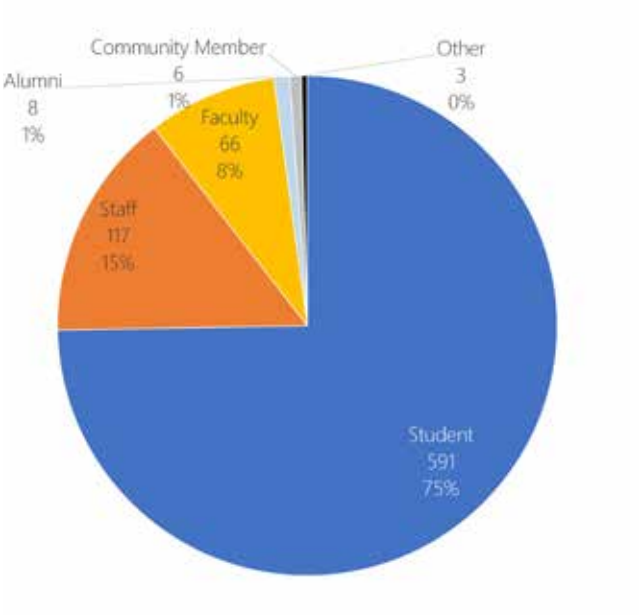
THE WAYNE FRAMEWORK 2019 APPENDIX

CONTENTS

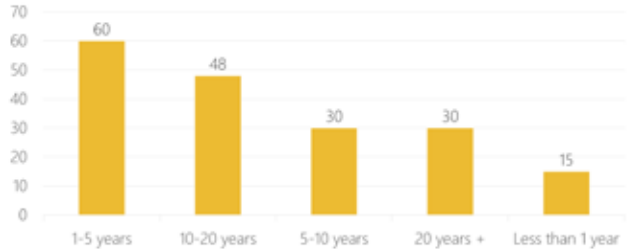
COMAP SURVEY

791 survey responses

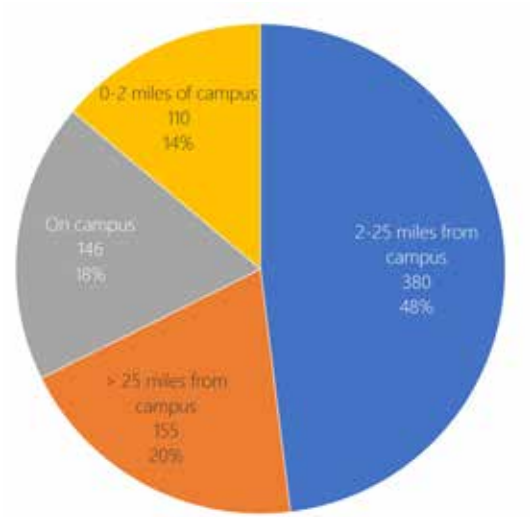


Years at WSU (student)

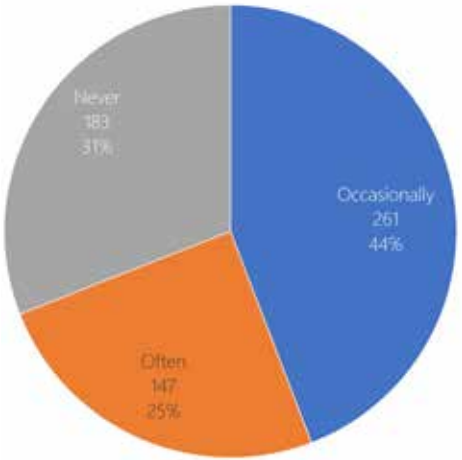
Years at WSU (faculty and staff)



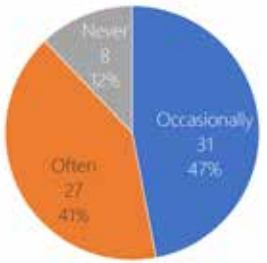
Lived distance



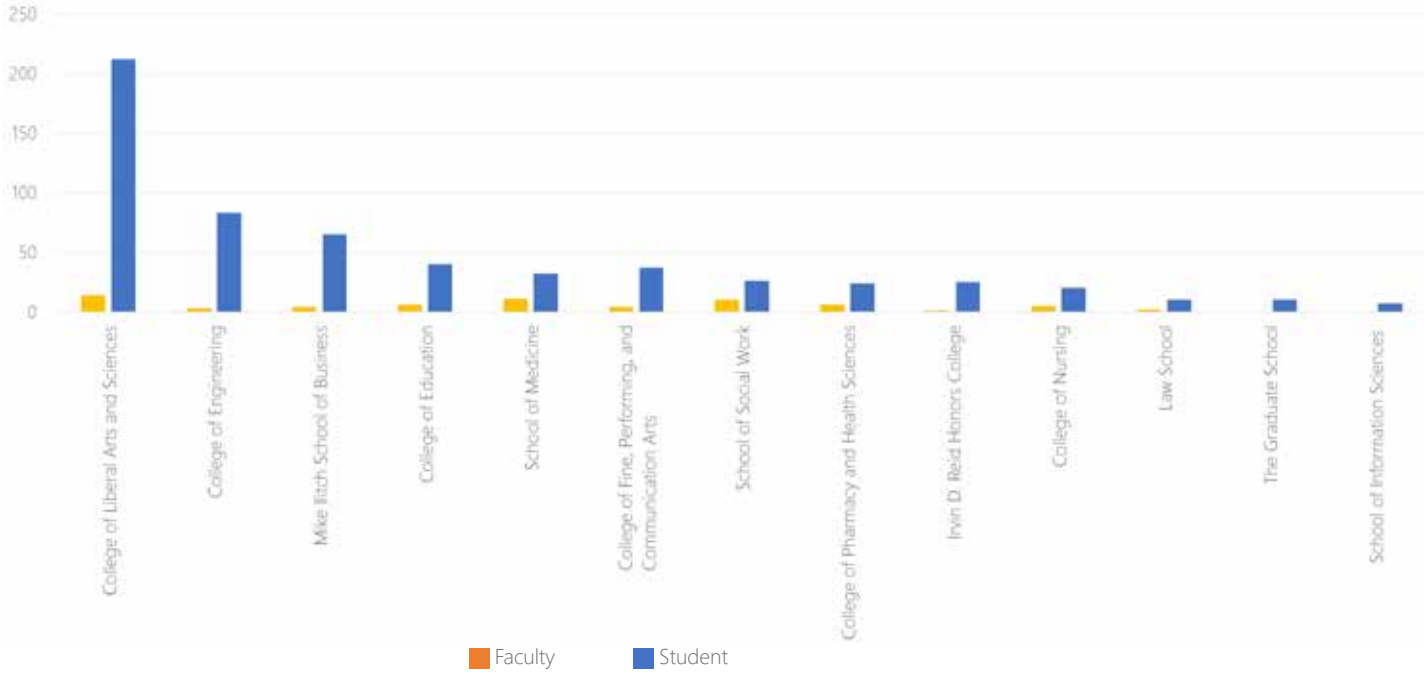
Collaboration (student)



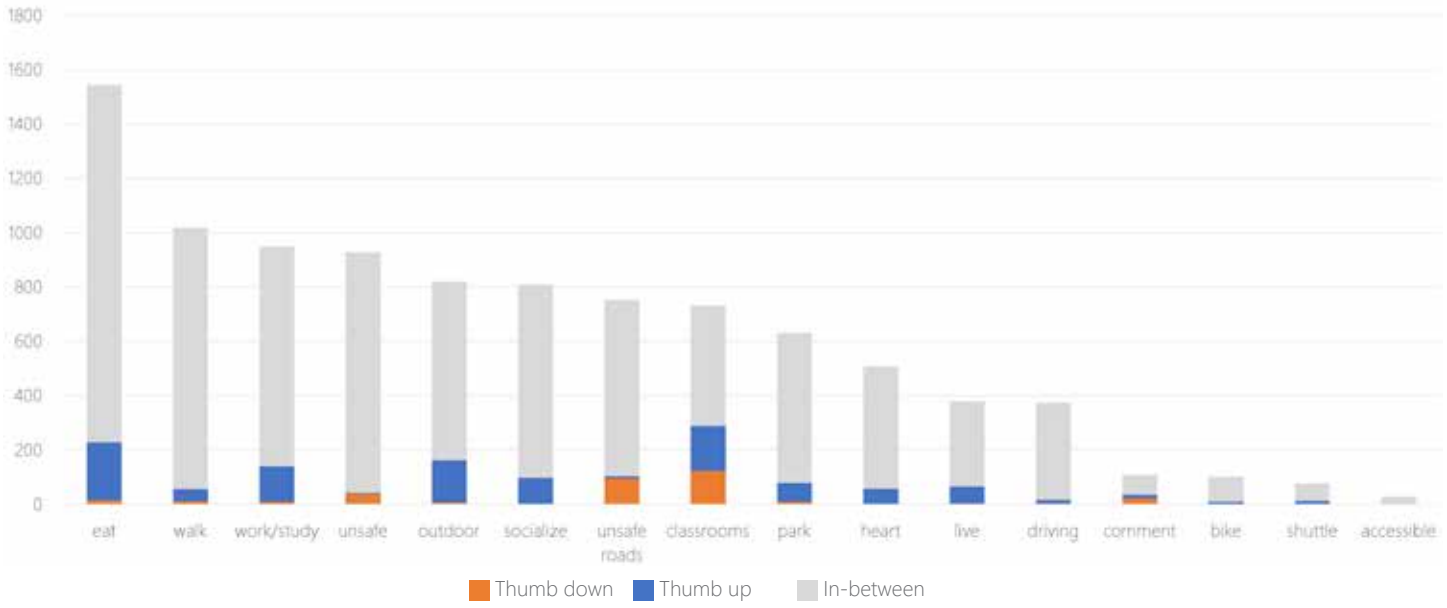
Collaboration (faculty)



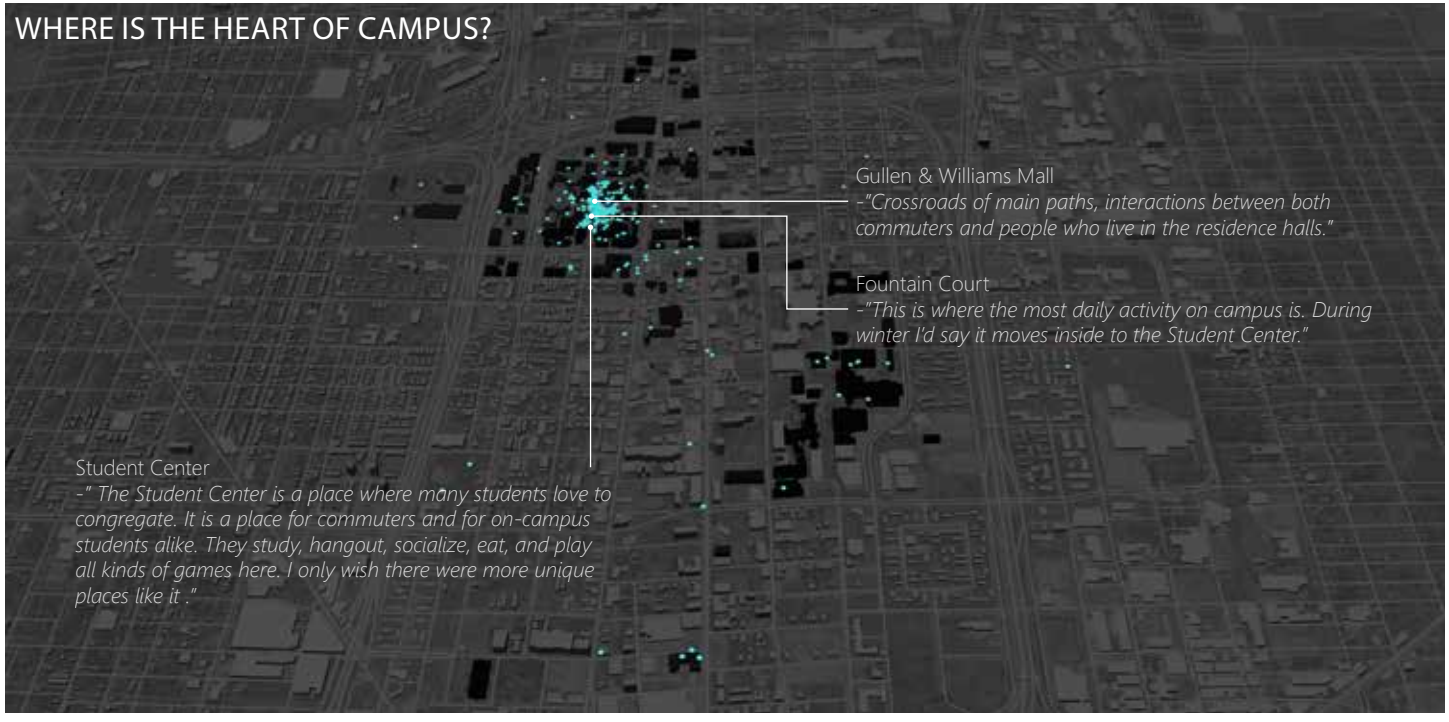
Responses by school/college



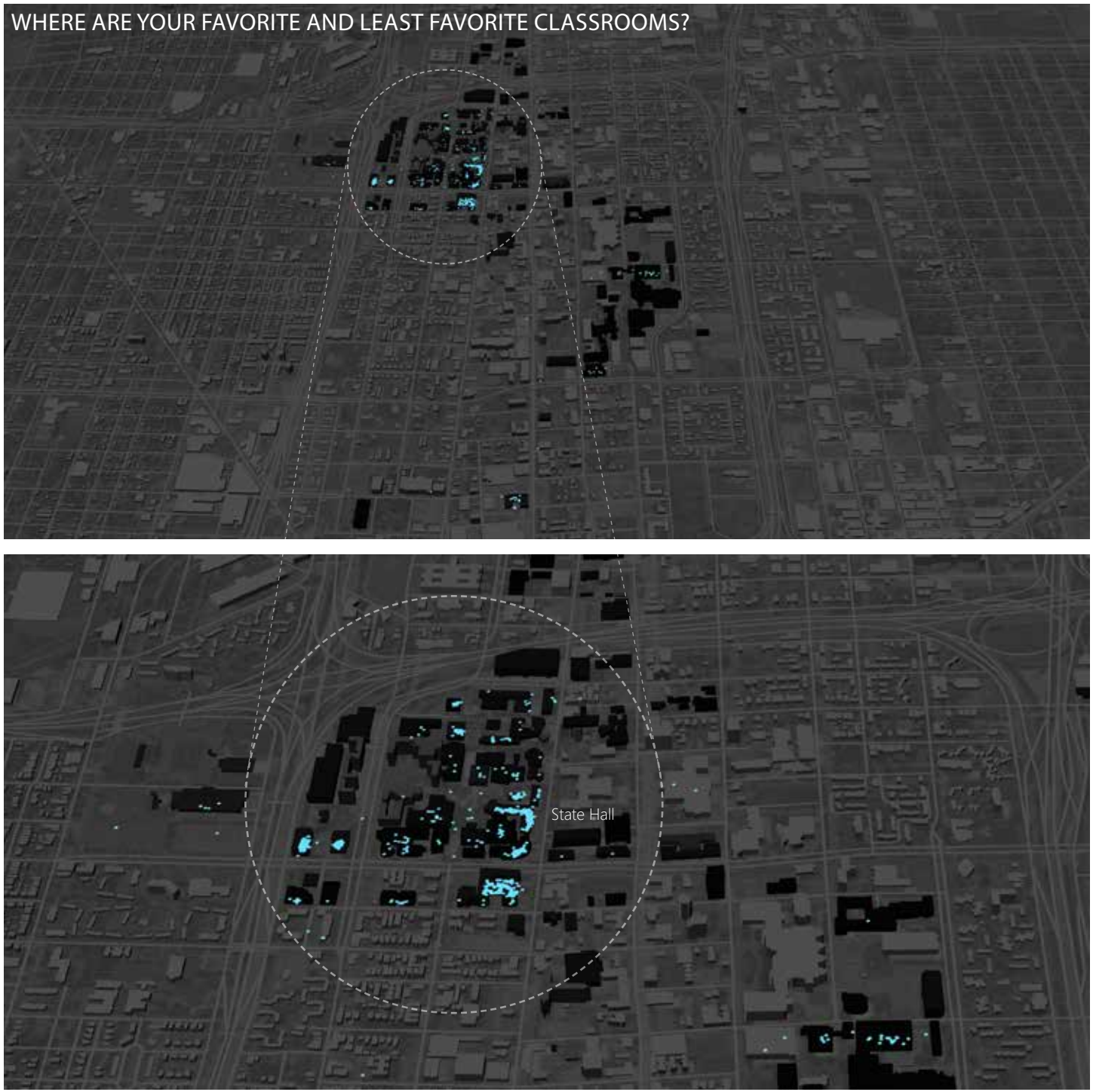
9755 icons placed




CAMPUS ZONE

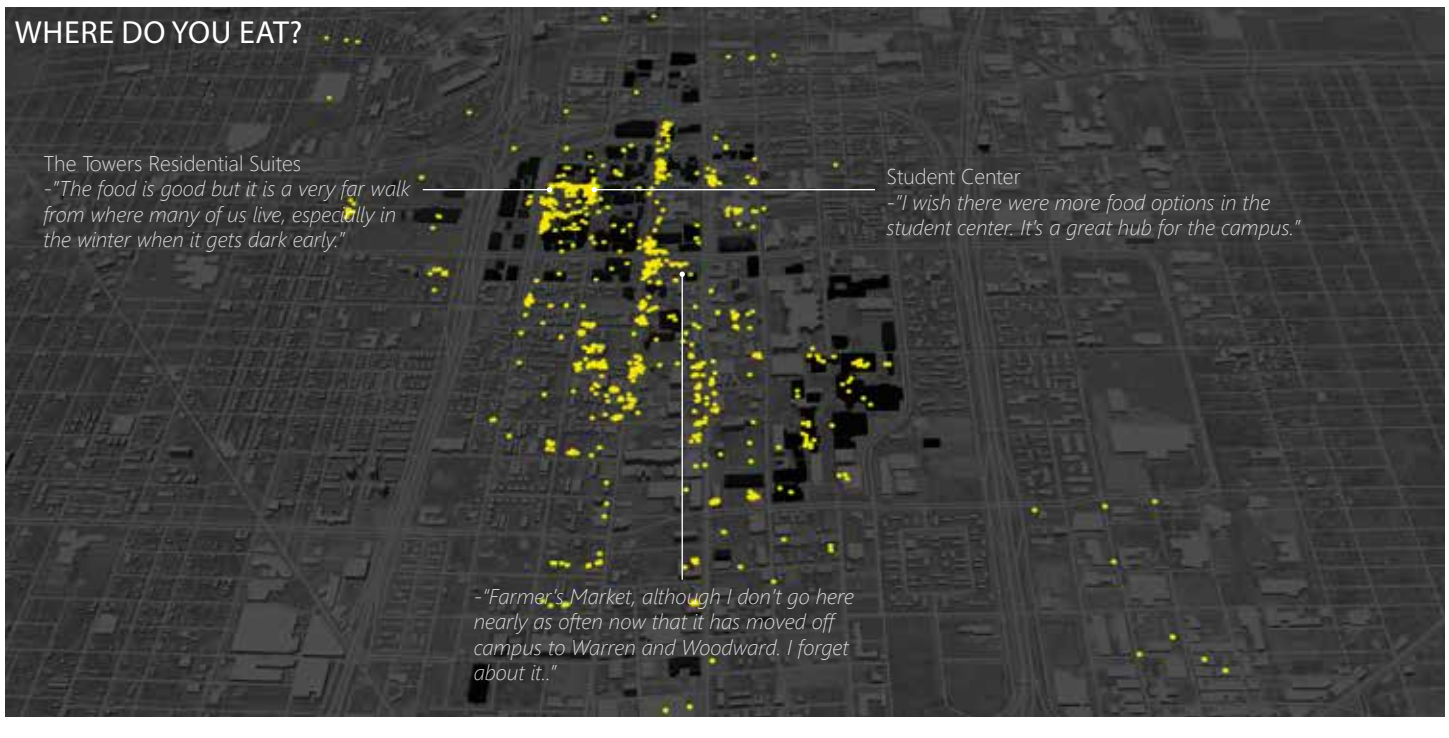

WHERE IS THE HEART OF CAMPUS?
Gullen & Williams Mall
-"Crossroads of main paths, interactions between both commuters and people who live in the residence halls."
Fountain Court
-"This is where the most daily activity on campus is. During winter I'd say it moves inside to the Student Center."
Student Center
-" The Student Center is a place where many students love to congregate. It is a place for commuters and for on-campus students alike. They study, hangout, socialize, eat, and play all kinds of games here. I only wish there were more unique places like it ."

WHERE ARE YOUR FAVORITE AND LEAST FAVORITE CLASSROOMS?

