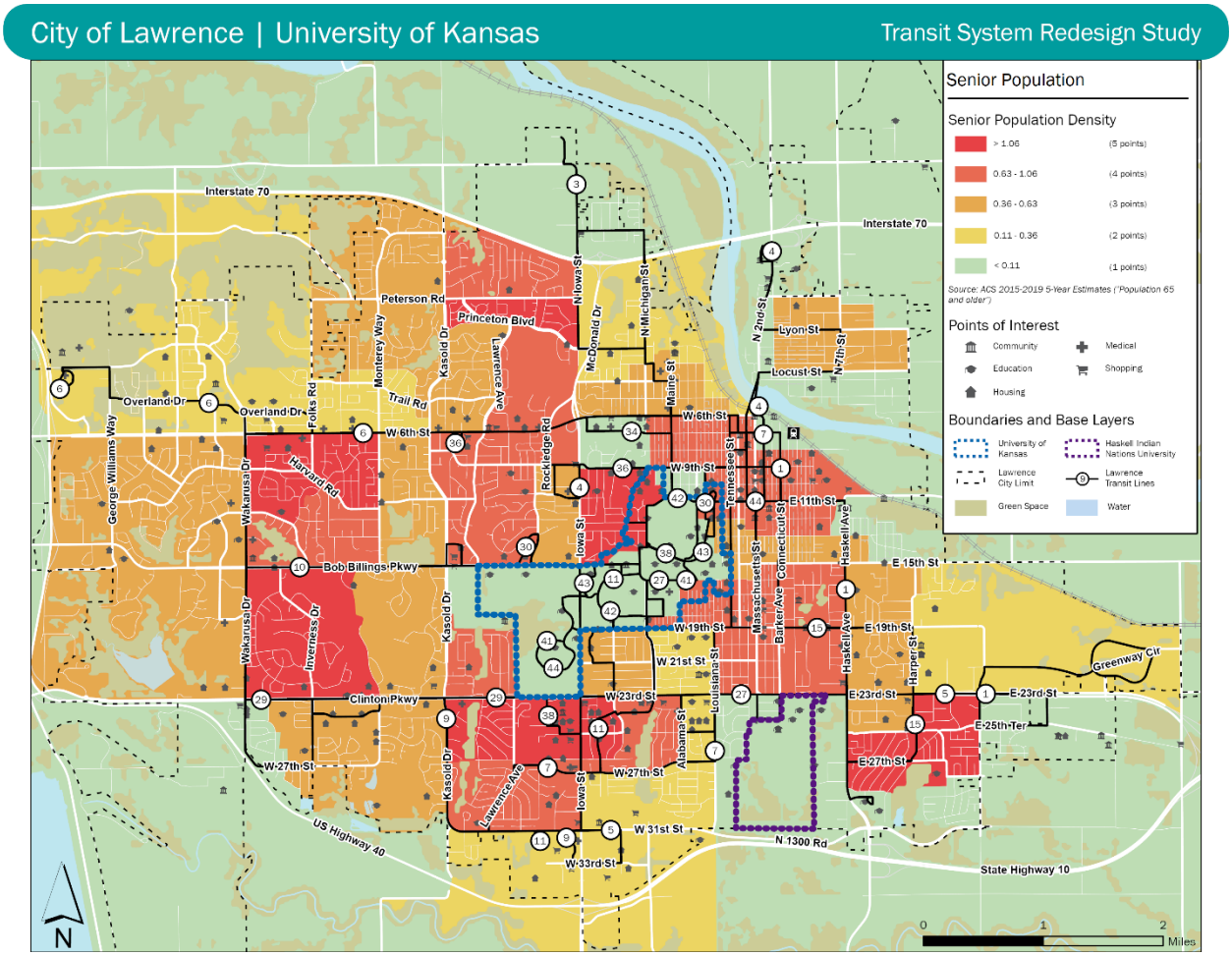
FIGURE 13: YOUTH POPULATION DENSITY



4.2.5. Senior Population

Figure 14 shows the population of adults aged 65 or older in Lawrence. The city of Lawrence has a high senior-aged population density, relative to Douglas County, so high concentrations of seniors appear prevalent throughout the city. In Lawrence, concentrations of seniors are highest in neighborhoods east of Wakasura Drive between West 6th Street and Clinton Parkway, around West 23rd Street and Iowa Street, and in the neighborhood of Prairie Park. Additional pockets of high senior density can be found in the neighborhoods adjacent to Princeton Boulevard. Transit services in most of these neighborhoods primarily serve arterial roads only and would require riders to walk to the nearest stop to access transit.

FIGURE 14: SENIOR POPULATION DENSITY



4.2.6. Transit Need

Figure 15 combines the five preceding demographic-density maps into one composite Transit Need map. The Transit Need Index reveals that the populations most likely to need transit services are most prevalent in neighborhoods and new housing developments along Iowa Street at West 9th Street and south of West 23rd Street, in the Quail Run neighborhood in western Lawrence, and the Brook Creek neighborhood in eastern Lawrence.

FIGURE 15: TRANSIT NEED COMPOSITE SCORE