

KANSAS CITY STREETCAR MAIN STREET EXTENSION

Travel Forecasts



Submitted by the KC Streetcar Partnership

Applicant: City of Kansas City, Missouri

Partner: Kansas City Streetcar Authority

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August 23, 2019



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1.0 Travel Forecasts

This section documents the ridership forecasts for the Kansas City Streetcar Main Street Extension Project (Project). Ridership forecasts were developed using the Federal Transit Administration (FTA) Simplified Trips-on-Project Software (STOPS) version 2.1. The current year Project ridership estimate, assumed annualization factor, and an estimation of current transit-dependent ridership based on the application of the FTA STOPS model are all included in this section. Also included is a summary of the travel forecasting methodology and key project assumptions.

1.1 Project Description

The Project will extend the current Streetcar route from Union Station at Main Street / Pershing Road to 51st Street / Brookside Boulevard – approximately 3.5 miles. With the expansion, the KC Streetcar will have a weekday service span of 4:00am to 12:00am. (On Fridays, this will extend to 2:00am – into Saturday morning.) The route will operate at 10-minute headways for most of the day (5:00am to 10:00pm). The route will operate at 30-minute headways from 4:00am to 5:00am and 12-minute headways from 10:00pm to 12:00am. The route extension will add the following station locations:

- Union Station northbound
- 27th Street and Main Street northbound and southbound
- 31st Street and Main Street northbound and southbound
- Armour Boulevard and Main Street northbound and southbound
- 39th Street and Main Street northbound and southbound
- 43rd Street and Main Street northbound and southbound
- 45th Street and Main Street northbound and southbound
- 47th Street and Main Street northbound and southbound
- 51st Street and Brookside Boulevard combined northbound and southbound

In addition to the KC Streetcar stations, a bus transit center will be constructed on the east side of Brookside Boulevard, south of Emanuel Cleaver Boulevard.

1.2 Travel Forecasts Report

This section documents the current assumptions, inputs, and methodology used to estimate ridership, the change in vehicle miles traveled (VMT), the consideration of transit-dependent populations, and the annualization factor for the Streetcar. The results from the STOPS model are used for this application.

1.2.1 Primary Mobility Benefits

The purpose of the Project is to improve mobility in Kansas City's urban core and enhance transit service along Main Street, Kansas City's central transit spine, by providing faster service due to multi-door boarding, level boarding, optimized station spacing, and transit priority measures such as transit signal priority (TSP). The Project will replace the existing Main Street MAX route and improve circulation and mobility in the Main Street Corridor by strengthening connections to employment and downtown activities, including tourism, leisure, cultural, historic, and residential.

The Project will improve the quality of transit infrastructure and service along Main Street, the second busiest transit corridor in the Kansas City area. Main Street MAX is the existing north-south transit spine through the corridor connecting the Waldo, Brookside, Plaza, and Midtown neighborhoods with downtown Kansas City, south Kansas City and the greater metropolitan region. Increased transit capacity and speed will better serve the existing 4,000 weekday passengers on Main Street MAX, which connects with eight cross-town routes providing access to regional opportunities throughout the corridor. Main Street MAX also connects to routes providing service south to the larger southern part of the service area. The Streetcar already connects with most routes serving the downtown area and will connect with almost all suburban and express routes upon completion of the Project. The Project will continue the investment in rapid transit to improve the mobility options available in the metropolitan area.

The Project will provide two primary mobility benefits. The Project will enhance the existing transit system and provide an integrated transit spine that provide riders increased capacity, greater reliability, and improved travel times. In addition, the Project will enhance the effectiveness of the current transit system by expanding the existing Streetcar route to extend the accessibility of the route to employment, entertainment, and other key destinations in the Kansas City area. The Project will:

- Expand transit capacity and service reliability in the corridor to better serve the existing 4,000 weekday transit riders on Main Street MAX;
- Provide enhanced transit service for the high concentration of low-income and transit-dependent residents along Main Street;
- Enhance the region's transit system by creating a significant central spine around which to organize and integrate regional service;
- Improve the quality of transit infrastructure along Main Street;
- Support economic development and transit-oriented development (TOD) within the urban core by providing a strong incentive for the new, infill and redevelopment along the corridor; and
- Streamline the downtown transit network and support existing redevelopment in the corridor.

1.2.2 STOPS Inputs

The following discussion documents the inputs used in the model to develop the forecasts. The inputs include Mid-America Regional Council (MARC) socioeconomic and highway skim data, existing transit system data from the KCATA, and transit survey data.