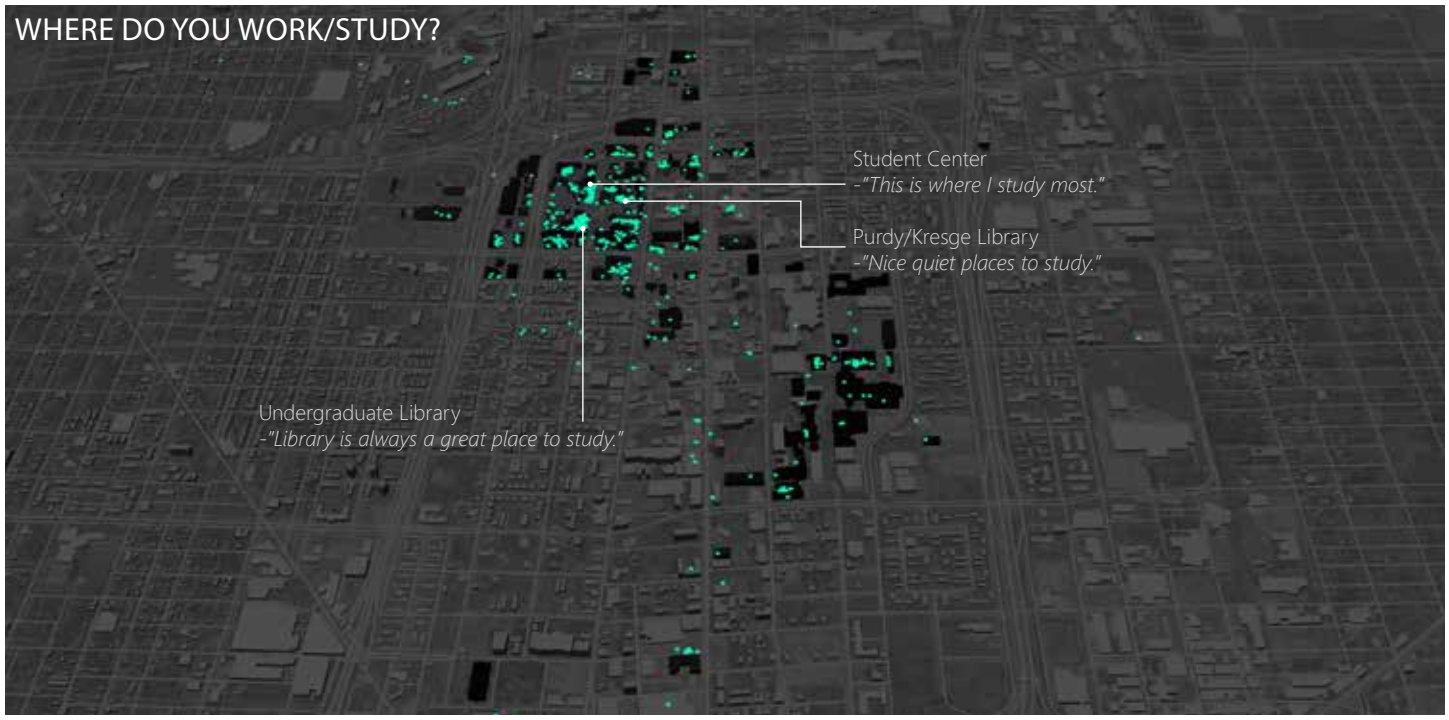


WHERE DO YOU LIVE?

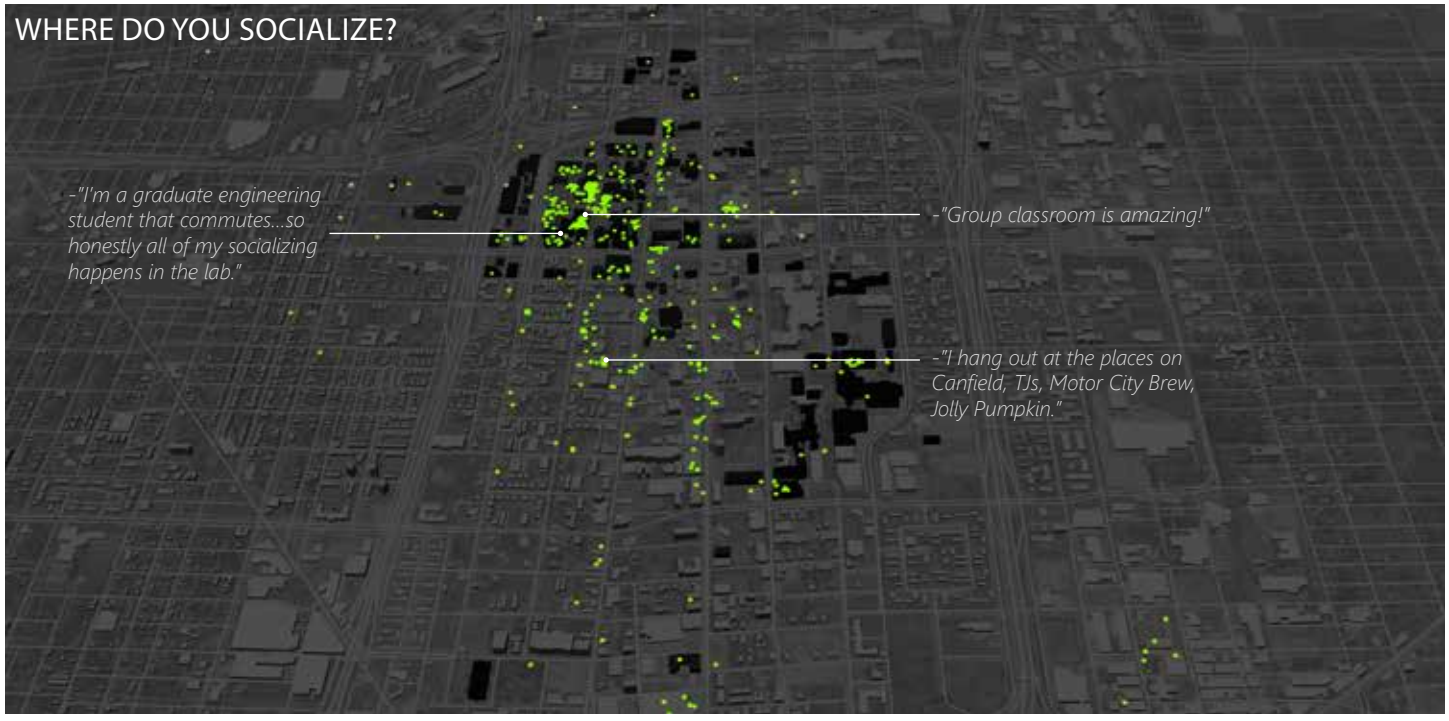
WHERE DO YOU EAT?



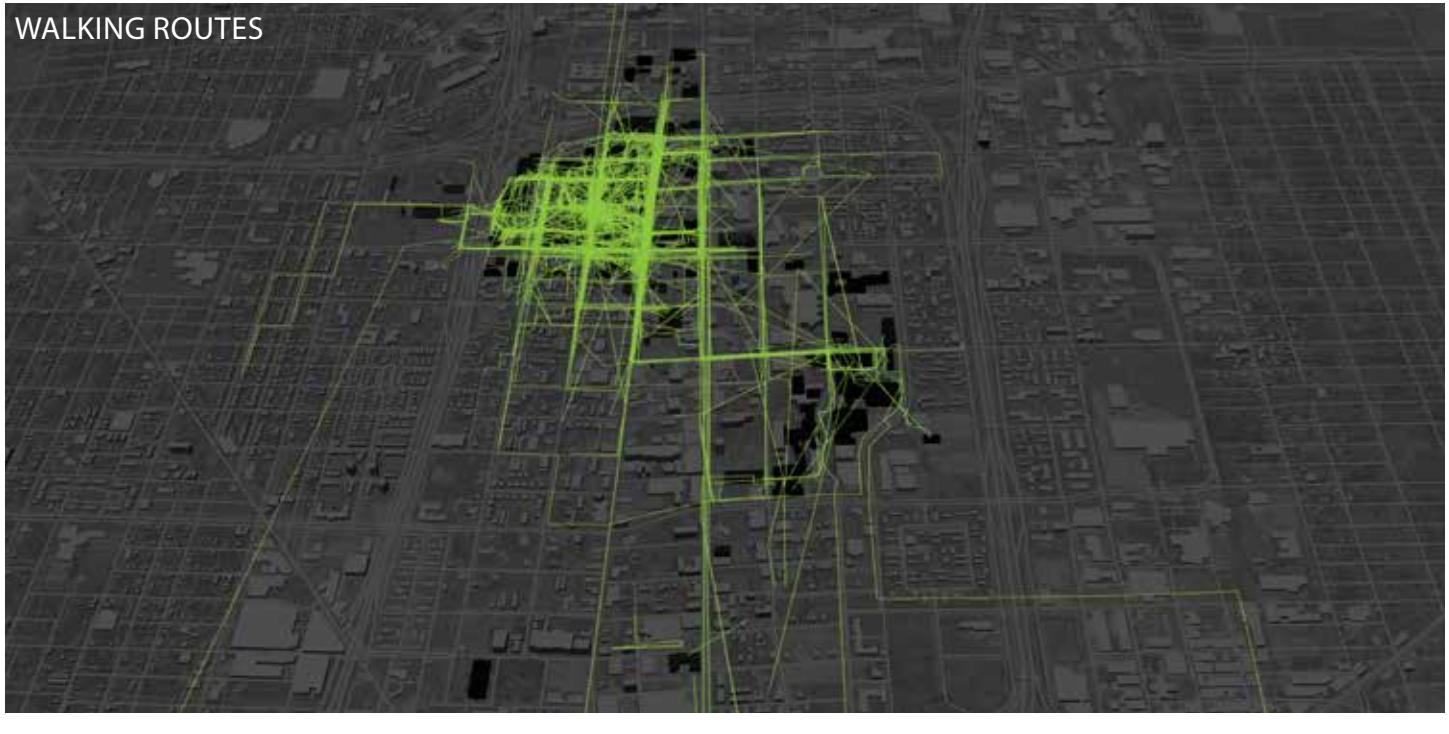
WHERE DO YOU WORK/STUDY?

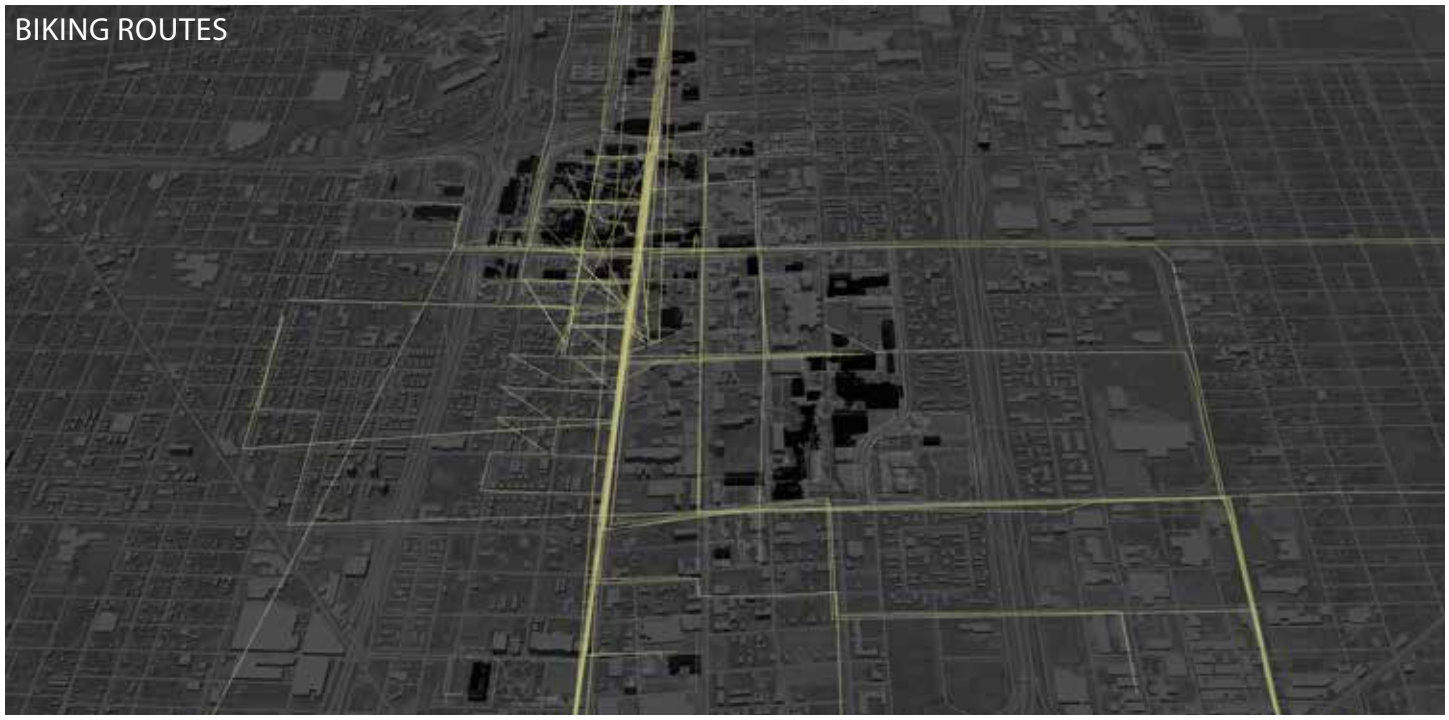


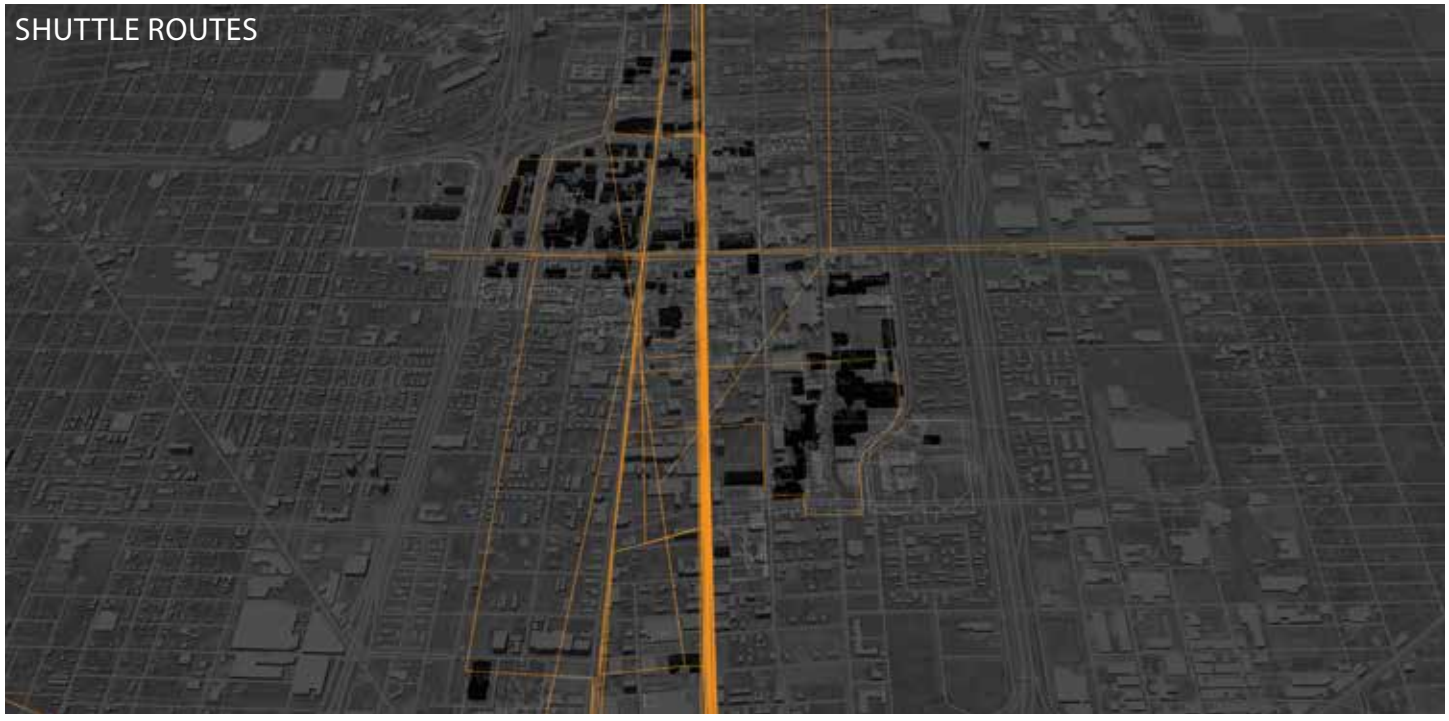
WHERE DO YOU SOCIALIZE?



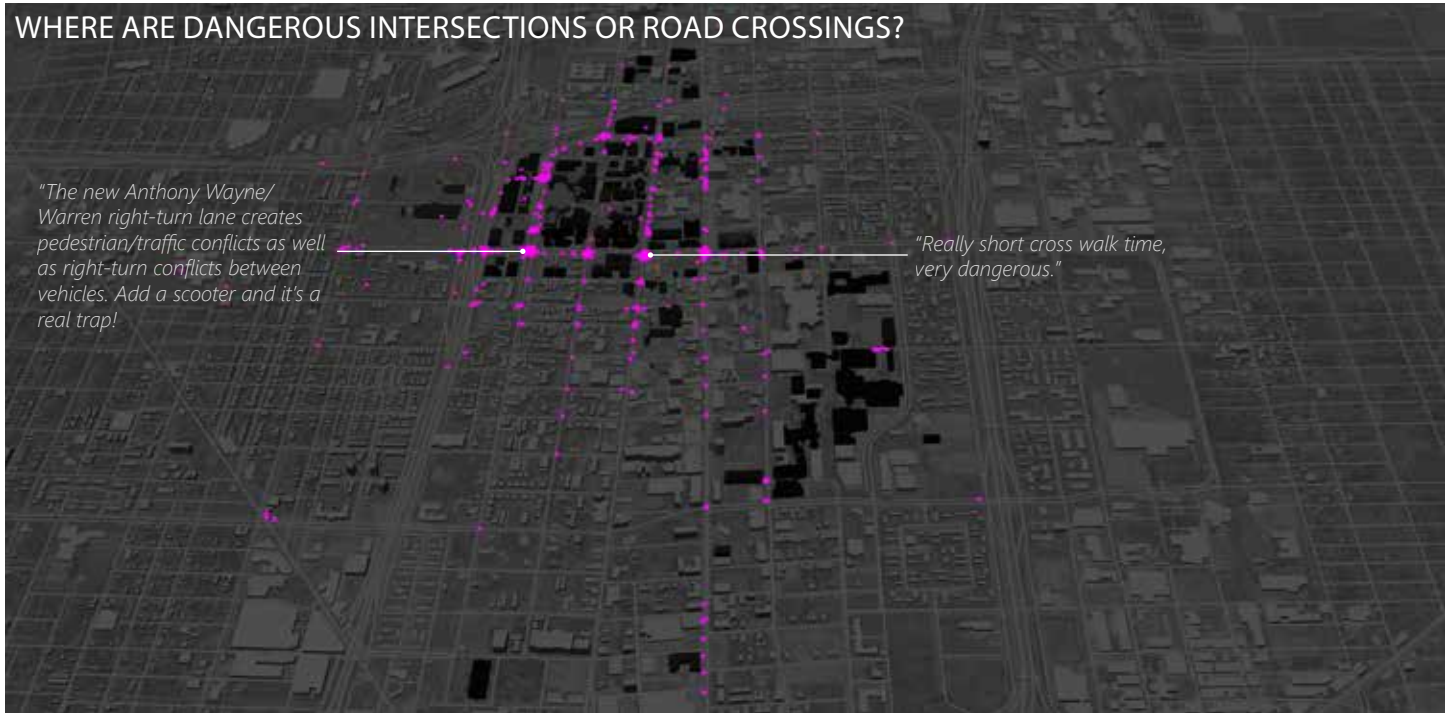

DRIVING ROUTES


WALKING ROUTES


BIKING ROUTES

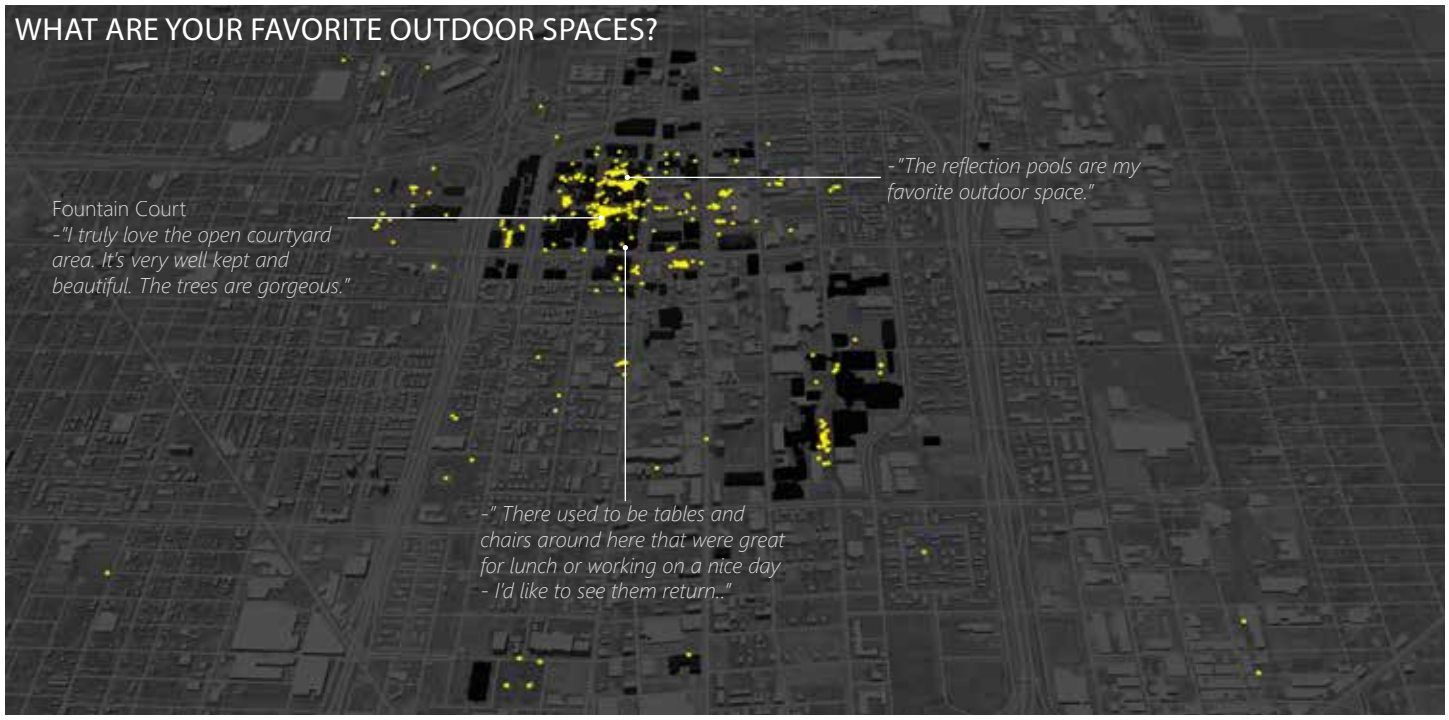

SHUTTLE ROUTES

WHERE ARE DANGEROUS INTERSECTIONS OR ROAD CROSSINGS?