MARC Data

The current regionally adopted socioeconomic data was obtained from MARC, the region's Metropolitan Planning Organization (MPO). The base year in the MARC data is 2015 and the future year is 2040. To develop the data for the existing year ridership forecast (2017) and future year ridership forecasts, including 2023 (opening year), 2027 and 2037, the population and employment data was interpolated between 2015 and 2040 to develop the inputs.

The highway travel time and distance skims were also obtained from MARC from the regional travel demand model. The 2015 and 2040 data was input into the STOPS model.

KCATA Data

The existing transit system data was obtained from the KCATA. The existing transit network general transit feed specification (GTFS) was input into the model to develop the existing transit network. The GTFS data for the realignment of Main Street MAX to Grand Avenue was also obtained for use in the no build and build scenarios. Average daily ridership by stop by route was obtained for the current transit network including Johnson County Transit routes and the existing Streetcar route.

On-Board Survey

ETC Institute completed an in-person survey on-board Main Street MAX and Streetcar vehicles in August through October 2017. The primary purpose of the survey was to better understand travel patterns, trip purpose, access modes, and general demographics of transit passengers in the Main Street corridor to assist with ridership forecasting and potential bus route modifications. The survey field work consisted of two major elements:

- On-to-Off (O2O) survey to identify boarding and alighting paths, and
- Origin-Destination (OD) survey that includes a detailed interview of passengers on the two routes.

ETC collected 572 validated weekday responses from Main Street MAX riders and 642 validated responses from Streetcar riders. ETC surpassed the goal of 7.5 percent of weekday ridership surveyed. The OD survey was weighted and expanded to represent the total ridership population on both routes using existing automated passenger counter (APC) data and the O2O survey. A detailed description of the survey design, sampling procedures, methodology, and data analysis is included in a separate report, 2017 KC Streetcar and Main Street MAX On-Board Survey Methodology Report.

The Main Street MAX and Streetcar Survey was combined with the 2005 MARC System Wide On-Board Survey to develop the transit trip tables for use in the model. The MARC survey was re-weighted using 2017 KCATA APC counts by route. The survey contained records for Route 56 which pre-dated Main Street MAX. The records that corresponded with Route 56 were removed from the survey and replaced with the Main Street MAX survey records from the 2017 survey. Because the Streetcar is a new service, the survey records for the Streetcar were added to the 2005 survey. The survey records were converted into a transit trip table that was then used in the model.

1.2.3 STOPS Scenarios

The STOPS model estimates three service scenarios which include Existing, No Build, and Build.

Existing and No-Build Scenario

The existing scenario includes the KCATA system that was in place prior to July 2017. The KCATA system underwent significant modifications in July and September of 2017. As a result, KCATA did not have accurate ridership data for some routes to calibrate the model. Therefore, the existing scenario was based on the system that was in place prior July 2017 – the system KCATA had reliable ridership data for. The No-Build scenario is the KCATA system that is currently in place. The No-Build system includes the realignment of Main Street MAX to Grand Boulevard, which was implemented by the KCATA in October of 2017.

Build Scenario

The Build scenario includes the extension of the Streetcar and the supporting system modifications to the underlying bus system. The following bus network modifications were coded into the model.

Main Street MAX: The existing Main Street MAX route was removed, as it will be replaced with the extension of the Streetcar. A new route, Route 603, was created that will operate from 47th Street / Main Street to 75th Street / Wornall Road (the southern portion of the existing Main Street MAX route that will remain), connecting to the streetcar at the Country Club Plaza. Route 603 was coded to operate at 10-minute peak headways and 20-minute off peak headways.

Route 35 35th Street: The headways were improved on Route 35 from 30-minute to 15-minute peak and midday service. Evening headways were also improved from the existing 60-minute headways to 30-minute headways. Route 35 becomes Route 635 in the model.

Route 39 39th Street: Midday service on Route 39 was improved from 20-minute to 15-minute headways. Route 39 becomes Route 639 in the model.

Route 47 Broadway: The existing Route 47 will be removed and replaced with two separate routes that meet at the Country Club Plaza. The portion of Route 47 that operates from Blue Ridge Crossing to the Plaza becomes Route 647 in the model. The new Route 647 will operate with 20-minute peak headways and 30-minute off peak headways. The portion of Route 47 that operates from the Plaza to Downtown becomes Route 640 in the model. The new Route 640 will operate with 30-minute peak and midday headways and 60-minute early morning and evening headways.