WHERE DO YOU FEEL PERSONALLY UNSAFE?

WHAT ARE YOUR FAVORITE OUTDOOR SPACES?



WHERE DO YOU PARK?


YOU!
YOU!
DELL

COST ESTIMATE + FINANCIAL MODEL


FAB
SHA
ST. ANDREWS
MAN
GL
KRE
MUSIC ANNEX
PUR
UGL
PRENTIS
LINSELL
STATE
LS
OM
MAC
MDH

BUILDING FINANCIAL MODEL
SUMMARY

NPV value	5%
Sitelines multiplier	1.68

CAPITAL	BASIC RENEWAL	MASTER PLAN	Δ
Total 10-year capital expenditures	$ 520,831,441	$ 510,161,744	$ (10,669,697)
10-year capital expenditure NPV	$ 463,656,929	$ 471,137,797	$ 7,480,868

OPERATING	BASIC RENEWAL	MASTER PLAN	Δ
10-year operating	$ 232,649,760	$ 220,863,608	$ (11,786,152)
10-year operating NPV	$ 177,525,084	$ 170,044,216	$ (7,480,868)

COMBINED (NPV)	BASIC RENEWAL	MASTER PLAN	Δ
	$ 641,182,013	$ 641,182,013	$ (0)

Note: Excludes Scott Hall / Health Sciences
Any operational savings should be repurposed to increase the level of service in remaining buildings.

PER SF COMPARISON

BUILDING	SIGHTLINES	MASTER PLAN
Maccabees Building	$ 287.90	$ 300.00
State Hall	$ 286.48	$ 350.00
Old Main	$ 272.10	$ 300.00
Undergraduate Library	$ 206.95	$ 350.00
Faculty/Administration Building	$ 234.20	$ 250.00
Purdy Library	$ 282.32	$ 250.00
Kresge Library	$ 282.32	$ 250.00
Donaldson House	$ 184.73	$ 600.00
Music Annex	$ 157.66	$ 600.00
Linsell House	$ 234.70	$ 150.00
Prentis Building	$ 261.27	$ 100.00
St. Andrew's	$ 305.87	$ 350.00

Note:
Sightlines estimate does not account for current renovation
Sightlines figure includes current + 10-year need + modernization; no escalations in either column

SIGHTLINES ESTIMATES

#	BUILDING	GSF	CURRENT	2018	2019	2020	2021	2022	2023	2024
1	Maccabees Building	288,419	$ 22,644,127	$ -	$ -	$ -	$ -	$ -	$ 4,190,645	$ -
2	State Hall	163,530	$ 18,493,098	$ -	$ -	$ 2,376,049	$ -	$ -	$ -	$ -
3	Old Main	436,295	$ 13,735,865	$ -	$ -	$ 17,776,482	$ 2,218,999	$ -	$ -	$ -
4	Undergraduate Library	310,965	$ -	$ -	$ -	$ -	$ 4,518,225	$ 8,414,369	$ -	$ -
5	Faculty/Administration Building	158,065	$ 19,367,816	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	Purdy Library	162,770	$ 15,647,645	$ -	$ -	$ -	$ -	$ 2,759,492	$ -	$ 2,365,004
7	Kresge Library	68,272	$ 6,563,232	$ -	$ -	$ -	$ -	$ 1,157,438	$ -	$ 991,975
8	Donaldson House	17,763	$ 543,433	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9	Music Annex	10,202	$ 312,105	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	Linsell House	6,581	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 457,993
11	Prentis Building	68,404	$ 6,878,509	$ -	$ -	$ -	$ -	$ -	$ -	$ -
12	St. Andrew's	17,840	$ 505,421	$ -	$ -	$ -	$ -	$ 986,108	$ -	$ -
13	Manoogian Hall	189,150	$ 15,069,641	$ 2,748,290	$ -	$ 962,017	$ -	$ -	$ -	$ -
14	General Lectures	30,073	$ 3,247,923	$ -	$ 436,955	$ -	$ 152,953	$ -	$ -	$ -
15	Life Science	59,904	$ 7,644,784	$ -	$ -	$ -	$ -	$ -	$ -	$ -
16	Shapero Hall	41,181	$ 5,045,980	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		2,029,416	$ 135,699,577	$ 2,748,290	$ 436,955	$ 21,114,549	$ 6,890,176	$ 13,317,407	$ 4,190,645	$ 3,814,973

SIGHTLINES ESTIMATES WITH MULTIPLIER

#	BUILDING	GSF	CURRENT	2018	2019	2020	2021	2022	2023	2024
1	Maccabees Building	288,419	$ 38,085,120	$ -	$ -	$ -	$ -	$ -	$ 7,048,239	$ -
2	State Hall	163,530	$ 31,103,511	$ -	$ -	$ 3,996,273	$ -	$ -	$ -	$ -
3	Old Main	436,295	$ 23,102,328	$ -	$ -		$ 3,732,130	$ -	$ -	$ -
4	Undergraduate Library	310,965	$ -	$ -	$ -	$ -	$ 7,599,195	$ 14,152,113	$ -	$ -
5	Faculty/Administration Building	158,065	$ 32,574,698	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6	Purdy Library	162,770	$ 26,317,748	$ -	$ -	$ -	$ -	$ 4,641,185	$ -	$ 3,977,697
7	Kresge Library	68,272	$ 11,038,689	$ -	$ -	$ -	$ -	$ 1,946,694	$ -	$ 1,668,401
8	Donaldson House	17,763	$ 913,999	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9	Music Annex	10,202	$ 524,928	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	Linsell House	6,581	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 770,298
11	Prentis Building	68,404	$ 11,568,952	$ -	$ -	$ -	$ -	$ -	$ -	$ -
12	St. Andrew's	17,840	$ 850,067	$ -	$ -	$ -	$ -	$ 1,658,534	$ -	$ -
13	Manoogian Hall	189,150	$ 25,345,604	$ 4,622,345	$ -	$ 1,618,016	$ -	$ -	$ -	$ -
14	General Lectures	30,073	$ 5,462,677	$ -	$ 734,914	$ -	$ 257,251	$ -	$ -	$ -
15	Life Science	59,904	$ 12,857,749	$ -	$ -	$ -	$ -	$ -	$ -	$ -
16	Shapero Hall	41,181	$ 8,486,825	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		2,029,416	$ 228,232,895	$ 4,622,345	$ 734,914	$ 5,614,288	$ 11,588,576	$ 22,398,525	$ 7,048,239	$ 6,416,396

Note: Excludes Scott Hall / Health Sciences

	2025	2026	2027	MODERNIZATION	TOTAL 10 YR	CURRENT NEED/SF	TOTAL NEED/SF	10-YR NPV	NPV + MOD
	$ 5,783,691	$ -	$ 681,885	$ 16,070,112	$ 49,370,460	$ 78.51	$ 171.18	$ 28,670,951	$ 44,741,063
	$ -	$ -	$ -	$ 6,985,540	$ 27,854,687	$ 113.09	$ 170.33	$ 19,567,256	$ 26,552,796
	$ 12,360,303	$ 9,586,666	$ -	$ 32,682,679	$ 88,360,993	$ 31.48	$ 202.53	$ 43,298,118	$ 75,980,797
	$ -	$ -	$ 21,479,690	$ 3,850,289	$ 38,262,572	$ -	$ 123.04	$ 22,377,808	$ 26,228,097
	$ -	$ -	$ -	$ 2,642,125	$ 22,009,941	$ 122.53	$ 139.25	$ 18,445,539	$ 21,087,664
	$ -	$ -	$ -	$ 6,549,993	$ 27,322,133	$ 96.13	$ 167.86	$ 18,562,422	$ 25,112,415
	$ -	$ -	$ -	$ 2,747,322	$ 11,459,968	$ 96.13	$ 167.86	$ 7,785,803	$ 10,533,125
	$ -	$ -	$ -	$ 1,407,630	$ 1,951,063	$ 30.59	$ 109.84	$ 517,555	$ 1,925,185
	$ -	$ -	$ -	$ 644,218	$ 956,323	$ 30.59	$ 93.74	$ 297,242	$ 941,460
	$ -	$ -	$ -	$ 460,413	$ 918,406	$ -	$ 139.55	$ 309,988	$ 770,401
	$ 1,503,031	$ -	$ -	$ 2,244,443	$ 10,625,983	$ 100.56	$ 155.34	$ 7,519,828	$ 9,764,271
	$ -	$ -	$ 482,742	$ 1,270,148	$ 3,244,419	$ 28.33	$ 181.86	$ 1,499,452	$ 2,769,600
	$ -	$ -	$ -	$ 5,503,716	$ 24,283,665	$ 79.67	$ 128.38	$ 17,636,273	$ 23,139,989
	$ -	$ -	$ -	$ 856,426	$ 4,694,257	$ 108.00	$ 156.09	$ 3,590,561	$ 4,446,987
	$ -	$ -	$ -	$ 2,113,909	$ 9,758,692	$ 127.62	$ 162.90	$ 7,280,746	$ 9,394,655
	$ -	$ -	$ -	$ 1,325,738	$ 6,371,718	$ 122.53	$ 154.72	$ 4,805,695	$ 6,131,433
	$ 19,647,025	$ 9,586,666	$ 22,644,316	$ 87,354,701	$ 327,445,280	$ 66.87	$ 161.35	$ 202,165,238	$ 289,519,939

	2025	2026	2027	MODERNIZATION	TOTAL 10 YR	CURRENT NEED/SF	TOTAL NEED/SF	10-YR NPV	NPV + MOD
	$ 9,727,581	$ -	$ 1,146,862	$ 27,028,295	$ 83,036,096	$ 132.05	$ 287.90	$ 48,221,626	$ 75,249,921
	$ -	$ -	$ -	$ 11,748,968	$ 46,848,752	$ 190.20	$ 286.48	$ 32,910,135	$ 44,659,103
	$ 20,788,773	$ 16,123,798	$ -	$ 54,968,944	$ 118,715,973	$ 52.95	$ 272.10	$ 49,536,854	$ 104,505,798
	$ -	$ -	$ 36,126,654	$ 6,475,795	$ 64,353,757	$ -	$ 206.95	$ 37,637,199	$ 44,112,994
	$ -	$ -	$ -	$ 4,443,785	$ 37,018,483	$ 206.08	$ 234.20	$ 31,023,522	$ 35,467,307
	$ -	$ -	$ -	$ 11,016,422	$ 45,953,051	$ 161.69	$ 282.32	$ 31,220,107	$ 42,236,529
	$ -	$ -	$ -	$ 4,620,717	$ 19,274,501	$ 161.69	$ 282.32	$ 13,094,930	$ 17,715,646
	$ -	$ -	$ -	$ 2,367,491	$ 3,281,490	$ 51.45	$ 184.73	$ 870,475	$ 3,237,966
	$ -	$ -	$ -	$ 1,083,509	$ 1,608,437	$ 51.45	$ 157.66	$ 499,931	$ 1,583,441
	$ -	$ -	$ -	$ 774,367	$ 1,544,666	$ -	$ 234.70	$ 521,368	$ 1,295,736
	$ 2,527,946	$ -	$ -	$ 3,774,925	$ 17,871,823	$ 169.13	$ 261.27	$ 12,647,586	$ 16,422,511
	$ -	$ -	$ 811,922	$ 2,136,261	$ 5,456,784	$ 47.65	$ 305.87	$ 2,521,925	$ 4,658,186
	$ -	$ -	$ -	$ 9,256,691	$ 40,842,656	$ 134.00	$ 215.93	$ 29,662,419	$ 38,919,110
	$ -	$ -	$ -	$ 1,440,422	$ 7,895,263	$ 181.65	$ 262.53	$ 6,038,958	$ 7,479,380
	$ -	$ -	$ -	$ 3,555,380	$ 16,413,129	$ 214.64	$ 273.99	$ 12,245,475	$ 15,800,855
	$ -	$ -	$ -	$ 2,229,757	$ 10,716,581	$ 206.08	$ 260.23	$ 8,082,690	$ 10,312,447
	$ 33,044,299	$ 16,123,798	$ 38,085,438	$ 146,921,727	$ 520,831,441	$ 112.46	$ 256.64	$ 316,735,201	$ 463,656,929

CONSOLIDATION CAPEX ASSUMPTIONS

#	BUILDING	GSF	GHAFARI RATING	STRATEGY	START YEAR	2019 COST/SF	TOTAL
1	Maccabees Building	288,419	Poor	Reposition as admin building	2026	$ 300	$ 86,525,700
2	State Hall	163,530	Unreliable	Full renovation as classroom building	2020	$ 350	$ 57,235,623
3	Old Main	436,295	Poor	Partial renovation	2023	$ 300	$ 130,888,353
4	Undergraduate Library	210,000	Adequate	Major reconfiguration	2024	$ 350	$ 73,500,000
5	Faculty/Administration Building	158,065	Poor	Reposition as academic building	2025	$ 250	$ 39,516,368
6	Purdy Library	162,770	Poor	Consolidate library functions	2021	$ 250	$ 40,692,553
7	Kresge Library	68,272	Poor	Reposition as student building	2021	$ 250	$ 17,068,043
8	Donaldson House	17,763	Unreliable	Full renovation as int'l student center	2027	$ 600	$ 10,658,040
9	Music Annex	10,202	Unreliable	Full renovation as faculty club	2027	$ 600	$ 6,121,128
10	Linsell House	6,581	Poor	Partial renovation as student building	2027	$ 150	$ 987,206
11	Prentis Building	68,404	NA	Reposition	2027	$ 100	$ 6,840,400
12	St. Andrew's	17,840	NA	Reposition	2027	$ 350	$ 6,244,000
13	Manoogian Hall	189,150	Adequate	Demolish	2027	$ 15	$ 2,837,245
14	General Lectures	30,073	Poor	Demolish	2027	$ 15	$ 451,098
15	Life Science	59,904	Unreliable	Demolish	2029	$ 30	$ 1,797,133
16	Shapero Hall	41,181	Poor	Demolish	2029	$ 15	$ 617,722
17	Undergraduate Library (demo)	100,965	Adequate	Demolish	2025	$ 15	$ 1,514,468
18	Wet Labs	53,333	NA	New construction	2027	$ 500	$ 26,666,667
		1,608,142					$ 510,161,744

Note: Excludes Scott Hall / Health Sciences

PROPOSED SPEND TIMELINE

Construction escalation: 4.5%
Year one cost share: 20%
Year two cost share: 50%
Year three cost share: 30%

#	BUILDING	GSF	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	NPV
1	Maccabees Building	288,419	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 23,549,904	$ 61,524,125	$ 38,575,627	$ -	$ 79,280,591
2	State Hall	163,530	$ -	$ 11,962,245	$ 31,251,365	$ 19,594,606	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53,966,744
3	Old Main	436,295	$ -	$ -	$ -	$ -	$ 31,217,359	$ 81,555,351	$ 51,135,205	$ -	$ -	$ -	$ -	$ 121,658,311
4	Undergraduate Library	210,000	$ -	$ -	$ -	$ -	$ -	$ 18,318,874	$ 47,858,060	$ 30,007,003	$ -	$ -	$ -	$ 67,991,577
5	Faculty/Administration Building	158,065	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,292,118	$ 26,888,158	$ 16,858,875	$ -	$ -	$ 36,380,761
6	Purdy Library	162,770	$ -	$ -	$ 8,887,457	$ 23,218,481	$ 14,557,988	$ -	$ -	$ -	$ -	$ -	$ -	$ 38,185,786
7	Kresge Library	68,272	$ -	$ -	$ 3,727,746	$ 9,738,736	$ 6,106,187	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,016,607
8	Donaldson House	17,763	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,031,361	$ 7,919,431	$ 4,965,483	$ 9,719,101
9	Music Annex	10,202	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,740,972	$ 4,548,289	$ 2,851,777	$ 5,581,876
10	Linsell House	6,581	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 280,781	$ 733,541	$ 459,930	$ 900,236
11	Prentis Building	68,404	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,945,547	$ 5,082,743	$ 3,186,880	$ 6,237,783
12	St. Andrew's	17,840	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,775,919	$ 4,639,589	$ 2,909,022	$ 5,693,924
13	Manoogian Hall	189,150	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,034,848	$ -	$ -	$ 2,600,899
14	General Lectures	30,073	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 641,507	$ -	$ -	$ 413,521
15	Life Science	59,904	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,790,892	$ 1,631,777
16	Shapero Hall	41,181	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 959,303	$ 560,885
17	Undergraduate Library (demo)	100,965	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,972,231	$ -	$ -	$ -	$ -	
18	Wet Labs	53,333	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,584,537	$ 19,814,602	$ 12,423,755	$ 24,317,419
			$ -	$ 11,962,245	$ 43,866,568	$ 52,551,823	$ 51,881,534	$ 99,874,225	$ 111,257,613	$ 80,445,066	$ 99,418,473	$ 81,313,821	$ 30,547,043	$ 471,137,797

Note: Excludes Scott Hall / Health Sciences

EXISTING OPERATION BUDGET ASSUMPTION

#	BUILDING	GSF	2020	2021	2022	2023
1	Maccabees Building	288,419	$ 2,884,190	$ 2,970,716	$ 3,059,837	$ 3,151,632
2	State Hall	163,530	$ 1,635,304	$ 1,684,363	$ 1,734,893	$ 1,786,940
3	Old Main	436,295	$ 4,362,945	$ 4,493,833	$ 4,628,648	$ 4,767,508
4	Undergraduate Library	310,965	$ 3,109,645	$ 3,202,934	$ 3,299,022	$ 3,397,993
5	Faculty/Administration Building	158,065	$ 1,580,655	$ 1,628,074	$ 1,676,917	$ 1,727,224
6	Purdy Library	162,770	$ 1,627,702	$ 1,676,533	$ 1,726,829	$ 1,778,634
7	Kresge Library	68,272	$ 682,722	$ 703,203	$ 724,299	$ 746,028
8	Donaldson House	17,763	$ 177,634	$ 182,963	$ 188,452	$ 194,105
9	Music Annex	10,202	$ 102,019	$ 105,079	$ 108,232	$ 111,479
10	Linsell House	6,581	$ 65,814	$ 67,788	$ 69,822	$ 71,916
11	Prentis Building	68,404	$ 684,040	$ 704,561	$ 725,698	$ 747,469
12	St. Andrew's	17,840	$ 178,400	$ 183,752	$ 189,265	$ 194,942
13	Manoogian Hall	189,150	$ 1,891,497	$ 1,948,242	$ 2,006,689	$ 2,066,890
14	General Lectures	30,073	$ 300,732	$ 309,754	$ 319,046	$ 328,618
15	Life Science	59,904	$ 599,044	$ 617,016	$ 635,526	$ 654,592
16	Shapero Hall	41,181	$ 411,815	$ 424,169	$ 436,894	$ 450,001
		2,029,416	$ 20,294,156	$ 20,902,981	$ 21,530,071	$ 22,175,973

Operating cost/SF $ 10.00
Annual escalation 3%

	2024	2025	2026	2027	2028	2029	TOTAL 10 YR
	$ 3,246,181	$ 3,343,567	$ 3,443,874	$ 3,547,190	$ 3,653,606	$ 3,763,214	$ 33,064,006
	$ 1,840,548	$ 1,895,765	$ 1,952,638	$ 2,011,217	$ 2,071,554	$ 2,133,700	$ 18,746,922
	$ 4,910,533	$ 5,057,849	$ 5,209,585	$ 5,365,872	$ 5,526,848	$ 5,692,654	$ 50,016,276
	$ 3,499,933	$ 3,604,931	$ 3,713,079	$ 3,824,471	$ 3,939,205	$ 4,057,382	$ 35,648,596
	$ 1,779,041	$ 1,832,412	$ 1,887,384	$ 1,944,006	$ 2,002,326	$ 2,062,396	$ 18,120,435
	$ 1,831,993	$ 1,886,953	$ 1,943,561	$ 2,001,868	$ 2,061,924	$ 2,123,782	$ 18,659,780
	$ 768,409	$ 791,462	$ 815,205	$ 839,662	$ 864,851	$ 890,797	$ 7,826,639
	$ 199,929	$ 205,926	$ 212,104	$ 218,467	$ 225,021	$ 231,772	$ 2,036,375
	$ 114,823	$ 118,268	$ 121,816	$ 125,470	$ 129,234	$ 133,111	$ 1,169,531
	$ 74,074	$ 76,296	$ 78,585	$ 80,943	$ 83,371	$ 85,872	$ 754,480
	$ 769,893	$ 792,990	$ 816,780	$ 841,283	$ 866,521	$ 892,517	$ 7,841,752
	$ 200,791	$ 206,814	$ 213,019	$ 219,409	$ 225,992	$ 232,772	$ 2,045,156
	$ 2,128,896	$ 2,192,763	$ 2,258,546	$ 2,326,303	$ 2,396,092	$ 2,467,974	$ 21,683,892
	$ 338,476	$ 348,631	$ 359,090	$ 369,862	$ 380,958	$ 392,387	$ 3,447,554
	$ 674,230	$ 694,456	$ 715,290	$ 736,749	$ 758,851	$ 781,617	$ 6,867,370
	$ 463,501	$ 477,406	$ 491,728	$ 506,480	$ 521,675	$ 537,325	$ 4,720,994
	$ 22,841,252	$ 23,526,489	$ 24,232,284	$ 24,959,253	$ 25,708,030	$ 26,479,271	$ 232,649,760