Route 55 Universities-Crossroads: The headways were improved on Route 55 from 60-minute all-day service to 30-minute all-day service. Route 55 becomes Route 655 in the model.

Streetcar: The Project extension was coded into the GTFS extending the Streetcar route south from Union Station (existing south terminus) to 51st Street / Brookside Boulevard (future south terminus). The Streetcar is modeled to operate at 10-minute headways from 5:00am to 10:00pm (30-minute headways from 4:00am to 5:00am and 12-minute headways from 10:00pm to 12:00am). The extension of the Streetcar adds approximately 13.5 minutes in each direction to the existing travel time of the streetcar route. The existing Streetcar route, Route 601, becomes Route 602 in the build model.

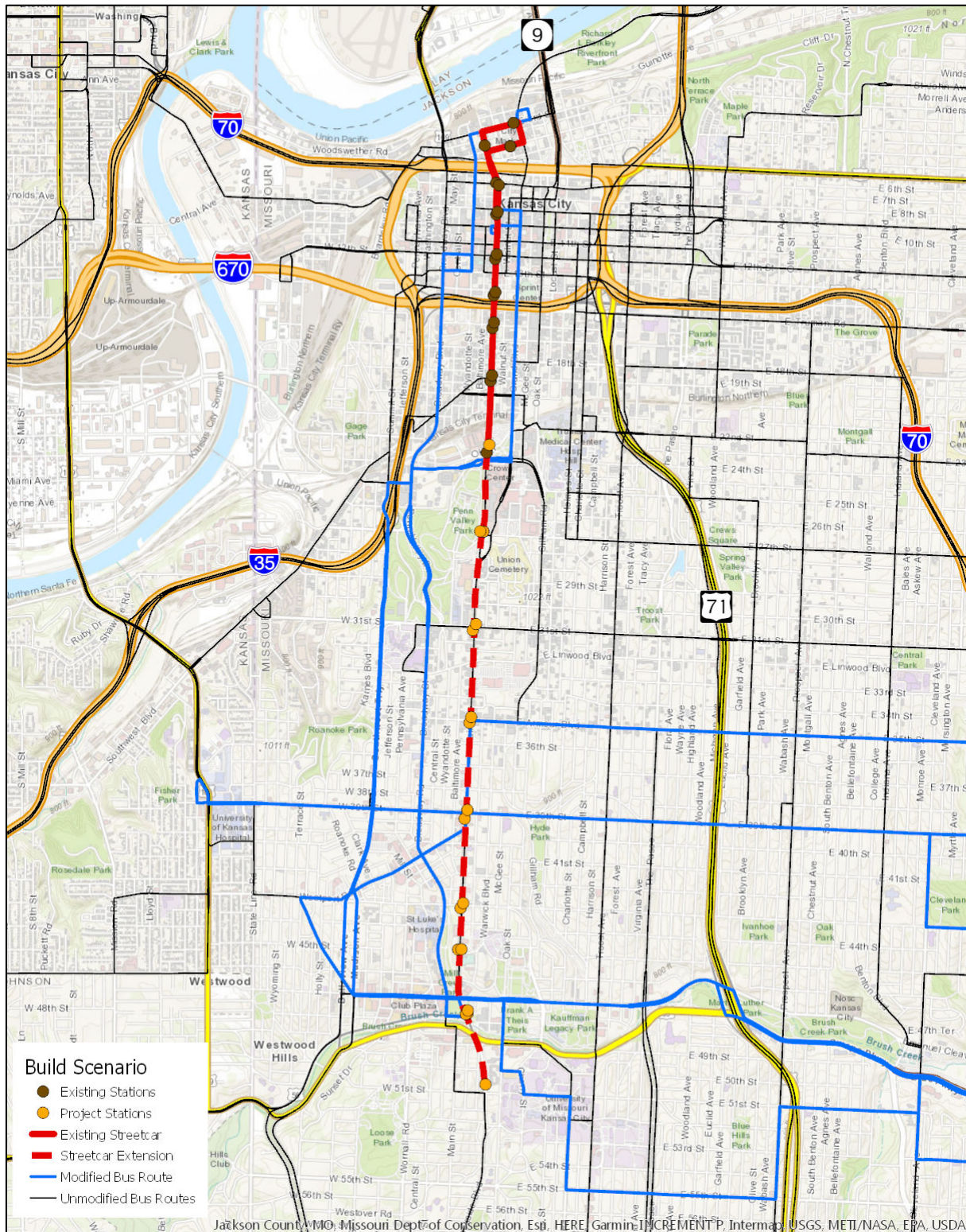
The following stations were coded into the build model as part of the Streetcar Extension:

- Union Station northbound
- 27th Street and Main Street northbound and southbound
- 31st Street and Main Street northbound and southbound
- Armour Boulevard and Main Street northbound and southbound
- 39th Street and Main Street northbound and southbound
- 43rd Street and Main Street northbound and southbound
- 45th Street and Main Street northbound and southbound
- 47th Street and Main Street northbound and southbound
- 51st Street and Brookside Boulevard combined northbound and southbound

In addition to the KC Streetcar stations, a bus transit center will be constructed on the east side of Brookside Boulevard, south of Emanuel Cleaver Boulevard.

The Build scenario is shown in Figure 1 on the following page.

Figure 1. Build Scenario Route Alterations



1.2.4 Calibration

Thirty districts were defined for the Project as part of the coding of the STOPS to assist with model calibration. The districts that contain Project stations include CrwnCtr, Midtown, Plaza, and UMKC. Figure 2 shows the TAZs used in the model; Figure 3 shows all of the districts; Figure 4 is focused on the project area and shows a better view of Project stations. The districts shown were used in all three scenarios.

Currently, the Streetcar and the KCATA bus system have a different fare structure. The existing streetcar has no fare and the Project extension is anticipated to be fare-free as well. The KCATA bus system has a \$1.50 base fare and average fare of \$0.65. A time impedance was added for each access mode to calibrate the existing scenario. To develop this time impedance, a value of \$10 an hour was assumed, as suggested by FTA. Using this value, the KCATA's average fare of \$0.65 was converted to a time value of 1.95 minutes. The impedance was then added to all existing bus stops in the bus system.