MASTER PLAN PROPOSED OPERATION BUDGET ASSUMPTION

#	BUILDING	GSF	2020	2021	2022	2023
1	Maccabees Building	288,419	$ 2,884,190	$ 2,970,716	$ 3,059,837	$ 3,151,632
2	State Hall	163,530	$ 1,635,304	$ 1,684,363	$ 1,734,893	$ 1,786,940
3	Old Main	436,295	$ 4,362,945	$ 4,493,833	$ 4,628,648	$ 4,767,508
4	Undergraduate Library	310,965	$ 3,109,645	$ 3,202,934	$ 3,299,022	$ 3,397,993
5	Faculty/Administration Building	158,065	$ 1,580,655	$ 1,628,074	$ 1,676,917	$ 1,727,224
6	Purdy Library	162,770	$ 1,627,702	$ 1,676,533	$ 1,726,829	$ 1,778,634
7	Kresge Library	68,272	$ 682,722	$ 703,203	$ 724,299	$ 746,028
8	Donaldson House	17,763	$ 177,634	$ 182,963	$ 188,452	$ 194,105
9	Music Annex	10,202	$ 102,019	$ 105,079	$ 108,232	$ 111,479
10	Linsell House	6,581	$ 65,814	$ 67,788	$ 69,822	$ 71,916
11	Prentis Building	68,404	$ 684,040	$ 704,561	$ 725,698	$ 747,469
12	St. Andrew's	17,840	$ 178,400	$ 183,752	$ 189,265	$ 194,942
13	Manoogian Hall	189,150	$ 1,891,497	$ 1,948,242	$ 2,006,689	$ 2,066,890
14	General Lectures	30,073	$ 300,732	$ 309,754	$ 319,046	$ 328,618
15	Life Science	59,904	$ 599,044	$ 617,016	$ 635,526	$ 654,592
16	Shapero Hall	41,181	$ 411,815	$ 424,169	$ 436,894	$ 450,001
17	NEW WET LAB	53,333	$ -	$ -	$ 586,667	$ 604,267
		2,082,749	$ 20,294,156	$ 20,902,981	$ 22,116,737	$ 22,780,239
		(53,333)	$ -	$ -	$ (586,667)	$ (604,267)

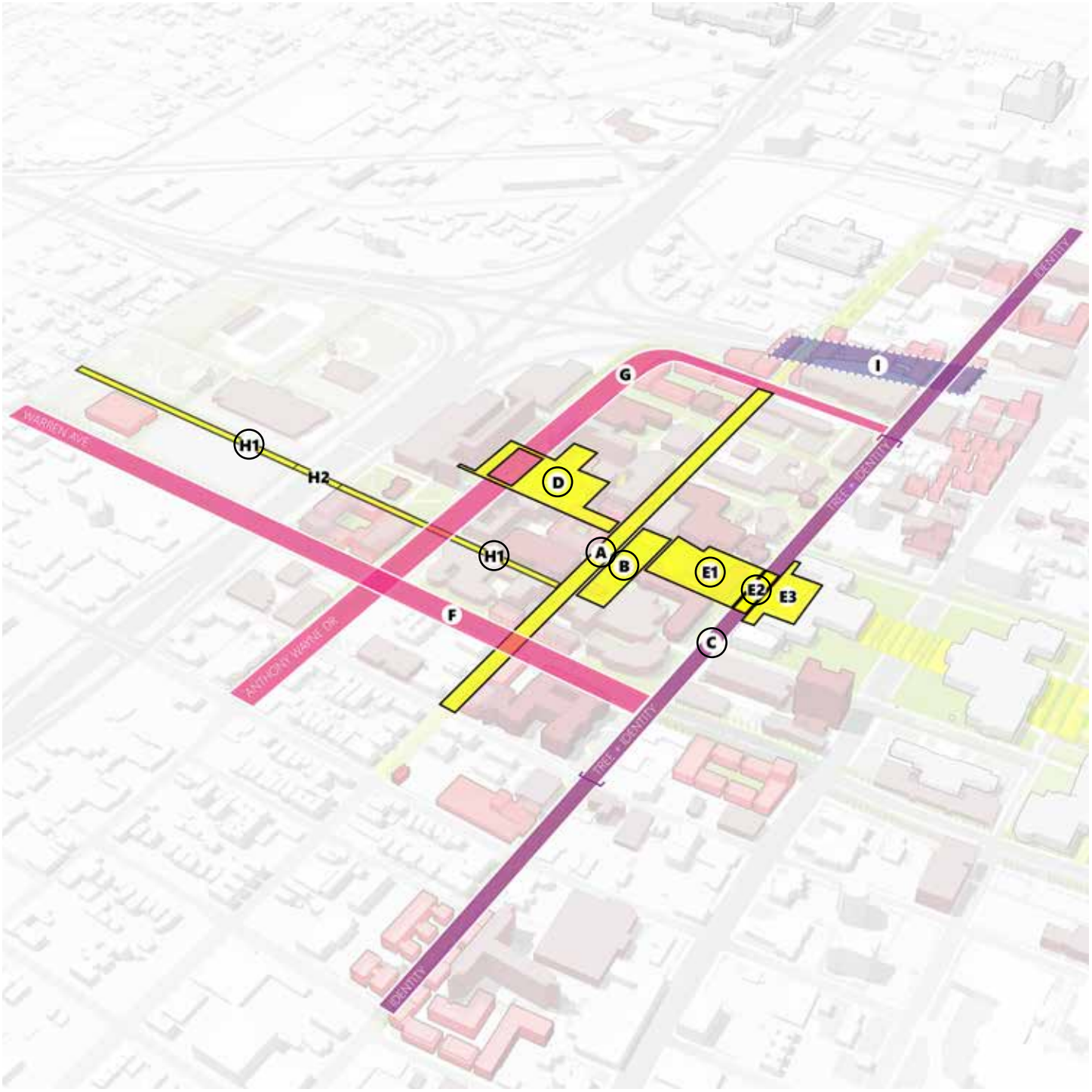
Note: Excludes Scott Hall / Health Sciences

	2024	2025	2026	2027	2028	2029	TOTAL 10 YR
	$ 3,246,181	$ 3,343,567	$ 3,443,874	$ 3,547,190	$ 3,653,606	$ 3,763,214	$ 33,064,006
	$ 1,840,548	$ 1,895,765	$ 1,952,638	$ 2,011,217	$ 2,071,554	$ 2,133,700	$ 18,746,922
	$ 4,910,533	$ 5,057,849	$ 5,209,585	$ 5,365,872	$ 5,526,848	$ 5,692,654	$ 50,016,276
	$ 2,363,569	$ 2,434,476	$ 2,507,510	$ 2,582,735	$ 2,660,217	$ 2,740,024	$ 28,298,125
	$ 1,779,041	$ 1,832,412	$ 1,887,384	$ 1,944,006	$ 2,002,326	$ 2,062,396	$ 18,120,435
	$ 1,831,993	$ 1,886,953	$ 1,943,561	$ 2,001,868	$ 2,061,924	$ 2,123,782	$ 18,659,780
	$ 768,409	$ 791,462	$ 815,205	$ 839,662	$ 864,851	$ 890,797	$ 7,826,639
	$ 199,929	$ 205,926	$ 212,104	$ 218,467	$ 225,021	$ 231,772	$ 2,036,375
	$ 114,823	$ 118,268	$ 121,816	$ 125,470	$ 129,234	$ 133,111	$ 1,169,531
	$ 74,074	$ 76,296	$ 78,585	$ 80,943	$ 83,371	$ 85,872	$ 754,480
	$ 769,893	$ 792,990	$ 816,780	$ 841,283	$ 866,521	$ 892,517	$ 7,841,752
	$ 200,791	$ 206,814	$ 213,019	$ 219,409	$ 225,992	$ 232,772	$ 2,045,156
	$ 2,128,896	$ 2,192,763	$ 2,258,546	$ -	$ -	$ -	$ 14,493,523
	$ 338,476	$ 348,631	$ 359,090	$ -	$ -	$ -	$ 2,304,347
	$ 674,230	$ 694,456	$ 715,290	$ 736,749	$ 758,851	$ -	$ 6,085,754
	$ 463,501	$ 477,406	$ 491,728	$ 506,480	$ 521,675	$ -	$ 4,183,669
	$ 622,395	$ 641,067	$ 660,299	$ 680,107	$ 700,511	$ 721,526	$ 5,216,837
	$ 22,327,282	$ 22,997,100	$ 23,687,014	$ 21,701,459	$ 22,352,503	$ 21,704,136	$ 220,863,608
	$ 513,970	**$ 529,389**	**$ 545,271**	**$ 3,257,794**	**$ 3,355,527**	**$ 4,775,135**	**$ 11,786,152**
						NPV	$ 7,480,868

RENOVATE LIFE SCIENCE VS NEW WET LAB BUILDING

LIFE SCIENCE	
Circulation, etc. (FICM 000, exc. 050)	25,111 SF
Vacant (FICM 050)	14,711 ASF
ASF (FICM 200,300,500,700)	14,285 ASF
Walls etc.	5,797 ASF
TOTAL AREA	59,904 GSF
All-in renovation cost/sf	$ 517
All-in renovation cost estimate	$ 30,970,585

NEW WET LAB BUILDING	
Wet lab space need	32,000 ASF
Total proposed ASF	32,000 ASF
GSF @ 60% efficiency	53,333 GSF
Est. all-in new construction/sf	$ 500
Est. all-in new construction	$ 26,666,667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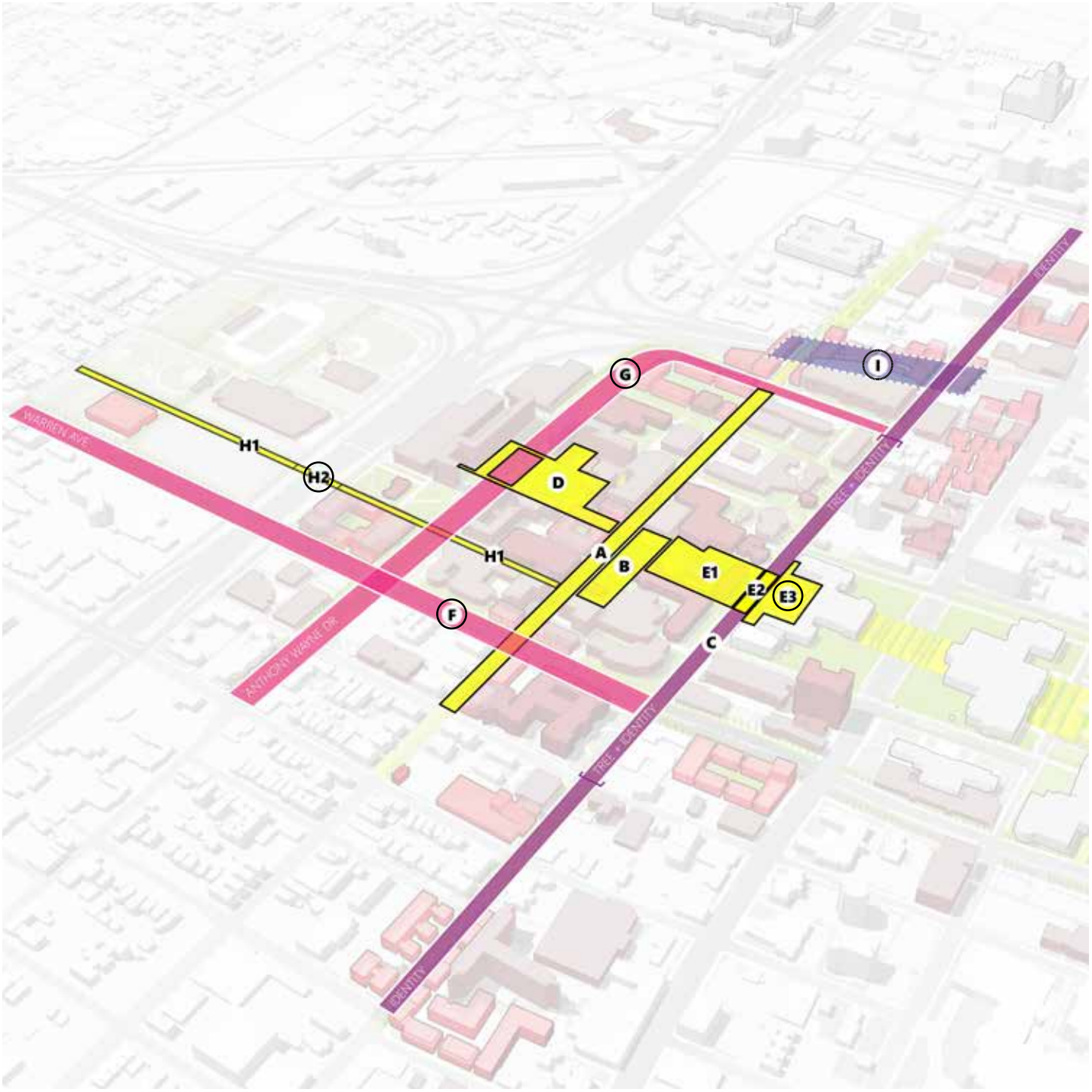
LANDSCAPE FINANCIAL MODEL
WSU-FUNDED SUMMARY

NPV estimate: $13,044,132.42

WSU-funded projects

No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
A	2nd Ave/Gullen Mall improvement	220,000	SF	$ 12		$ 2,702,000	Approx. 2,600 LF, 40% green, 10% asphalt pavement, 50% cast-in-place concrete, including rows of deciduous trees along the Mall and pedestrian lighting (60' o.c.)
	Concrete paver	23,000	SF	$ 15	$ 345,000		Plaza in front of Student Center and major paths
	Concrete	108,500	SF	$ 8	$ 868,000		2,600 LF, 20' pedestrain walk along both sides of the lawn/plaza, could be used as fire lane
	Green	88,500	SF	$ 10	$ 885,000		The green in the middle of the Mall, typical width 48', including initial site demolition
	Trees	174	LS	$ 1,000	$ 174,000		Rows of trees along the Mall (30' o.c.), 3-4" caliper
	Pedestrian lighting	86	LS	$ 5,000	$ 430,000		Pedestrian lighting along the Mall (60' o.c.)
B	Fountain Court	88,000	SF	$ 12		$ 1,016,000	67% lawn, 14% asphalt pavement, 19% cast-in-place concrete, including rows of deciduous trees and pedestrian lighting (60' o.c.)
	Concrete paver	12,000	SF	$ 15	$ 180,000		Plaza in front of the Recreation Center
	Concrete	17,000	SF	$ 8	$ 136,000		Concrete for other part
	Green	59,000	SF	$ 10	$ 590,000		The main green for the fountain court, approx. 130' by 450', including initial site demolition
	Trees	30	LS	$ 1,000	$ 30,000		Rows of trees along the Mall (30' o.c.), 3-4" caliper
	Pedestrian lighting	16	LS	$ 5,000	$ 80,000		Pedestrian lighting along the Mall (60' o.c.)
C	Cass Ave improvement	5,600	LF	$ 196		$ 1,096,000	Street tree improvement and university identity promotion
	Trees	166	LS	$ 1,000	$ 166,000		2,500' tree zone at the core campus, one row of trees along the sidewalk (30' o.c.), 3-4" caliper
	Identity built	186	LS	$ 5,000	$ 930,000		Wayfinding, unversity banner (60' o.c.)
D	Keast Commons	168,800	SF	$ 13		$ 2,125,700	39% lawn, 27% asphalt pavement, 40% cast-in-place concrete, including one row of deciduous trees on each grass strip and pedestrian lighting along major path
	Concrete paver	35,100	SF	$ 15	$ 526,500		Plaza of the new dining addition, major paths and service drive with special parvement
	Concrete	64,400	SF	$ 8	$ 515,200		Concrete for other part
	Green	63,800	SF	$ 10	$ 638,000		Green strips, main circle and green in front of the dining addition, including initial site demolition
	Stage at Chatsworth Tower	5,500	SF	$ 40	$ 220,000		Steps and concrete paver
	Trees	46	LS	$ 1,000	$ 46,000		Rows of trees along the dining hall plaza and the lawn strips (30' o.c.), 3-4" caliper
	Pedestrian lighting	36	LS	$ 5,000	$ 180,000		Pedestrain lighting along major path (60' o.c.)
E1	Cultural Axis (WSU side)	123,000	SF	$ 13		$ 1,600,300	40% lawn, 20% asphalt pavement, 40% concrete, including one row of deciduous trees on each grass strip and pedestrian lighting along major path
	Concrete paver	32,100	SF	$ 15	$ 481,500		Asphalt paver for major paths
	Concrete	42,100	SF	$ 8	$ 336,800		Concrete for other part of the plaza
	Green	48,800	SF	$ 10	$ 488,000		Including green strips, grassed refleting pool and other side grass, including initial site demolition
	Trees	35	LS	$ 1,000	$ 35,000		One row of tree along the green strip (30' o.c.), 3-4" caliper
	Pedestrian lighting	50	LS	$ 5,000	$ 250,000		Pedestrain lighting along major path, spacing (60' o.c.)
	Curbing	300	LF	$ 30	$ 9,000		Concrete curb
E2	Cultural Axis (Cass Ave)	14,800	SF	$ 13		$ 188,000	Intersection of Cultural Axis and Cass Ave
	Asphalt paver	4,000	SF	$ 20	$ 80,000		Major paths between WSU and BPL
	Driveway asphalt	10,800	SF	$ 10	$ 108,000		Asphalt of the drive
H1	Connection to athletics district (bridge excluded)	70,000	SF	$ 17		$ 1,216,000	Paved pedestrain corridor with rows of deciduous trees and pedestrian lighting, with one bridge at length of 300'
	Concrete	70,000	SF	$ 8	$ 560,000		Concrete for the walk, typical width 25'
	Trees	186	LS	$ 1,000	$ 186,000		Rows of trees along the walk (30' o.c.), 3-4" caliper
	Pedestrian lighting	94	LS	$ 5,000	$ 470,000		Pedestrain lighting along major path (60' o.c.)
				CONSTRUCTION COST	**$ 9,944,000**	**$ 9,944,000**	
				40% CONTINGENCY AND SOFT COST		**$ 3,977,600**	
				TOTAL PROJECT COST		**$ 13,921,600**	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IDENTITY

PARTNER-FUNDED PROJECTS SUMMARY

Partner-funded projects

No.	Item	Quantity	Unit	Unit Cost	Subtotal	Total	Remarks
E3	Cultural Axis (DPL side)	64,000	SF	$ 15		$ 981,600	33% lawn, 38% asphalt pavement, 29% concrete, including one row of deciduous trees on each grass strip and pedestrian lighting along major path
	Asphalt paver	23,000	SF	$ 20	$ 460,000		Major paths and the plaza in front of BPL, can be used as round-about
	Concrete	18,700	SF	$ 8	$ 149,600		Concrete for other part of the plaza
	Green	22,300	SF	$ 10	$ 223,000		Including green strips and other side grass, including initial site demolition
	Trees	40	LS	$ 1,000	$ 40,000		One row of tree along the green strip (30' o.c.), 3-4" caliper
	Pedestrian lighting	20	LS	$ 5,000	$ 100,000		Pedestrain lighting along major path, spacing (60' o.c.)
	Curbing	300	LF	$ 30	$ 9,000		Concrete curb
F	Warren Ave improvement	3,200	LF	$ 1,125		$ 3,599,600	3,200 LF, reduced 8 lanes to 5 lanes with 2 bike lanes, 73' wide roadway with asphalt pavement, concrete curb, deciduous trees, street lights on both sides
	Driveway asphalt	233,600	SF	$ 6	$ 1,401,600		73' wide with 5 lanes and 2 bike lanes
	Sidewalk concrete	96,000	SF	$ 8	$ 768,000		20' wide on the northside, 10' wide on the southside
	Green	51,200	SF	$ 10	$ 512,000		10' planting on the northside, 6' planting on the southside, including initial site demolition
	Trees	214	LS	$ 1,000	$ 214,000		One row of tree along the sidewalk (30' o.c.), 3-4" caliper
	Lighting	64	LS	$ 10,000	$ 640,000		Street lights (100' o.c.)
	Curbing	6,400	LF	$ 10	$ 64,000		Concrete curb
G	Anthony Wayne Dr and Palmer Ave Improvement	4,100	LF	$ 1,314		$ 5,386,000	4,100 LF, reduced to 4 lanes with 2 bike lanes, with asphalt pavement, concrete curb, deciduous trees, street lights on both sides, including 175,000 SF green at Anthony Wayne Dr
	Driveway asphalt	229,600	SF	$ 6	$ 1,377,600		56' wide with 4 lanes and 2 bike lanes
	Sidewalk concrete	73,800	SF	$ 8	$ 590,400		9' sidewalk on both sides
	Green	224,200	SF	$ 10	$ 2,242,000		Including 6 ' planting on both sides and 60'-70' wide (175,000 SF) green island at Anthony Wayne Dr, including initial site demolition
	Trees	274	LS	$ 1,000	$ 274,000		One row of tree along the sidewalk (30' o.c.), 3-4" caliper
	Lighting	82	LS	$ 10,000	$ 820,000		Street lights (100' o.c.)
	Curbing	8,200	LF	$ 10	$ 82,000		Concrete curb
H2	Connection to athletics district (bridge)	300	SF	$ 5,000		$ 1,500,000	Bridge at length of 300'
	Pedestrian bridge	300	LF	$ 5,000	$ 1,500,000		Bridge at length of 300'
				CONSTRUCTION COST	**$ 11,467,200**	**$ 11,467,200**	
				40% CONTINGENCY AND SOFT COST		**$ 4,586,880**	
				TOTAL PROJECT COST		**$ 16,054,080**	
I	Decking over I-94	237,000	SF				

CONSOLIDATION CAPEX ASSUMPTIONS

NPV Value	5%
Soft Cost	40%

WSU-funded projects

#	PROJECT	QUANTITY	UNIT	START YEAR	UNIT CONSTR. COST
A	2nd Ave/Gullen Mall improvement	220,000	SF	2020	$ 12
B	Fountain Court	88,000	SF	2021	$ 12
C	Cass Ave improvement	5,600	LF	2023	$ 196
D	Keast Commons	168,800	SF	2019	$ 13
E1	Cultural Axis (WSU side)	123,000	SF	2022	$ 13
E2	Cultural Axis (Cass Ave)	14,800	SF	2024	$ 13
H1	Connection to athletics district (bridge excluded)	70,000	SF	2025	$ 17

Partner-funded projects

#	PROJECT	QUANTITY	UNIT	START YEAR	UNIT CONSTR. COST
E3	Cultural Axis (DPL side)	64,000	SF	2022	$ 15
F	Warren Ave improvement	3,200	LF	2020	$ 1,125
G	Anthony Wayne Dr and Palmer Ave Improvement	4,100	LF	2021	$ 1,314
H2	Connection to athletics district (bridge)	300	SF	2025	$ 5,000
I	Decking over I-94	237,000	SF		$ -

PROPOSED SPEND TIMELINE

Construction escalation: 4.5%
Year one cost share: 20%
Year two cost share: 40%
Year three cost share: 40%

WSU-funded projects

#	PROJECT	QTY	UNIT	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	NPV
A	2nd Ave/Gullen Mall improvement	220,000	SF	$ -	$ 790,605	$ 1,652,365	$ 1,726,721	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,565,055
B	Fountain Court	88,000	SF	$ -	$ -	$ 310,659	$ 649,278	$ 678,495	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,334,141
C	Cass Ave improvement	5,600	LF	$ -	$ -	$ -	$ -	$ 365,960	$ 764,857	$ 799,275	$ -	$ -	$ -	$ -	$ 1,425,517
D	Keast Commons	168,800	SF	$ 595,196	$ 1,243,960	$ 1,299,938	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,818,097
E1	Cultural Axis (WSU side)	123,000	SF	$ -	$ -	$ -	$ 511,338	$ 1,068,697	$ 1,116,788	$ -	$ -	$ -	$ -	$ -	$ 2,091,396
E2	Cultural Axis (Cass Ave)	14,800	SF	$ -	$ -	$ -	$ -	$ -	$ 65,599	$ 137,102	$ 143,272	$ -	$ -	$ -	$ 243,359
H1	Connection to athletics district (bridge excluded)	70,000	SF	$ -	$ -	$ -	$ -	$ -	$ -	$ 443,394	$ 926,692	$ 968,394	$ -	$ -	$ 1,566,569
				$ 595,196	$ 2,034,565	$ 3,262,962	$ 2,887,337	$ 2,113,153	$ 1,947,244	$ 1,379,771	$ 1,069,964	$ 968,394	$ -	$ -	**$ 13,044,132**

Partner-funded projects

#	PROJECT	QTY	UNIT	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	NPV
E3	Cultural Axis (DPL side)	64,000	SF	$ -	$ -	$ -	$ 224,034	$ 468,231	$ 489,301	$ -	$ -	$ -	$ -	$ -	$ 916,308
F	Warren Ave improvement	3,200	LF	$ -	$ 752,316	$ 1,572,341	$ 1,643,097	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,392,400
G	Anthony Wayne Dr and Palmer Ave Improvement	4,100	LF	$ -	$ -	$ 1,176,329	$ 2,458,528	$ 2,569,162	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,051,801
H2	Connection to athletics district (bridge)	300	SF	$ -	$ -	$ -	$ -	$ -	$ -	$ 390,678	$ 816,517	$ 853,260	$ -	$ -	$ 1,380,318
I	Decking over I-94	237,000	SF	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
				$ -	$ 752,316	$ 2,748,671	$ 4,325,659	$ 3,037,393	$ 489,301	$ 390,678	$ 816,517	$ 853,260	$ -	$ -	$ 10,740,826
				$ 595,196	$ 2,786,881	$ 6,011,633	$ 7,212,996	$ 5,150,545	$ 2,436,545	$ 1,770,449	$ 1,886,481	$ 1,821,654	$ -	$ -	$ 23,784,959


1868-2018
150 YEARS
IN THE HEART OF DETROIT
Main Campus Shuttle
Main
Campus
Shuttle

TRANSPORTATION

GOROVE/SLADE

INTRODUCTION

PURPOSE OF STUDY

This report reviews the existing transportation conditions on and surrounding Wayne State University (WSU) as it relates to the creation of the campus Master Plan. WSU is an urban university located in Detroit, Michigan with a total enrollment of 25,101 students in Winter 2019 and occupies approximately 203 acres near downtown Detroit.

The purpose of this report is to evaluate the existing conditions of the transportation network on and surrounding WSU. The findings of this analyses will be used to develop alternate Master Plan scenarios and evaluate them. Initial thoughts on Master Plan implications are included in each chapter of this report.

Sources of data for this report were traffic counts conducted on and adjacent to campus, parking inventory and occupancy data provided by WSU staff, general observations conducted on campus, parking occupancy and traffic operations observations conducted while on campus, meetings with WSU faculty, staff and students, crash data obtained from Southeast Michigan Council of Governments (SEMCOG), and GIS files provided by local agencies and DumontJanks.

CONTENTS OF STUDY

This report contains four sections as follows:

- Parking
  This section presents campus parking inventory, peak hour occupancy, and overall parking findings. Parking data was obtained from WSU and analyzed using ArcGIS Pro software. This ensured data was correctly assigned to parking garages throughout campus and gave insights into how parking is utilized throughout campus.
- Traffic
  This section reviews the overall existing traffic operations on and surrounding campus. Turning movement counts (TMCs) were gathered at 25 intersections on and surrounding campus. The field data was used to create an existing transportation network where any areas of concern could be identified.
- Non-Auto
  This section reviews the overall pedestrian facilities, bicycle facilities, and transit facilities on and surrounding campus. Non-auto facilities were evaluated using data obtained from Southeast Michigan Council of Governments (SEMCOG). The data was imported into ArcGIS Pro software to evaluate the extent of bicycle infrastructure and the public transportation surrounding campus. A qualitative pedestrian comfort evaluation was conducted based on the width of a sidewalk and buffer space provided. The on-campus shuttle routes were taken from WSU's website and routes were drawn in ArcGIS Pro.
- Crash and Safety
  This section reviews the overall crash analysis findings on and surrounding campus. Utilizing crash data from the last three years (2015-2017) obtained from SEMCOG, a vehicular crash analysis was performed along with evaluating pedestrian and bicycle involved crashes. Patterns in crashes and crash rates were established and areas of concern were highlighted for further evaluation.

NEXT STEPS

The next step in the campus Master Plan process is developing alternative scenario that will be used to test ideas. The existing conditions provide a baseline for generating scenarios including identifying areas of interest. Initial thoughts on the Master Plan area included in each chapter within this report.

Once developed, the scenarios will be tested against several transportation metrics and goals, using the analyses and data contained within this report as a base.

Students walking though Fountain Court


Intersection of Warren and Woodward Avenues

PARKING

This section presents campus parking inventory, peak hour parking occupancy broken down by campus precinct and user type, and overall parking findings and their implications for the campus master plan. The parking analysis reached the following findings:

- Parking occupancy peaks in the middle of the day but most facilities have spaces available at peak hour, especially on the periphery of campus.
- Faculty and staff account for more than half the parking demand on the Main Campus, where demand is highest.
- Non-auto incentives for faculty and staff would probably reduce demand only slightly, given the convenience of driving.
- Student parking demand could be reduced by converting commuting students to on-campus students, but only with changes to parking behavior. This could be accomplished by adjusting costs and/or restrictions for on-campus student parking (i.e. using disincentives instead of incentives).

PARKING INVENTORY

An on-campus parking inventory was obtained through documents received from WSU. As of this report, the campus contains 12,172 parking spaces spread across 29 surface parking lots and eight (8) parking structures shown on Figure 1. The parking inventory by precinct is shown on Figure 2.

Of these 12,172 total spaces, 12,105 are included in this analysis. The remaining 67 spaces are in Lots 21, 30, and 52, for which occupancy information was not available.

Most parking facilities are shared between user types. 76% of WSU's parking spaces are in facilities that serve all user types, including faculty/staff, students, and visitors. Another 19% are in facilities designated for some combination of, but not all user types. The remaining 5% are in facilities designated for a single user type.

In addition to WSU parking facilities, there is on-street parking throughout the campus area which is substantially used.

PERMIT SALES

Parking permit sales have increased over the last three (3) years, rising from 15,857 active permits in Fall 2015 to 18,078 in Fall 2018, while total WSU campus-based enrollment has remained steady around 20,400 students.

Of the Fall 2018 active permits, 9,237 are designated for university employees (faculty, staff, or affiliates). There are currently 10,853 university employees, resulting in a permit-per-employee ratio of 0.85. Of the Fall 2018 active permits, 6,971 are designated for students. There are currently approximately 20,317 students based at the main WSU campus (i.e. excluding online students), resulting in a permit-per-student ratio of 0.34. Figure 3 shows the permits sold by type.

PARKING OCCUPANCY BY LOCATION

Parking occupancy by location was determined through a combination of WSU-provided entrance/exit activity data at each parking facility and field observations by both Gorove/Slade and WSU parking staff. Both the entrance/exit data and field observations took place on weekdays in October 2018. In most cases, timed entrance and exit data at facilities could be matched with timed occupancy observations, allowing daily occupancy profiles of each facility to be developed, as well as precinct- and campus-level occupancy profiles. Overall campus occupancy is shown on Figure 4. The analysis produced the following conclusions (also shown on Figure 5 through Figure 10):

- Parking demand peaks between 1:00 and 2:00 PM. During this peak hour, 75% of all parking spaces on campus are occupied. Precinct-level peak hour occupancy levels are as follows:
  Main Campus: 87%
  Athletic Campus: 60%
  Research & Technology Village: 36%
  East Campus: 47%
  South University Village: 78%
  Medical Campus: 61%

Garages are more occupied than surface lots, with garages 83% occupied at the peak hour and surface lots 54% occupied.