Figure 2. TAZs Used in STOPS Model

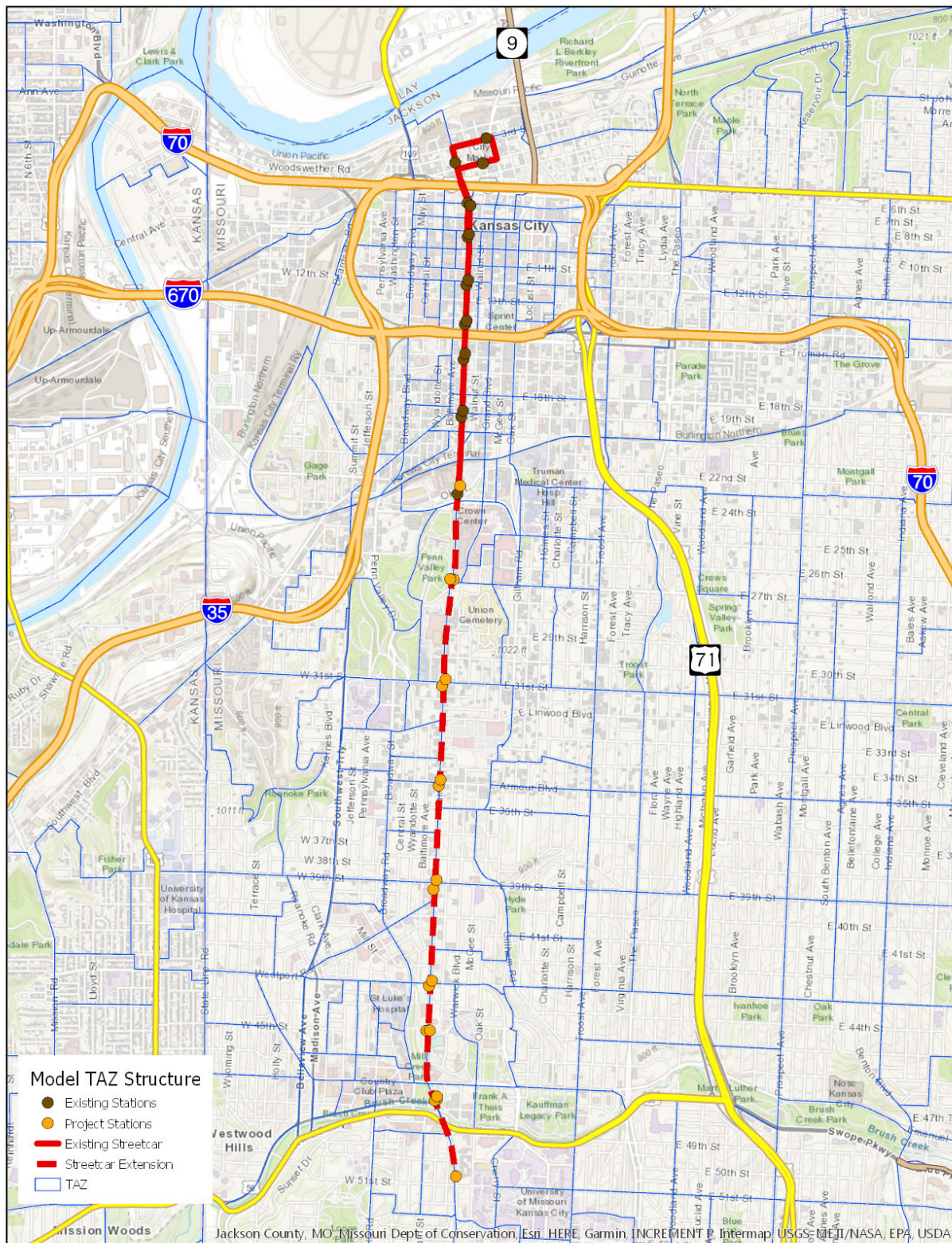


Figure 3. Districts Used in STOPS Model

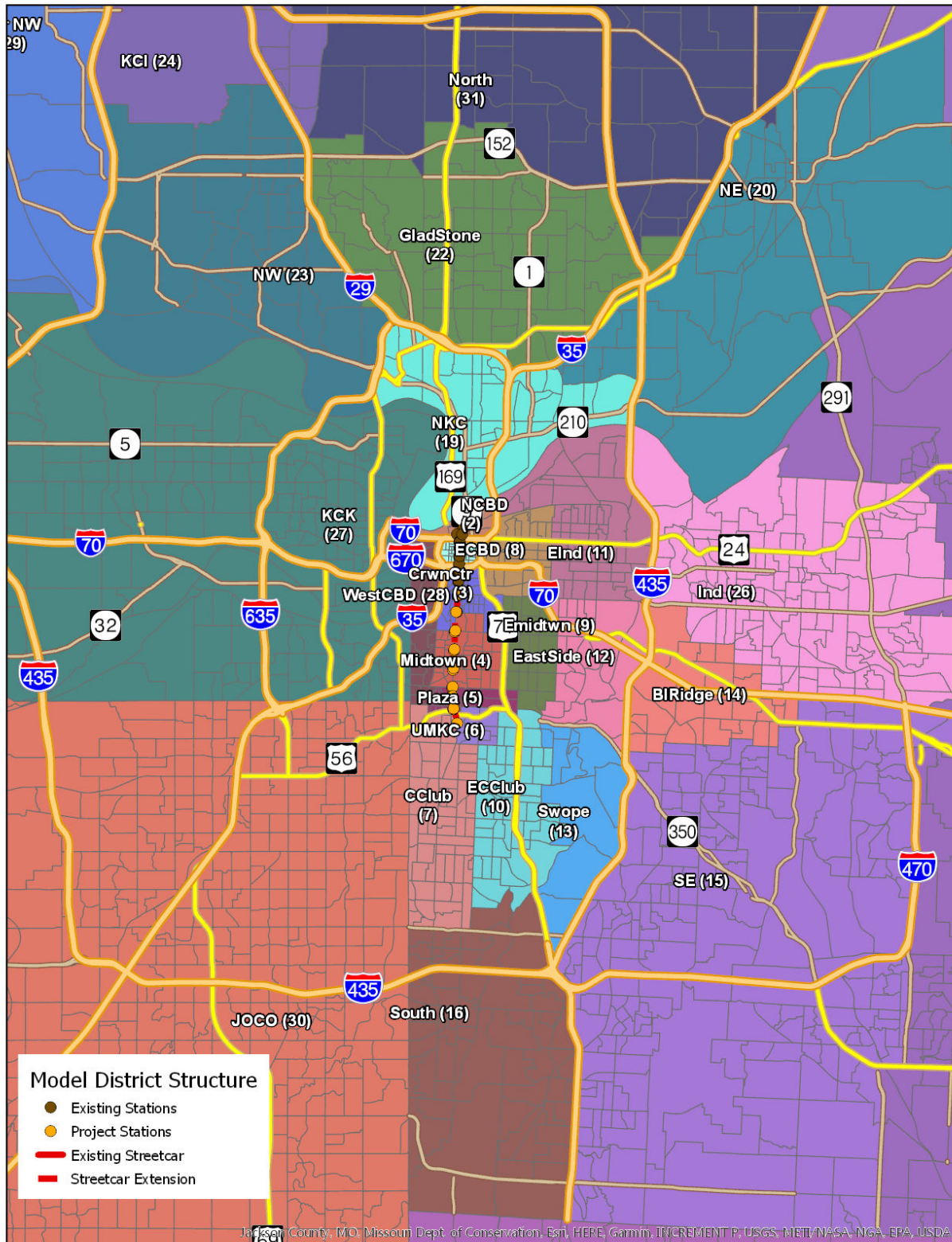
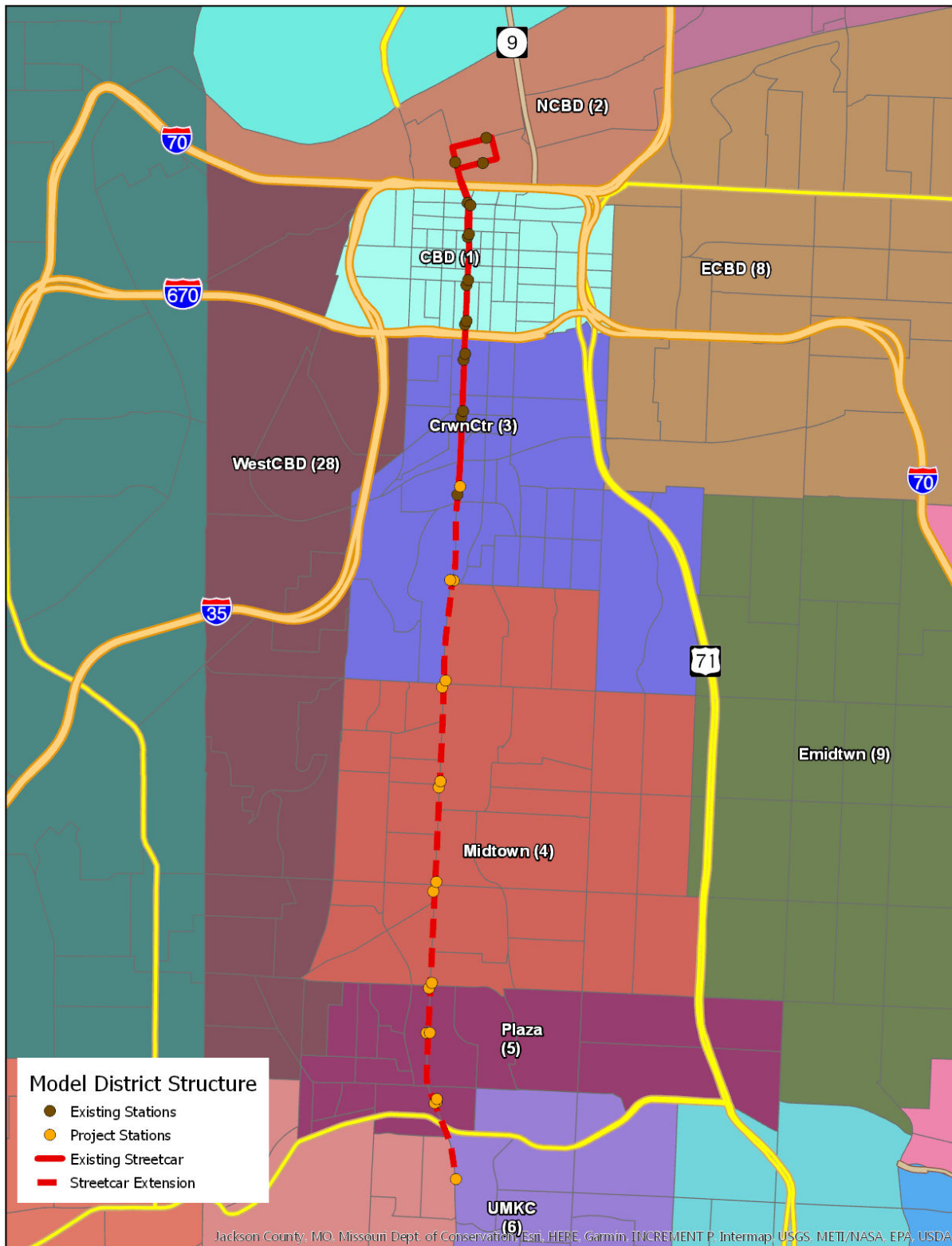


Figure 4. Districts and Project Stations Used in STOPS Model



All existing stops in the KCATA system were coded into the model for calibration. Average weekday ridership for each stop was coded into the station file. The average weekday ridership for all existing Streetcar stops was also coded into the model for calibration. In addition to the ridership by stop, ridership by route was also coded into the model. Table 1 shows the calibration results of the model.