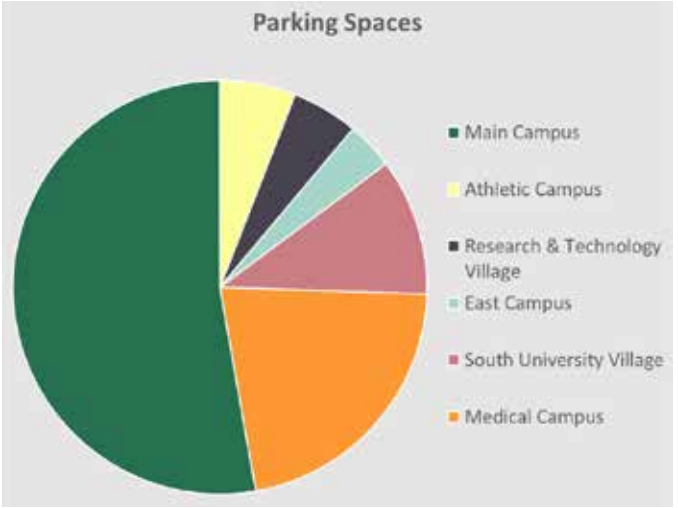


Figure 2: Parking Inventory by Location

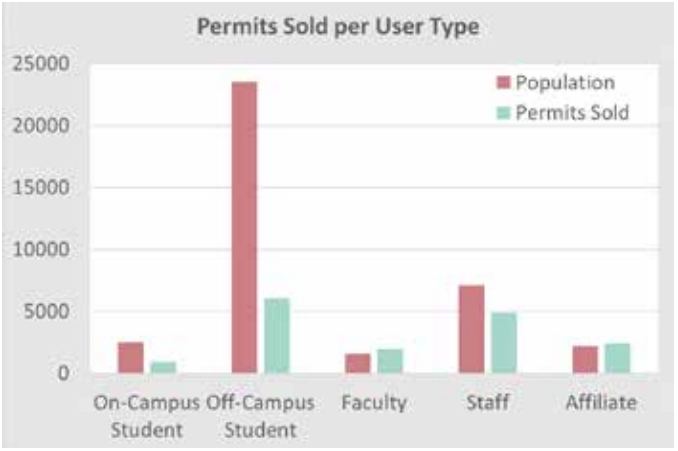


Figure 3: Permits Sold per User Type

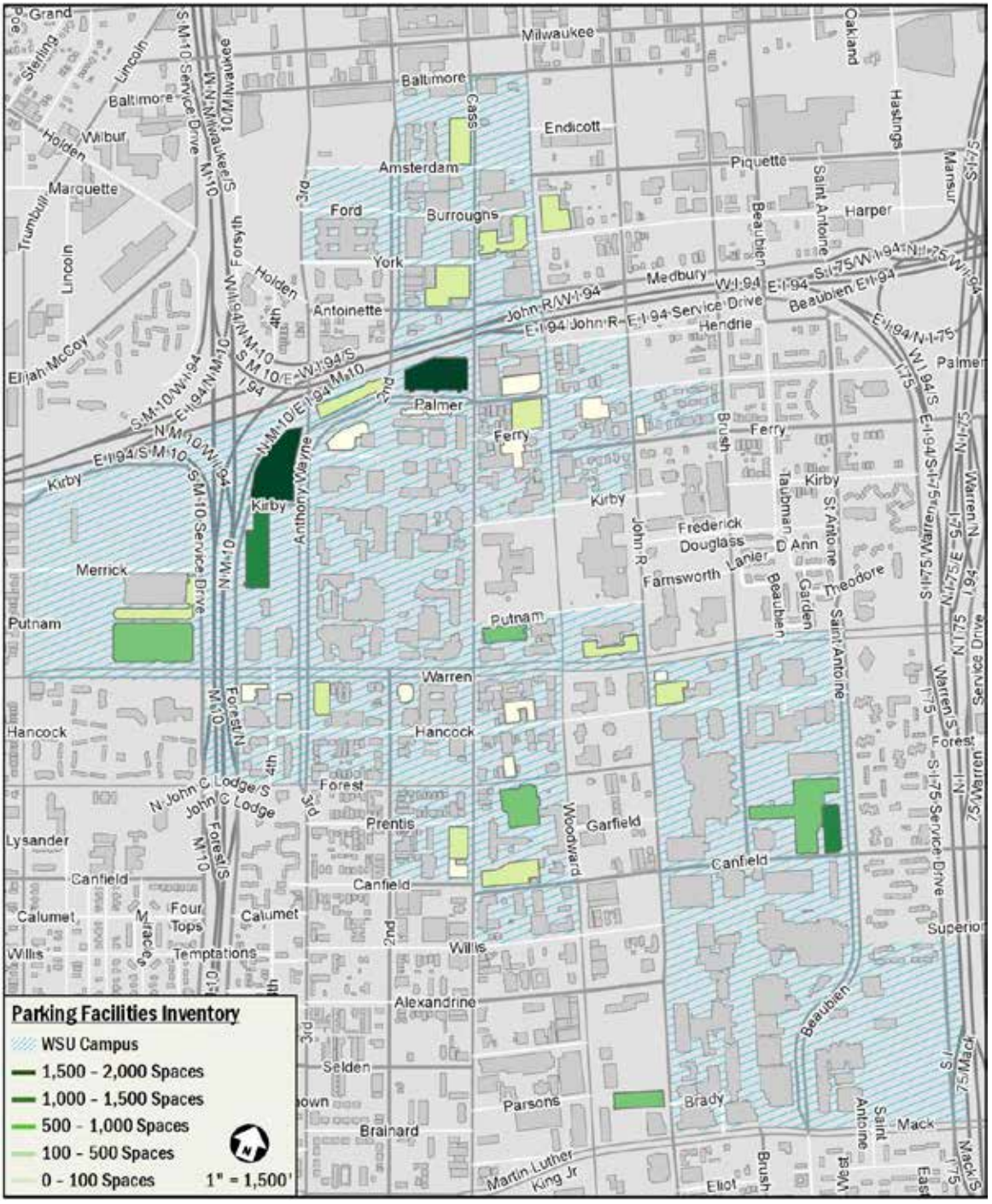


Figure 1: Parking Inventory

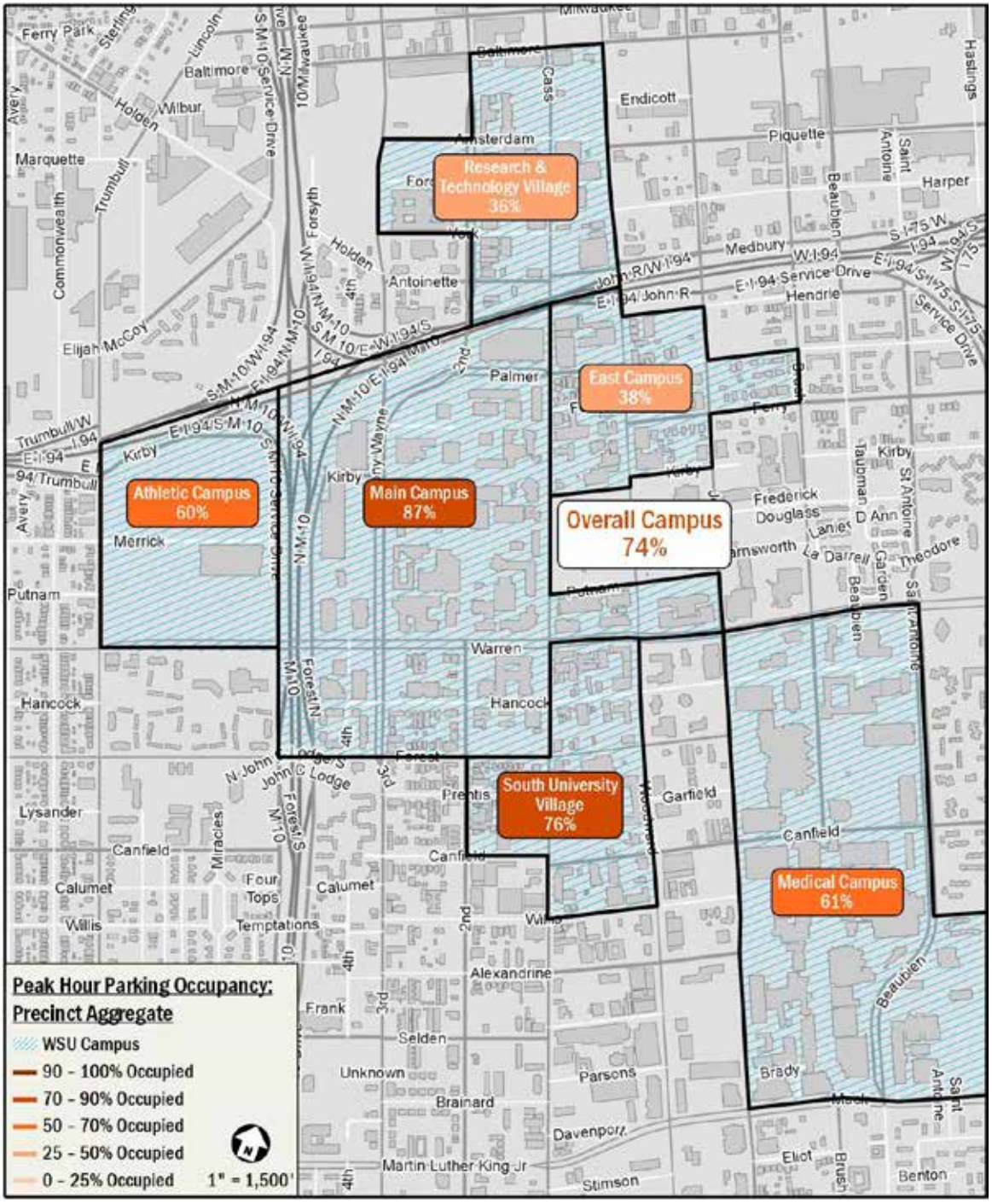


Figure 4: Parking Occupancy

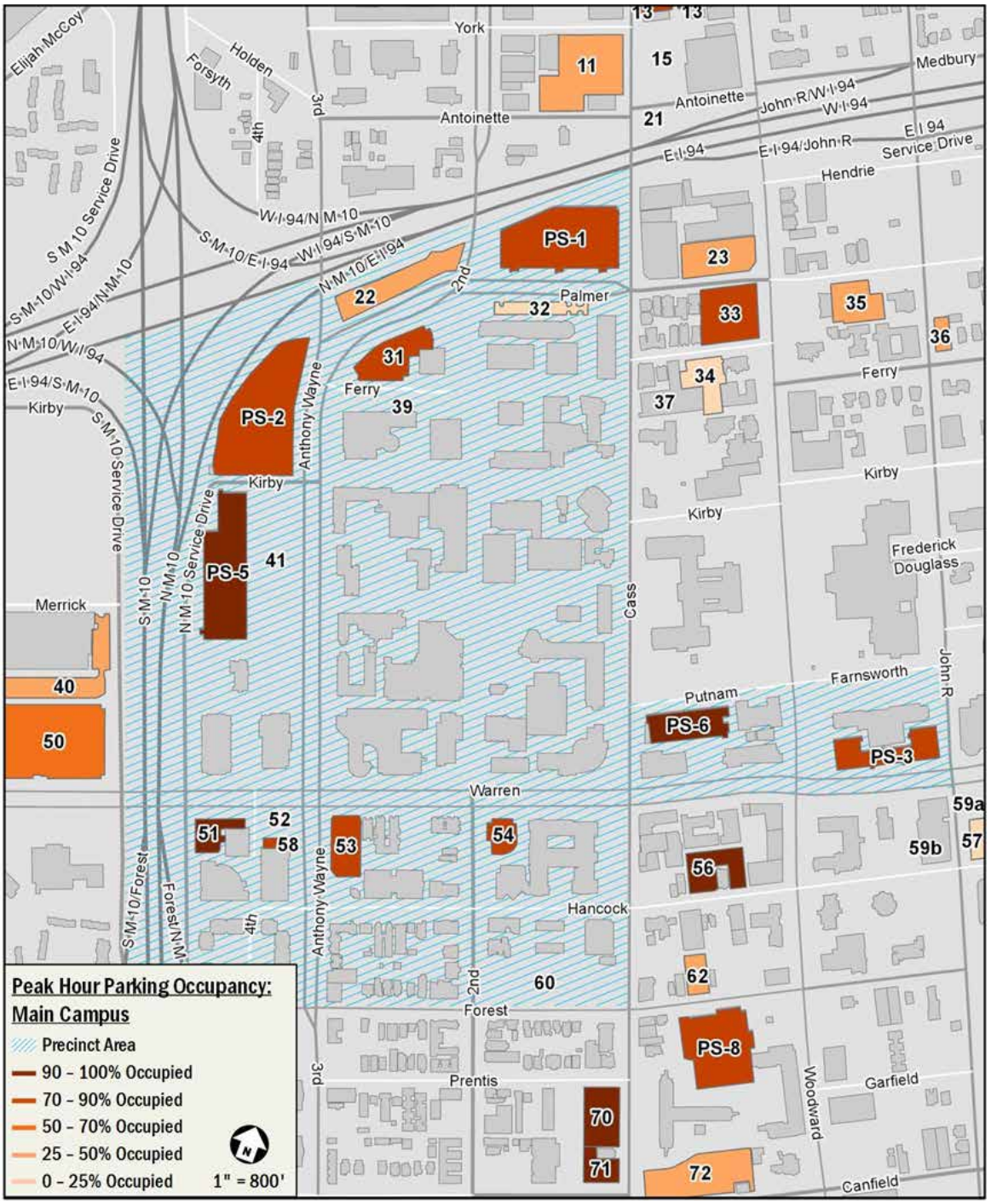


Figure 5: Parking Occupancy, Main Campus

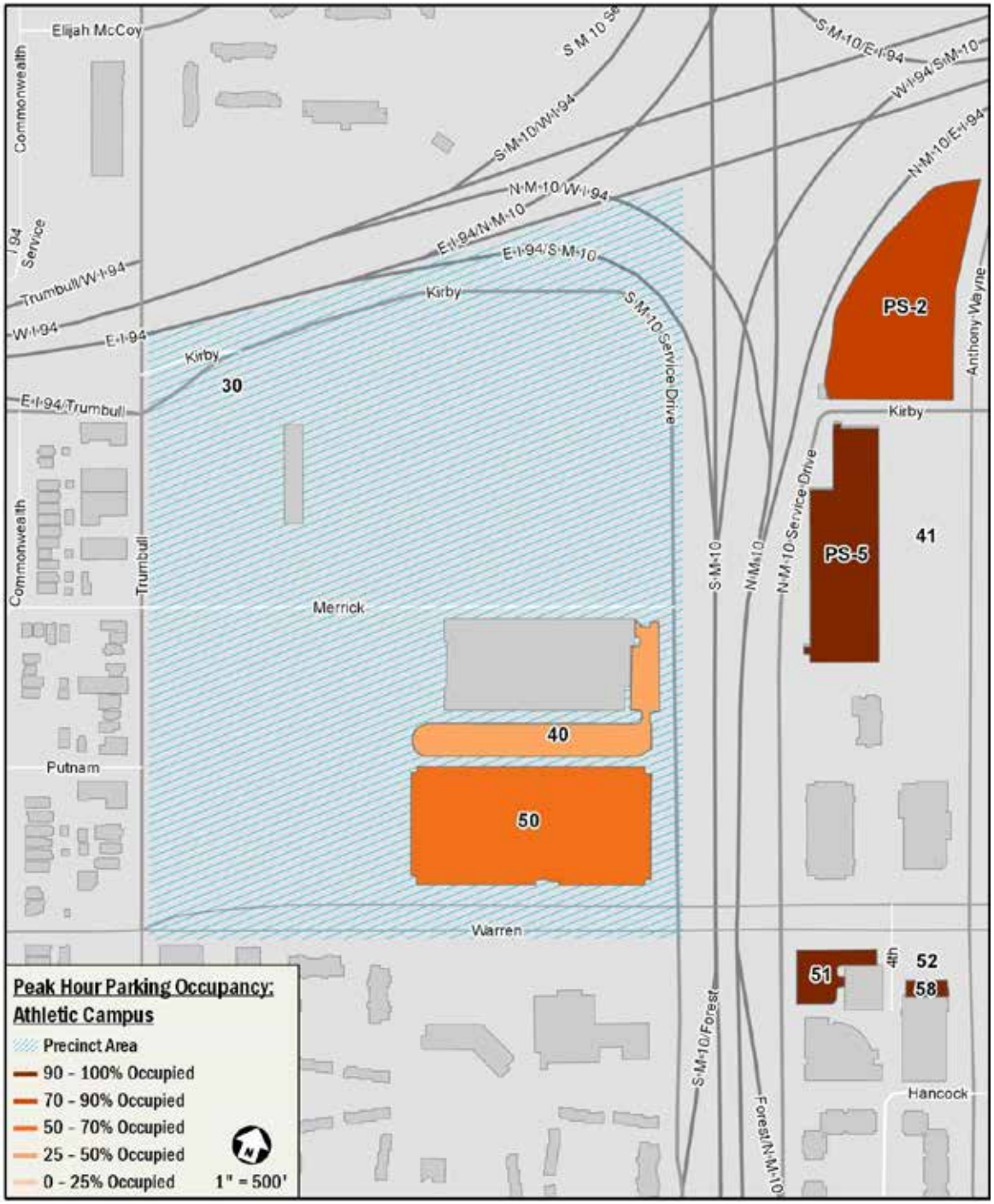


Figure 6: Parking Occupancy, Athletic Campus

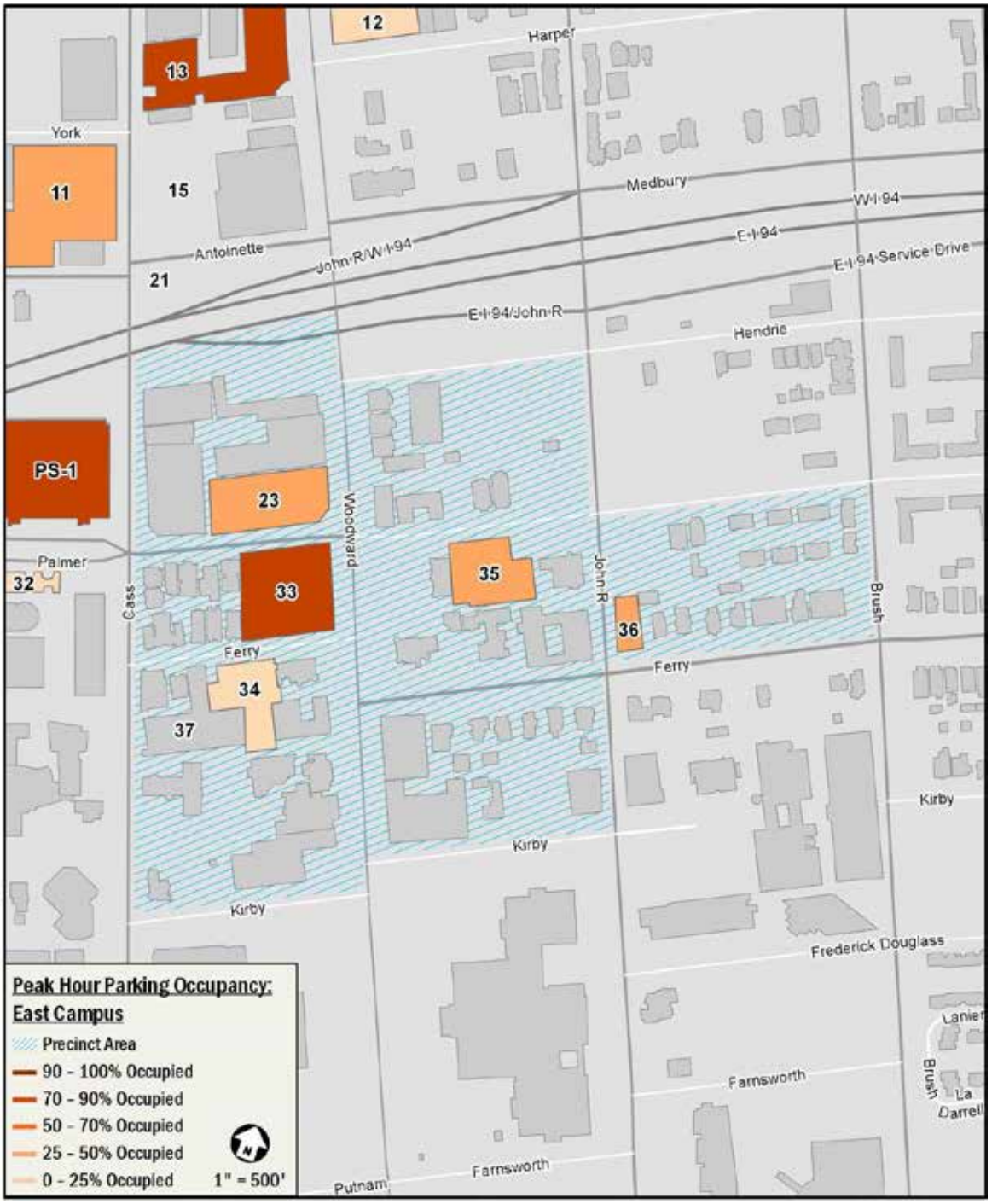


Figure 7: Peak Parking Occupancy, East Campus

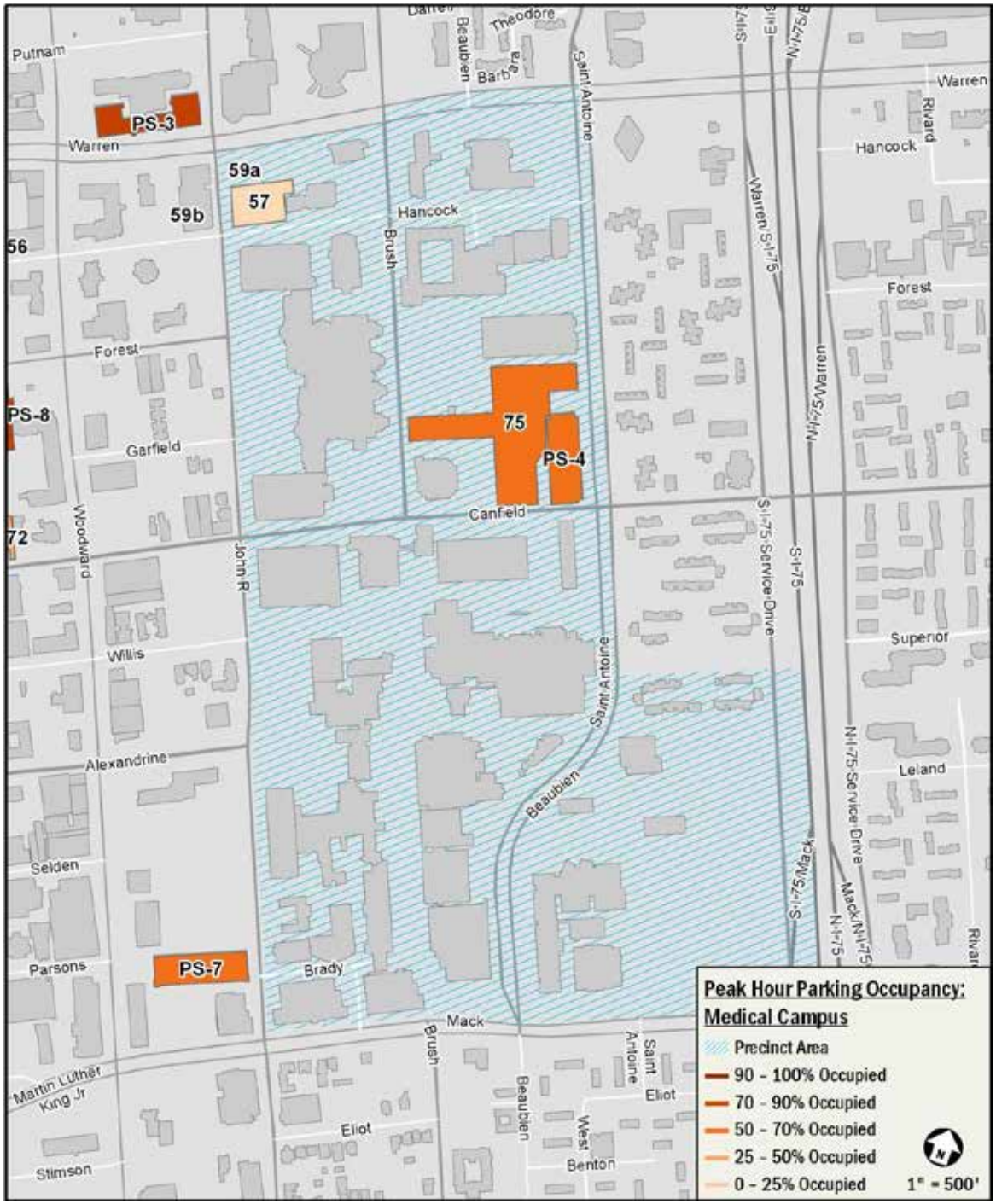


Figure 8: Peak Parking Occupancy, Medical Campus

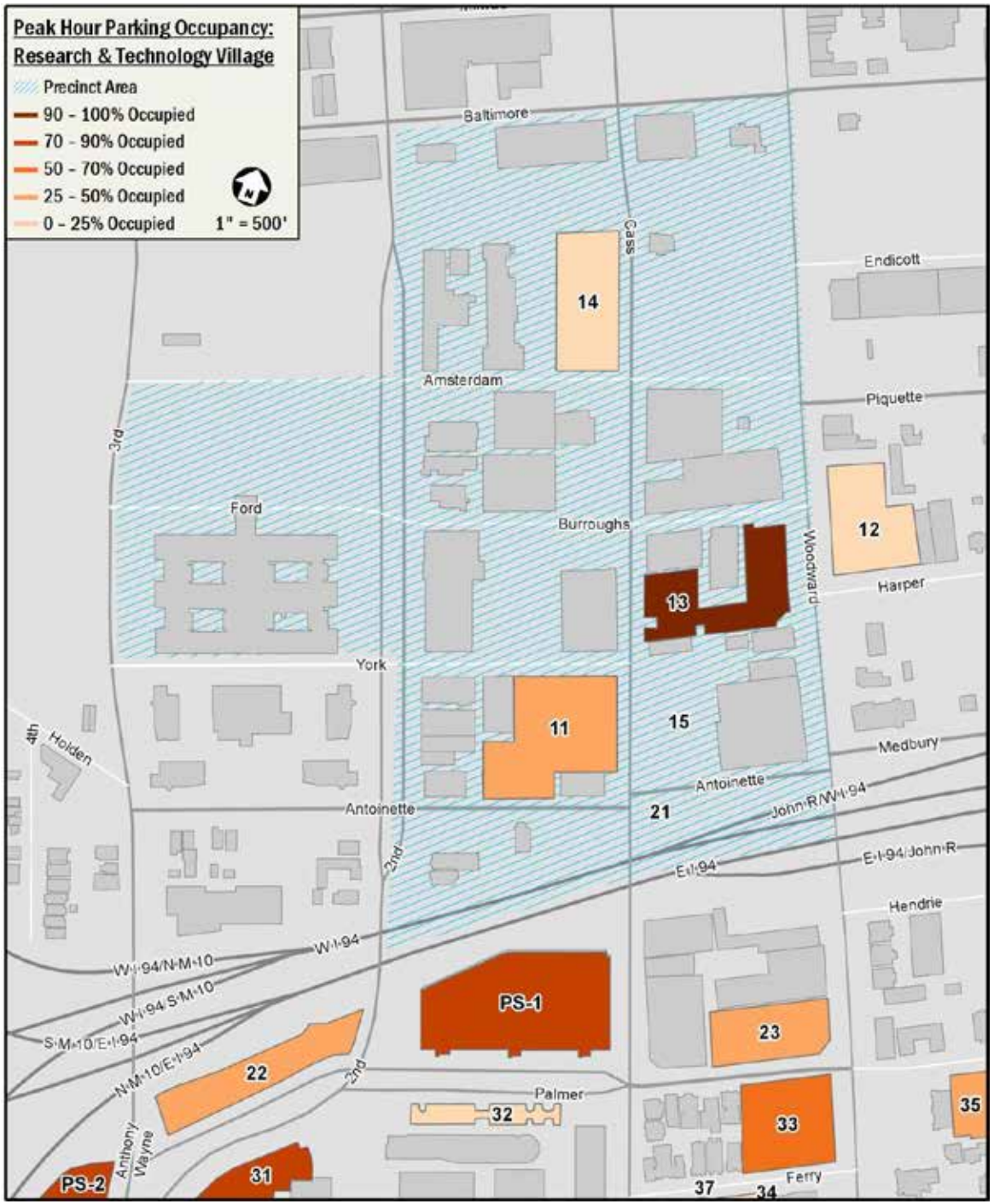


Figure 9: Peak Parking Occupancy, Research & Tech

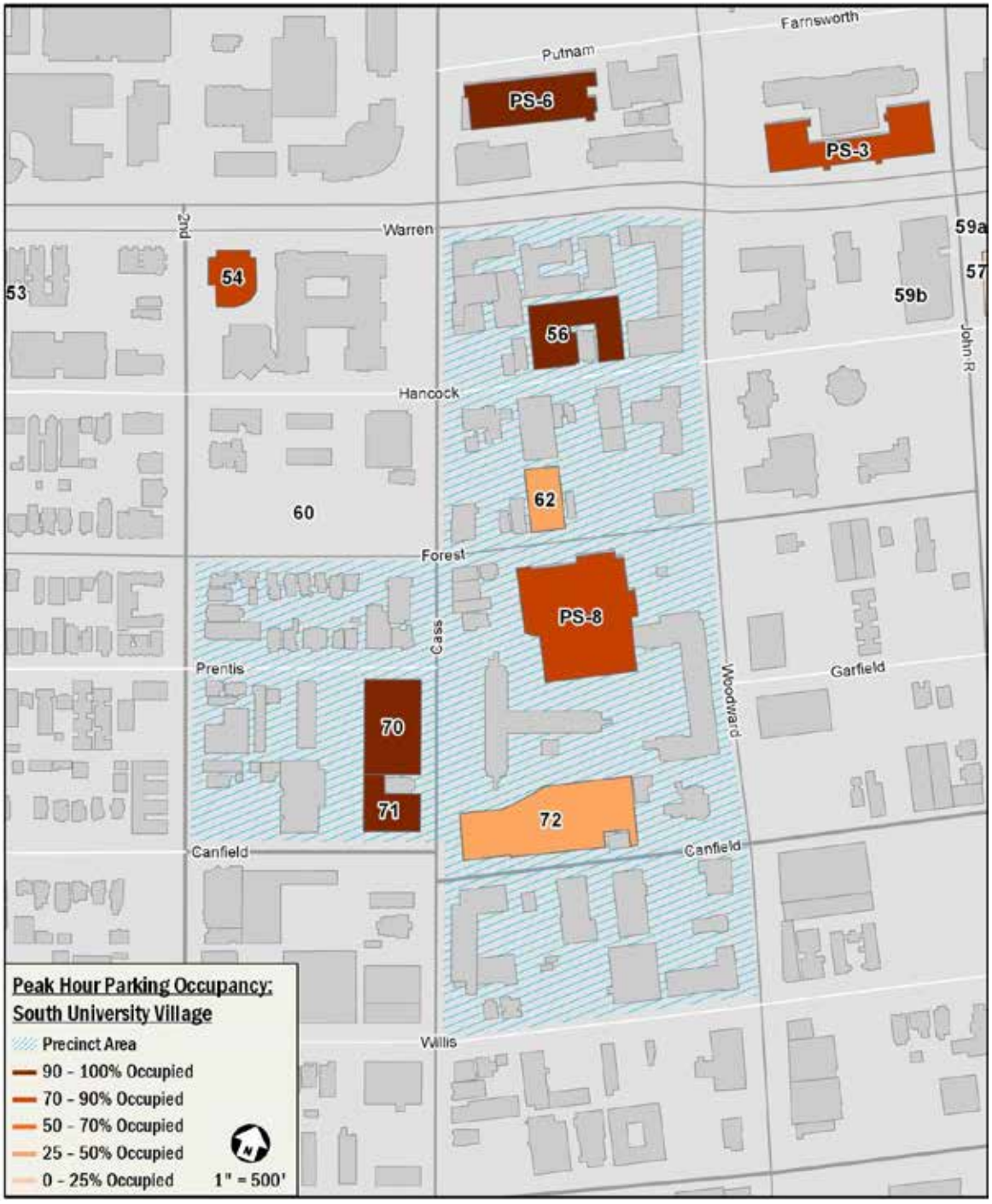


Figure 10: Peak Parking Occupancy, South University

PARKING OCCUPANCY BY USER TYPE

Parking occupancy by user type was determined through a combination of each facility's peak hour occupancy and WSU-provided parking permit sales data. The findings are summarized in Figure 11.

First, permit sales data was used to create a user type profile of each parking facility. Because most active WSU permits are linked to a certain parking facility, and because the sales data provides user breakdowns of each permit type, it was possible to apportion each facility's peak hour demand to students, faculty/staff/affiliate members, and others according to the user makeup of the facility's linked active permits.

Second, the permit-based user type profiles of each facility were combined to create precinct- and campus-level user type profiles.

Lastly, the profiles were adjusted per an assumption that the number of permits in a user category didn't correlate precisely with the number of individuals of that category parked on campus. For example, it was assumed that most on-campus student permit-holders had their vehicle parked on campus at the time of observations, while not as many off-campus permit-holders did. Similar adjustments were made for full-time and part-time faculty and staff.

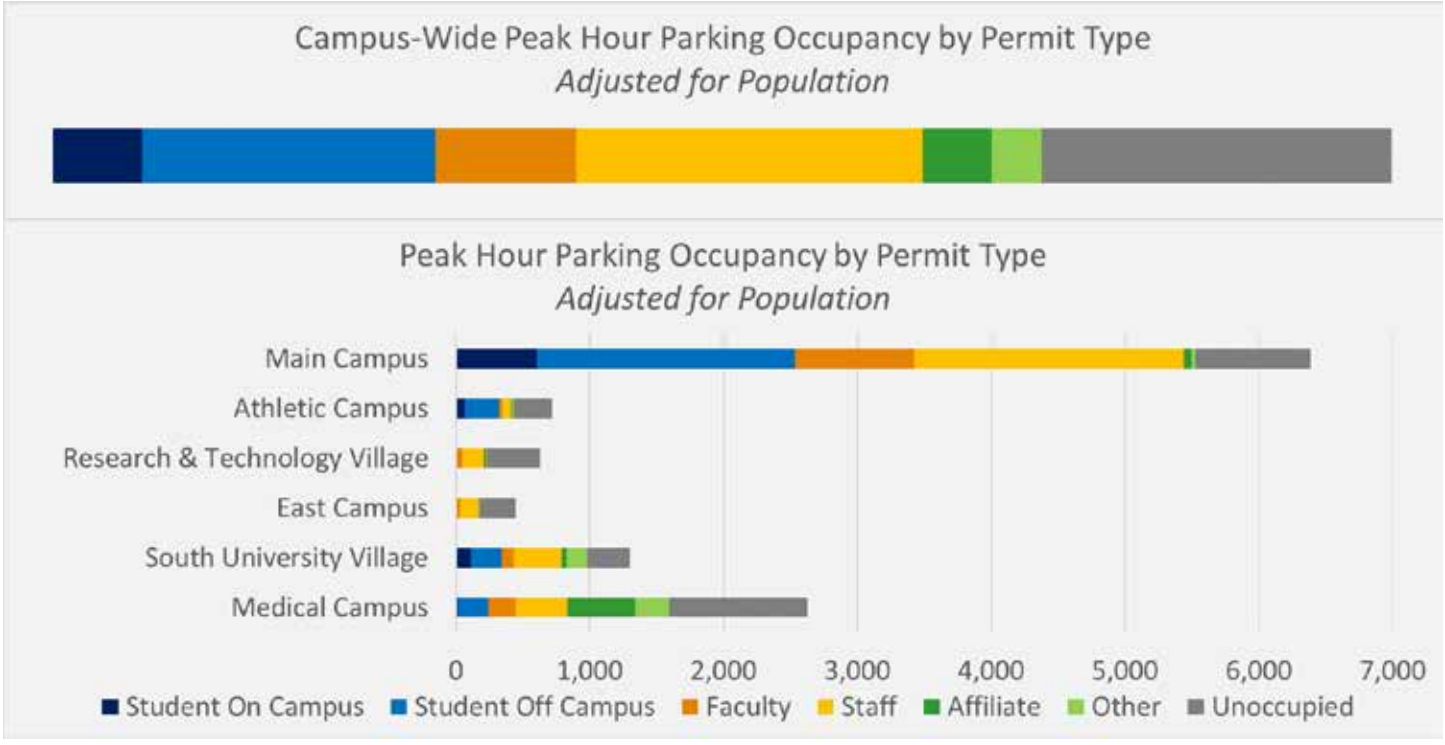


Figure 11: Parking Occupancy by User Type

PARKING FINDINGS

The analysis produced the following conclusions:

- As expected, based on observations and conversations with students, faculty, and staff, parking occupancy peaks in the middle of the day. However, most facilities still have spaces to spare at the peak hour, especially on the periphery of campus.
- Commuting students comprise 30% of peak parking demand on the overall campus, and 35% in the Main Campus precinct where demand is highest.
- Employees comprise 56% of peak parking demand on the overall campus, and 55% in the Main Campus precinct where demand is highest.
- Student-based demand is 0.31 spaces per on-campus students and 0.15 spaces per off-campus student.

MASTER PLAN IMPLICATIONS

The parking analysis informs the following observations regarding the master plan:

- The excess parking supply can accommodate slight decreases in supply and/or increases in demand.
- Substantial increases in campus population and/or removing surface parking lots will likely lead to supply not meeting demand. This can be solved either by increasing supply or reducing demand.
- Non-auto incentives for faculty and staff could yield lower parking demand, but results would likely be marginal due to the high convenience of driving by automobile.
- More substantial decreases in parking demand could be achieved through parking disincentives, such as not allowing freshman to park in the middle of campus (or freshman living on-campus to park at all), and/or increasing parking pricing.
- A large percentage of parking spaces are in the main campus. It would benefit WSU to not increase the number of parking spaces in the middle of campus, but rather add to the periphery. This would help avoid creating future traffic congestion spots in the middle campus, and provide a higher percentage supply in the periphery, which makes it easier to create a tiered pricing structure.

TRAFFIC

This section reviews the overall existing traffic operations surrounding WSU. Turning movement counts were obtained during AM and PM peak commuting hours (6:30-9:30 AM and 4:00-7:00 PM). The morning and evening peak hours for the system were determined to be 7:45-8:45 AM and 4:45-5:45 PM respectively. Using the peak hour traffic volumes, models were created using Synchro 9.2 software. Overall congestion within the study area was found to be relatively light for an urban university setting.

TRAFFIC MODEL

The traffic model was developed using industry standard software and the Highway Capacity Manual, 2000 (HCM 2000). As part of HCM 2000 methodology, intersection delays are expressed in Level of Service (LOS). LOS is a letter-grade traffic engineers assign to intersections that represent levels of delay drivers encounter. LOS E represents an intersection at capacity and is generally used as a threshold for what is acceptable in an urban setting. To obtain the most accurate LOS results at all the study area intersections, signal timings were provided by the City of Detroit and the Michigan Department of Transportation. The traffic model of existing conditions was used to identify any existing areas of concern and test potential mitigations.

TRAFFIC COUNTS

The traffic model was developed using industry standard software and the Highway Capacity Manual, 2000 (HCM 2000). As part of HCM 2000 methodology, intersection delays are expressed in Level of Service (LOS). LOS is a letter-grade traffic engineers assign to intersections that represent levels of delay drivers encounter. LOS E represents an intersection at capacity and is generally used as a threshold for what is acceptable in an urban setting. To obtain the most accurate LOS results at all the study area intersections, signal timings were provided by the City of Detroit and the Michigan Department of Transportation. The traffic model of existing conditions was used to identify any existing areas of concern and test potential mitigations.

TRAFFIC MODEL RESULTS

The existing morning and afternoon peak hour traffic model results are shown in Figure 13 and Figure 14 respectively. All intersections in the morning and afternoon perform at LOS D or better, meaning no real concern was observed at any of the study area intersections for existing conditions.

With all the study area intersections performing at a LOS D or better, further analysis was performed to compare the Average Annual Daily Traffic (AADT) on each roadway link to the number of lanes on each link. This analysis revealed that many links in the study area have more travel lanes than needed, meaning most roadways have excess capacity. The roadways with excess capacity (for existing volumes) on campus include northbound 3rd Avenue/Anthony Wayne Drive and Palmer Avenue. The results of this analysis are shown in Table 1 and a graphical representation shown on Figure 15.

ROUTING TO PARKING FACILITIES

The major streets surrounding WSU campus, including Warren Avenue, 3rd Avenue/Anthony Wayne Drive, and Cass Avenue, provide primary access to most parking facilities throughout campus. The routing to the major parking facilities are shown on Figure 16.

TRAFFIC FINDINGS

Overall traffic congestion and delay on and near campus is relatively light for an urban university setting. The overall low delay at the study area intersections could be due, in part, to the closure of the 3rd Street overpass, resulting in rerouting traffic away from campus roads.

There are opportunities to create more multi-modal and context appropriate roadways adjacent to, and within, campus without significantly impacting traffic congestion.

MASTER PLAN IMPLICATIONS

Any major moves, like relocating the Medical Campus would be feasible given existing excess roadway capacity in most areas to accommodate associated parking.

Roadways within campus are eligible to become more pedestrian friendly given excess capacity on most roadways within the study area. This could include providing room for bike lanes, wider sidewalks, shorter crosswalks, and other features.

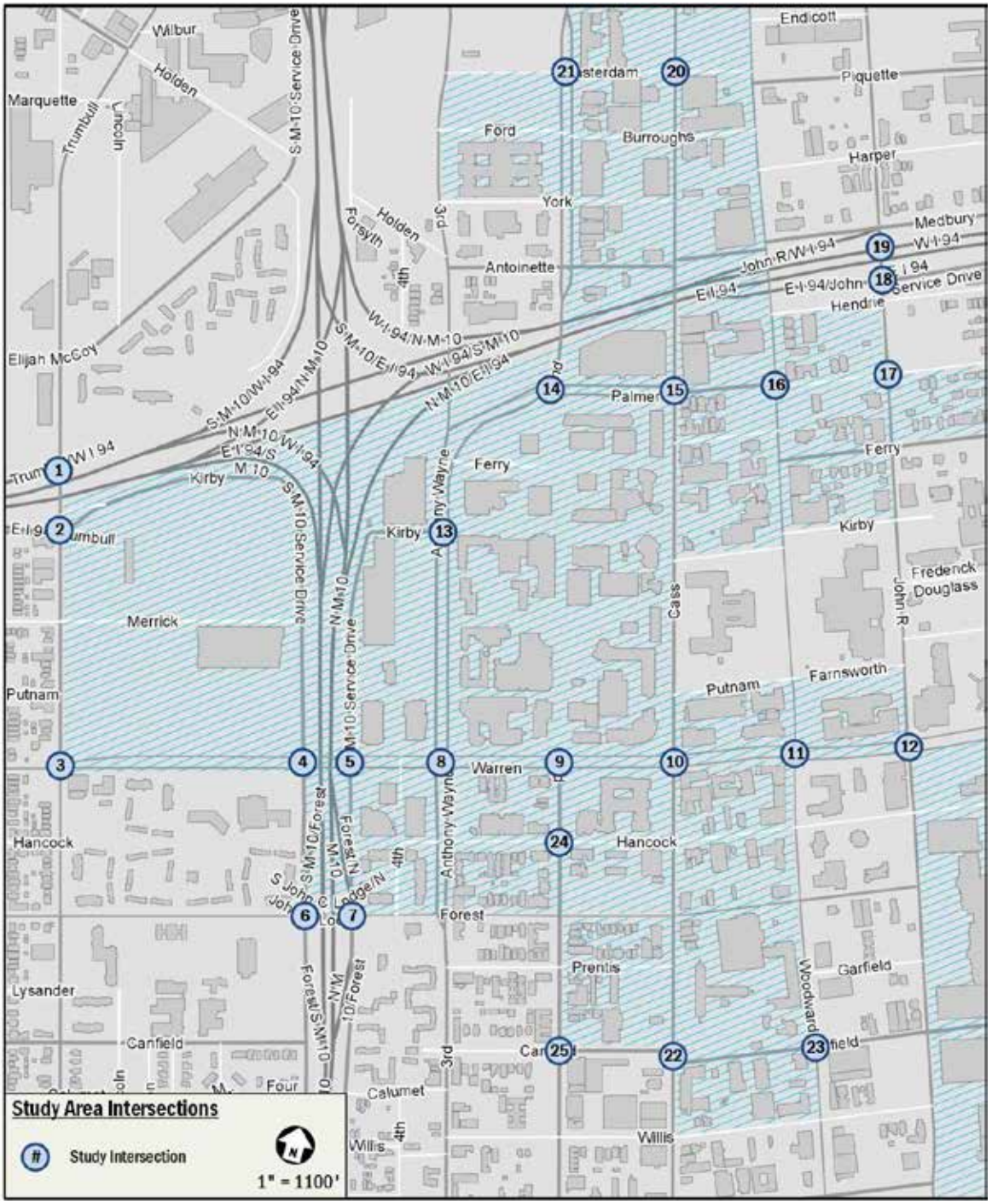


Figure 12: Study Area Intersections

Figure 13: Morning Level of Service

Figure 14: Afternoon Level of Service

Roadway Segment	Between			Travel Lanes	AADT	AADT per Lane	Excess Capacity?*
SB 2nd Ave	I-94	&	Baltimore St	1	5700	5700	No
Trumbull St	Warren Ave	&	Edsel Ford Service Dr	2	11200	5600	No
Cass Ave	MLK Jr Blvd	&	Warren Ave	2	10640	5320	No
Cass Ave	Forest Ave	&	W Warren Ave	2	10400	5200	No
Wooodward Ave	Forest Ave	&	Warren Ave	6	30700	5117	No
Woodward Ave	Canfield St	&	Forest Ave	6	28700	4783	No
NB 2nd Ave	I-94	&	Baltimore St	1	4700	4700	No
SB 3rd Ave/Anthony Wayne Dr	Kirby St	&	W Warren Ave	2	8480	4240	No
Cass Ave	W Warren Ave	&	Palmer St	2	8200	4100	No
W Warren Ave	Anthony Wayne Dr	&	J C Lodge Dr	6	21980	3663	Yes
Woodward Ave	I-94	&	Warren Ave	6	20800	3467	Yes
WB Warren Ave	Trumbull St	&	J C Lodge Dr	3	10400	3467	Yes
Cass Ave	Canfield St	&	Forest Ave	2	6900	3450	Yes
W Warren Ave	Cass Ave	&	Woodward Ave	6	20610	3435	Yes
W Warren Ave	2nd Ave	&	Cass Ave	6	19910	3318	Yes
W Palmer Ave	2nd Ave	&	Cass Ave	4	9600	2400	Yes
NB 3rd Ave/Anthony Wayne Dr	W Warren Ave	&	Kirby St	2	4320	2160	Yes
SB 3rd Ave	W Warren Ave	&	Forest Ave	2	4110	2055	Yes
John C Lodge Service Dr	W Warren Ave	&	Kirby St	3	5900	1967	Yes
John R St	I-94	&	Piquette St	3	5600	1867	Yes
2nd Ave	W Warren Ave	&	Hancock St	2	3600	1800	Yes
EB Warren Ave	Trumbull St	&	J C Lodge Dr	3	5400	1800	Yes
John R St	Warren Ave	&	Ferry St	3	4770	1590	Yes
Forest Ave	Trumbull St	&	J C Lodge Dr	4	5800	1450	Yes
John R St	Palmer St	&	I-94	3	3950	1317	Yes
John R St	Ferry St	&	Palmer St	3	3760	1253	Yes
Forest Ave	J C Lodge Dr	&	Anthony Wayne Dr	5	5500	1100	Yes
NB 3rd Ave	Forest Ave	&	W Warren Ave	3	2640	880	Yes

**AADT of 4,000 per travel lane means roadway segment may be candidate for road diet, pending additional analysis*

Table 1: AADT versus Number of Lanes

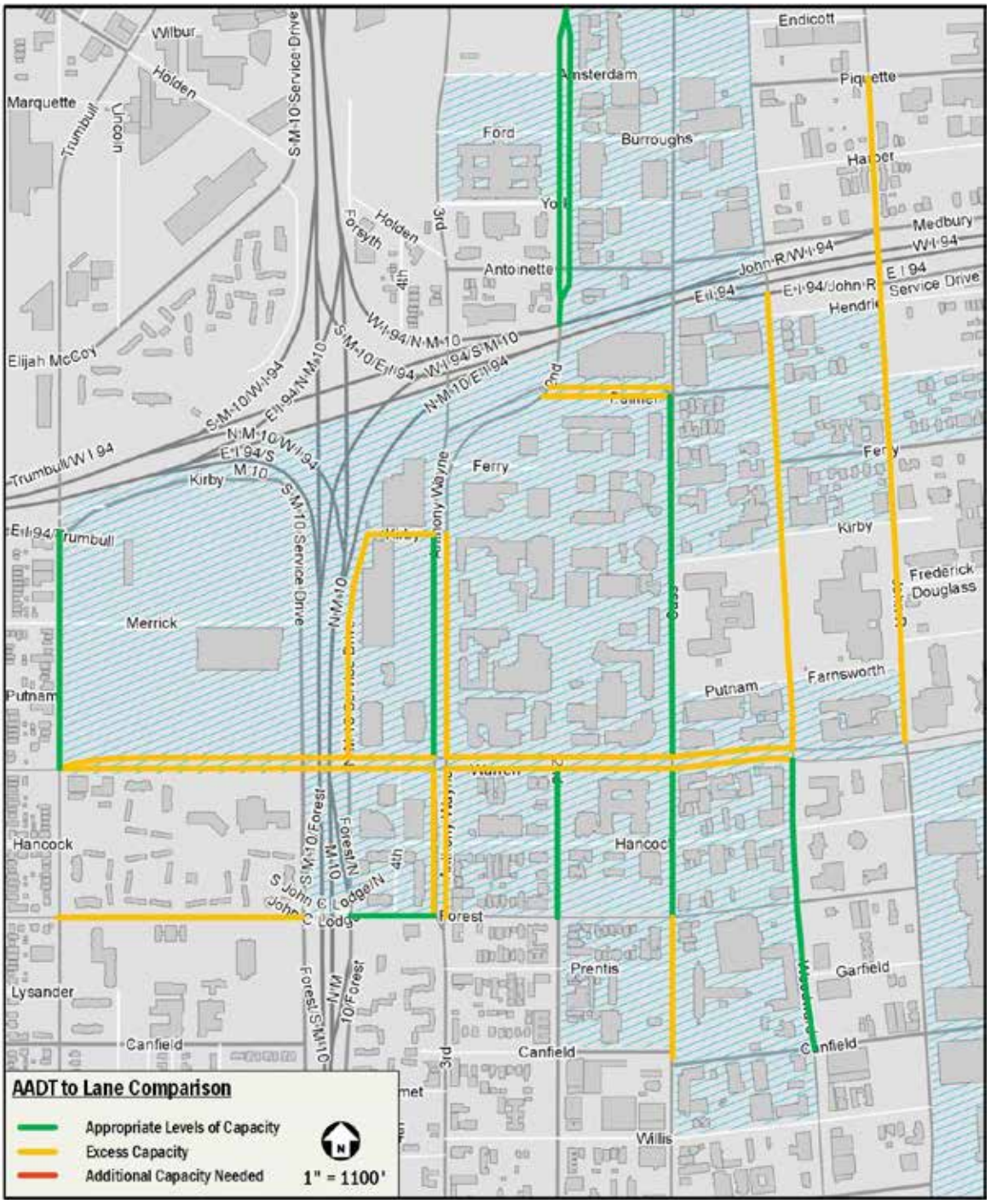


Figure 15: AADT to Lane Comparison

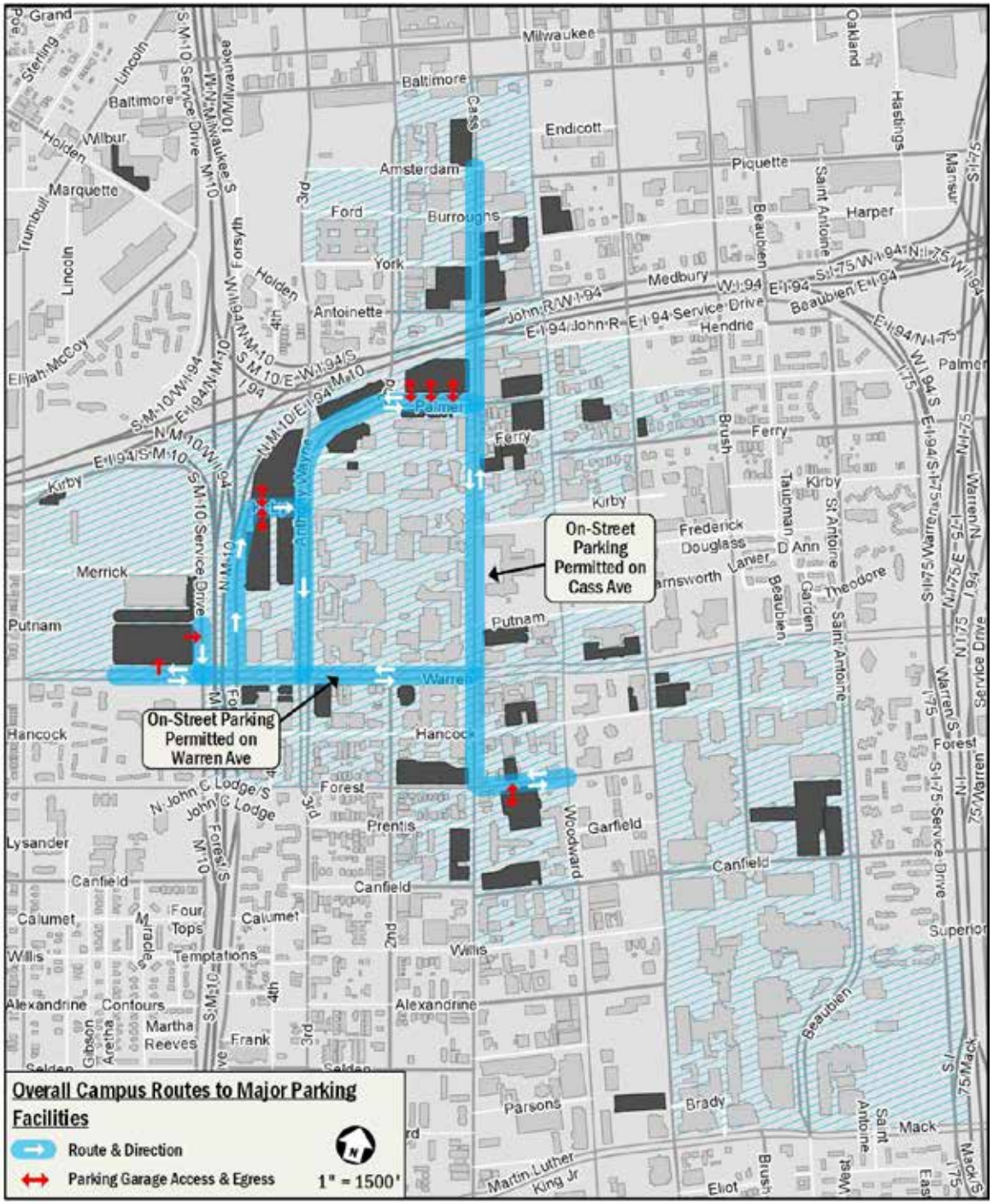


Figure 16: Routing to Major Parking Facilities

NON-AUTO FACILITIES

This section reviews the overall pedestrian facilities, pedestrian comfort, pedestrian crossings, pedestrian and bicycle involved crashes, bicycle facilities, and transit facilities. Existing non-auto safety issues were identified in the study area but there is, overall, sufficient non-auto connectivity on, and surrounding, campus