Table 1: Calibration Results
Actual and Projected Ridership by Route

Route ID	Route Name	Actual	2017 EXST	D	Route ID	Route Name	Actual	2017 EXST	D
1	MMAX-Main Street MAX	4537	4531	-6	31	31-31st Street	3073	3064	-9
10	10-Woodland/Brooklyn	0	280	280	340	340-TMC Lakewood	0	0	0
101	101-State Ave	1994	1983	-11	35	35-35th Street	1072	1066	-6
102k	102-Central Ave - UGT	0	72	72	635	635-35th St	0	0	0
103k	103-3rd - Fairfax	0	106	106	39	39-39th Street	2647	2632	-15
104	104-Argentine	420	418	-2	639	639-39th St	0	0	0
106	106-Quindaro	1049	1041	-8	401	401-Metcalf-Plaza	220	223	3
107	107-7th Street/Parallel	659	656	-3	402	402-Johnson-Quivira	78	80	2
108	108-Indiana	1390	1384	-6	403	403-Antioch-Olathe	183	189	6
11	11-Northeast-Westside	1239	1232	-7	404	404-Metcalf-Downtown	125	128	3
113k	113k-Leavenworth Road	0	74	74	405	405-Nall	30	30	0
114	114-Amazon Link	0	0	0	415	15X-Truman Rd Express	135	135	0
115k	115-Kansas Avenue	0	22	22	428	28X-Blue Ridge Express	252	252	0
116k	116-West Parallel	0	69	69	435	435-JOCO to Downtown Midday	22	23	1
12	12-12th Street	1038	1035	-3	436	36X-Gladstone Express	52	52	0
121	121-Cleveland-Antioch	567	564	-3	437	37X-North Broadway Express	47	47	0
129	129-Boardwalk/KCI	753	764	11	451	51X-Ward Parkway Express	94	94	0
133	133-Vivion/Antioch	298	298	0	47	47-Broadway	1643	1642	-1
136	136-Boardwalk/Antioch	46	47	1	640	640-Broadway/Plaza	0	0	0
15	15-Truman Rd	494	492	-2	647	647-Plaza/Blue Ridge Crossin	0	0	0
16	16-Truman Rd. Limited	0	0	0	475	475-Quivira-75th Street	154	161	7
18	18-Indiana	0	0	0	495	495-95th Street	33	34	1
2	TMAX-Troost MAX	5099	5092	-7	51	51-Ward Parkway	139	139	0
201	201-North Oak	1004	1003	-1	519	519-Olathe Express	204	204	0
21	21-Cleveland-Antioch	0	0	0	52	52-Ward Parkway Limited	0	0	0
229	229-Boardwalk/KCI	0	0	0	535	535-Shoal Creek/Liberty Expr	59	60	1
23	23-23rd Street	181	180	-1	55	55-55th Street	291	291	0
231	231-Riverside-Antioch	32	0	-32	655	655-Universities	0	0	0
233	233-Vivion/Antioch	0	0	0	550	550-Lee's Summit Express	159	160	1
234	234-Boardwalk/Antioch	0	0	0	563	563-Shawnee Express	42	42	0
235	235-Winnwood/Gracemor	0	30	30	569	569-South OP Express	165	165	0
236	236-East Gladstone	0	0	0	57	57-Wornall	619	622	3
237	237-West Gladstone	0	0	0	570	570-Blue Springs Express	164	52	-112
238	238-Meadowbrook	357	357	0	571	571-71 Hwy Express	146	146	0
24	24-Independence	2995	2985	-10	595	595-Gardner-OP Express	110	114	4
243	243-Riverside-Antioch	71	72	1	601	601-KC Streetcar	4849	4850	1
25	25-Troost	1246	1244	-2	602	STRC-KC Streetcar	0	0	0
251	251-TMC Lakewood	33	34	1	603	WC-Waldo Connector	0	0	0
27	27-27th Street	706	705	-1	63	63-63rd Street	732	733	1
28	28-Blue Ridge	1210	1207	-3	71	71-Prospect	4912	4894	-18
29	29-Blue Ridge Limited	0	0	0	75	75-75th Street	611	616	5
301	301-Green Route	0	3	3	77	77-Casino Cruiser	651	649	-2
302	302-Blue Route	0	232	232	771	PMAX-Prospect MAX	0	0	0
303	303-Purple Route	0	20	20	772	71-Prospect Local	0	0	0
304	304-Yellow Route	0	2	2	85	85-Paseo	1305	1303	-2
305	305-Orange Route	0	8	8	685	685-85 Paseo	0	0	0
306	306-Red Route	0	7	7	9	9-9th Street	449	447	-2
Total		52914	53585	671	Total		52914	53585	671

1.2.5 Ridership Estimate

The STOPS model projects a total of 11,870 total weekday unlinked trips for the Streetcar and 1,143 trips on the Waldo Brookside Connector for a total corridor ridership of 13,013 in the existing build scenario (2017). The projected ridership represents a 39 percent increase in ridership in the corridor. The Project also results in a 13 percent increase in total system ridership.

As part of the ridership estimate, the STOPS model generates the Trips on Project projections. Table 2 below summarizes the Trips on Project for the Streetcar Extension project. The project will produce 8,836 daily linked trips on project; the project produces 3,480 linked trips for zero-car households (transit-dependent riders). These Trips on Project result in 12,316 weighted Trips on Project; equating to 3,845,299 annual weighted trips on project. The annualization factor used to generate annual numbers is discussed in Section 2.2.5. In addition to the ridership projection, the model provides total trips by trip type on the Project. Table 3 provides a breakdown of total trips by trip type on the project. These figures represent 3,314 new daily transit trips in the total system as a result of the project.

Table 2: Trips on Project Projections

Linked Trips on Project	8,836
Annualized Linked Trips on Project*	2,758,774
Project Linked Trips for 0 Car Households	3,480
Annualized Project Linked Trips for 0 Car Households*	1,086,525
Weighted Trips on Project	12,316
Annualized Weighted Trips on Project*	3,845,299
New Weekday Linked Transit Trips	3,314
Annualized New Weekday Linked Transit Trips*	1,034,787
Reduction In Daily VMT	-12,144
Annualized Reduction In VMT*	-3,791,598

*Annualization Factor Based on 2017 KCATA Data

312.22

Table 3: Trips by Type

Trip Type	Non-Transit Dependents	Transit Dependents	Total
Home-Based-Work	2,085	1,079	3,164
All Other Trip types	3,271	2,401	5,672
Total	5,356	3,480	8,836

1.2.6 Estimation of Transit Dependent Trips

STOPS estimates transit-dependent trips as a function of trips made by zero-car households. The estimate for transit-dependent trips is 3,480 daily trips for the current year (2017). Table 3 in the previous section provides a summary of trips by type. These results reflect the demographics of the project area; 39 percent of the projected trips on Project are made by transit-dependent individuals.

1.2.7 Estimation of Vehicle-Miles Travelled

STOPS derives vehicle-miles traveled (VMT) by estimating person-miles on the transit system; this figure is used to estimate the reduction in VMT. MARC provided the daily VMT for the metropolitan area for the years 2015 and 2040. To determine the forecasted year VMT, the MARC data was interpolated to 2017. The 2017 VMT is estimated at 45,090,371. The STOPS model projects a daily reduction of 12,144 vehicle-miles travelled (VMT) in 2017. This provides a total reduction of 3,791,598 annual VMT.

1.2.8 Annualization Factor

An annualization factor of 312.22 was used to convert the weekday ridership estimate to an annual ridership estimate. The annualization factor was developed using KCATA and Streetcar ridership data for the most current full year, 2017. The 312.22 factor is based on this system wide ridership data. The table below shows the results of the calculation.

Table 4: KCATA Annual Ridership (January 2017 to December 2017)

	Weekday	Annual	Annualization Factor
System Total	48,920	15,273,883	312.22

1.2.9 Model Review

The use of the STOPS model facilitates FTA's review of the ridership and related estimates as the model was developed specifically to assess projects under FTA's Capital Investment Grants (CIG) Program. The STOPS model was applied in accordance with FTA guidance. Model inputs – including MPO socioeconomic data, KCATA ridership data and GTFS, Census CTPP data, and On-Board Survey data – are all consistent with FTA guidance.