PEDESTRIAN FACILITIES

To most efficiently review pedestrian facilities surrounding WSU, a sidewalk/buffer comfort map was created. This involved exploring the presence of a sidewalk, the width of the sidewalk, and the presence of a buffer between sidewalks and the street. For this analysis, a roadway was considered comfortable if it had sidewalks on both sides of the street with separation between pedestrians and cars. Most roadways surrounding campus have a comfortable walking environment. Roadways with narrow sidewalks or no separation were ranked as less comfortable. The overall campus pedestrian comfort is shown on Figure 17.

Pedestrian crossings were evaluated at signalized intersections where signal timings were obtained from the City of Detroit and Michigan Department of Transportation. Using the obtained signal timings, the walk/don't walk times were used to determine whether a pedestrian has sufficient time to cross the intersection. It was found that many intersections don't provide sufficient walk time and require pedestrians to wait in a median refuge for another signal cycle. This type of signal timing is usually reserved for suburban/rural locations with minimal pedestrian activity. Additionally, long unsignalized crosswalks exist due to wide roads. The existing crossing conditions are shown on Figure 18.

Utilizing crash data from 2015-2017, pedestrian crashes on and near campus were mapped as shown on Figure 19. As observed, pedestrian crashes are highest along Warren Avenue and Cass Avenue (this data is from a period before the recent changes to Cass Avenue).

BICYCLE FACILITIES

Several north-south bicycle links exist through campus, but a lack of east-west facilities was observed. East of Cass Avenue, no bicycle lanes exist. Bicycle crashes were mapped using data from 2015-2017. It was found that bicycle crashes occur less frequently on or near campus with the exception of Cass Avenue. This data was obtained before Cass Avenue was installed with bicycle lanes. A map of existing bicycle lanes and crashes is shown on Figure 20.

TRANSIT FACILITIES

There are multiple campus shuttle routes along with transit routes that serve the campus and surrounding areas. The three (3) campus shuttle routes are designed for coverage and not frequency or speed. One shuttle provides 20-minute intervals while the remaining two provide 30-minute intervals. The shuttle routes are shown on Figure 21.

DDOT, SMART, and QLine routes serve campus and the surrounding areas. Cass Avenue, adjacent to the main campus has a high concentration of bus stops. The DDOT and SMART routes near campus are shown on Figure 22 and Figure 23. QLine is a streetcar operating along Woodward Avenue with the route shown on Figure 24. Transit routes adjacent to campus are shown in Table 2.

NON-AUTO FINDINGS

There is significant pedestrian, bicycle, and transit connectivity on or adjacent to campus. The difference in convenience and price between non-auto modes and automobiles is likely why people are not switching to non-auto modes of transportation.

A significant pedestrian safety issue was observed crossing Warren Avenue along with perceived safety issues in walking outside of campus.

MASTER PLAN IMPLICATIONS

The master plan should seek to address some of the pedestrian safety concerns, including crossing Warren Avenue. The presence of multiple non-auto modes of transportation means that policy/culture changes are needed to promote travel behaviors near campus. Pedestrian desire lines should be understood in the master plan options.

The campus shuttle needs definition in how it serves campus and what ridership it should primarily serve.

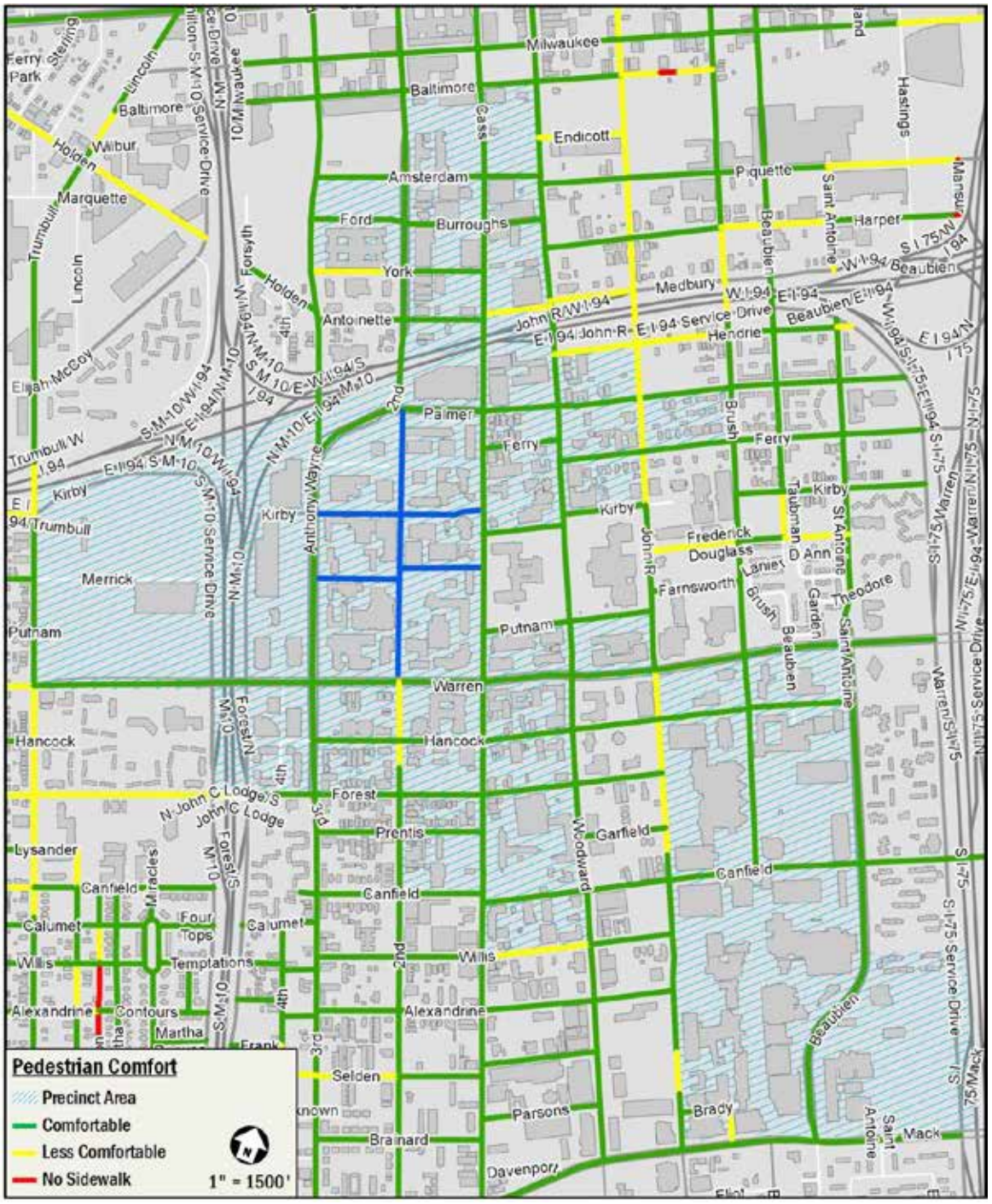


Figure 17: Pedestrian Comfort

Figure 18: Existing Crossing Conditions

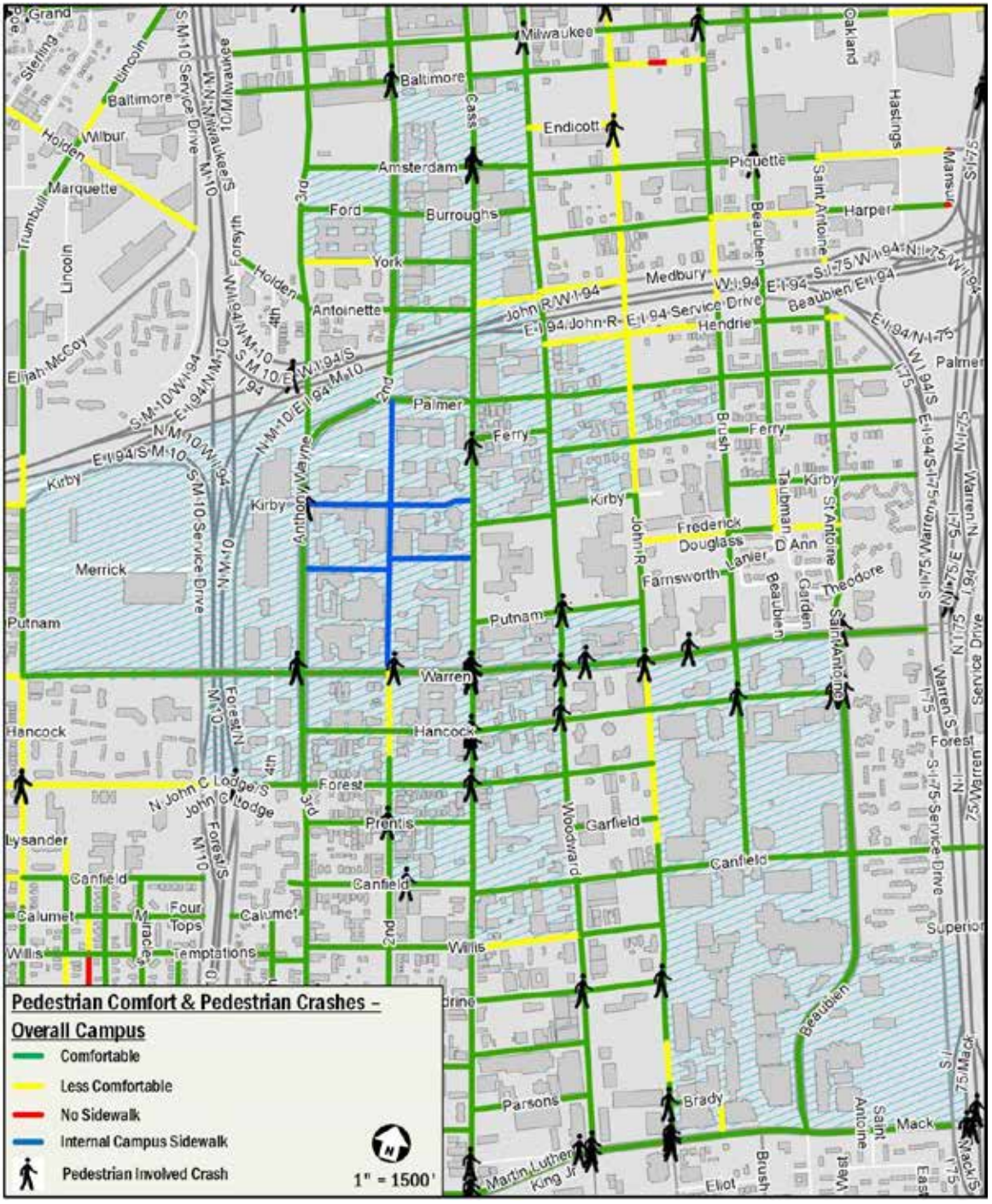


Figure 19: Pedestrian Comfort and Pedestrian Crashes

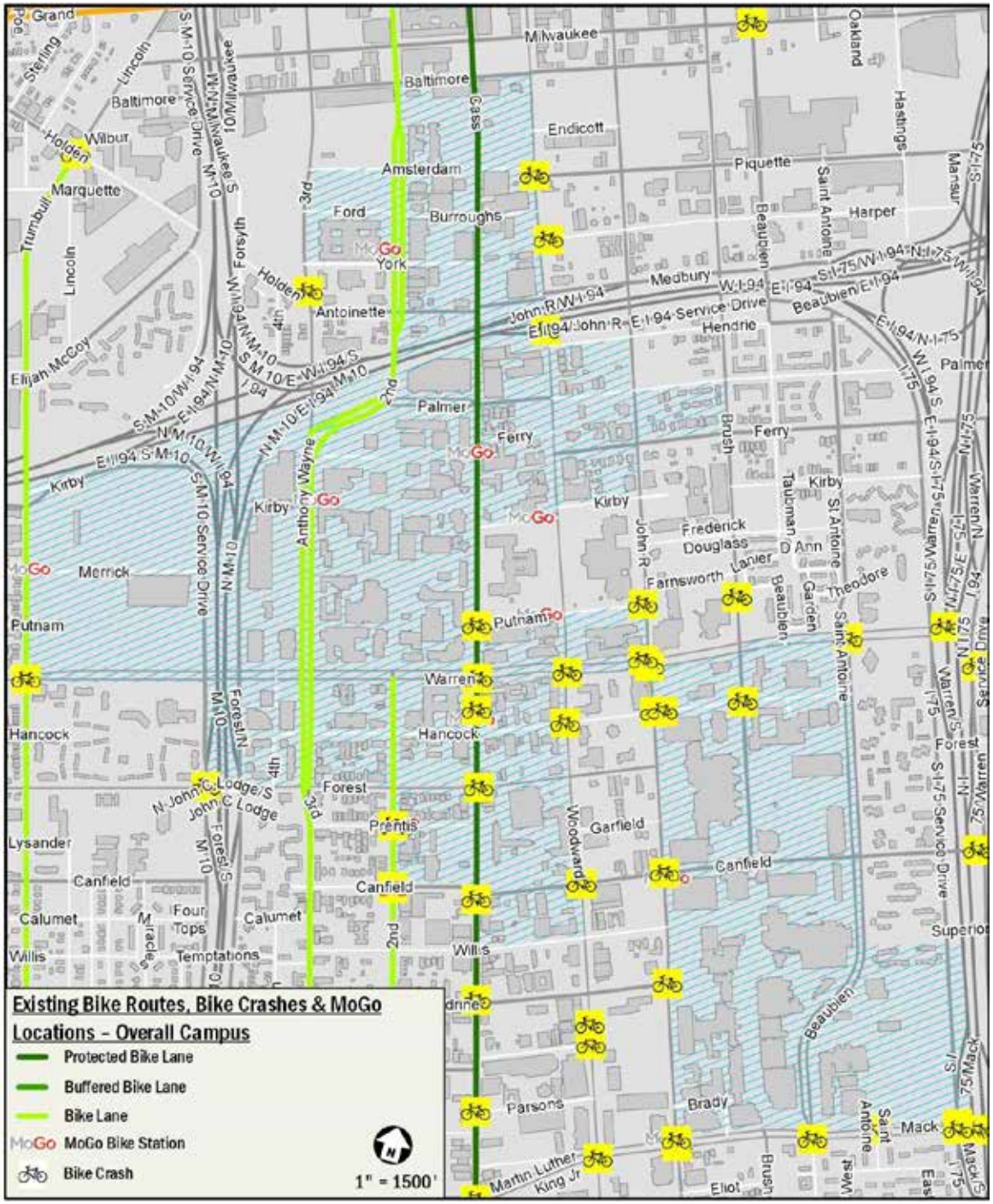


Figure 20: Bicycle Facilities and Bicycle Involved Crashes

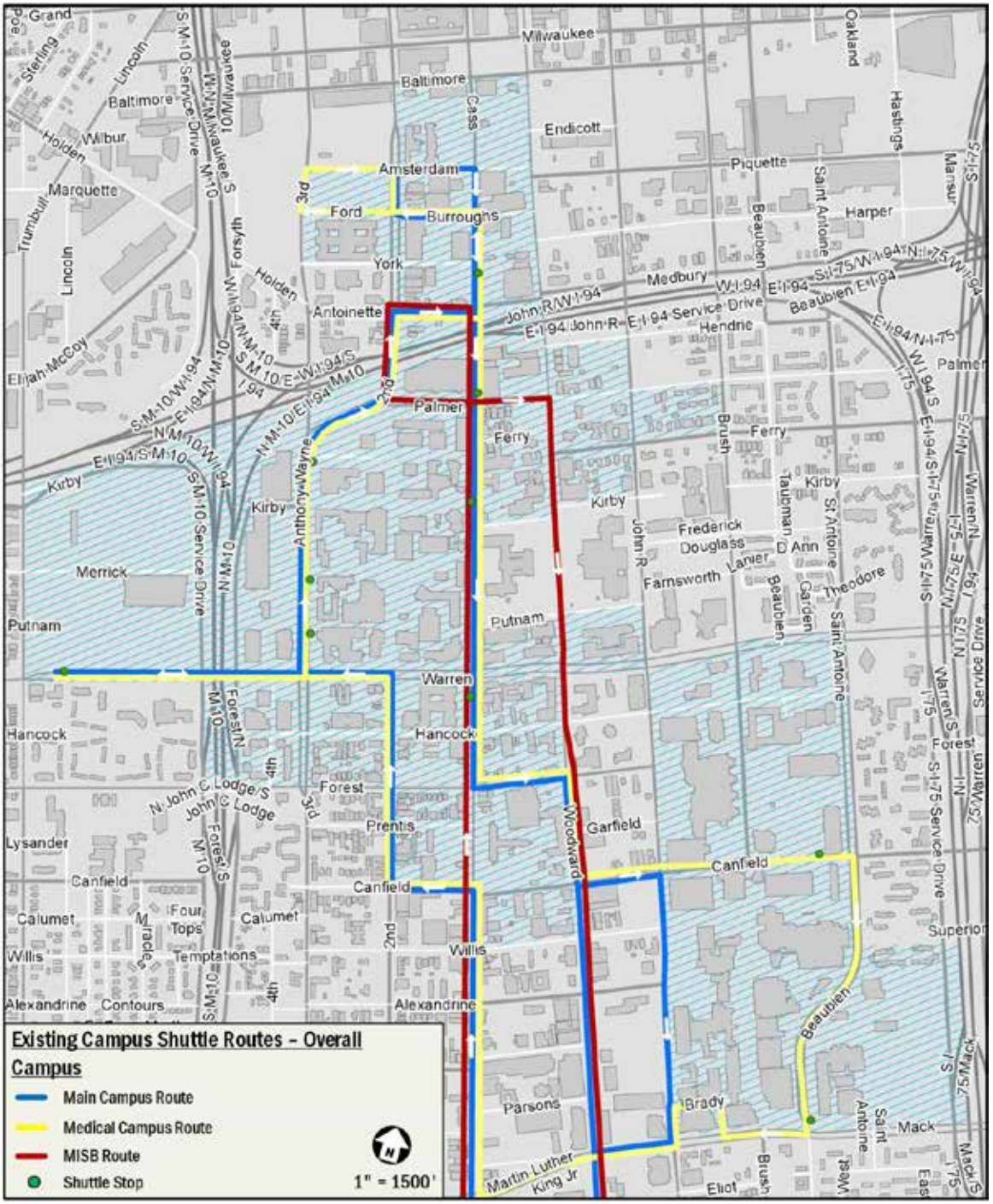


Figure 21: Existing Campus Shuttle Routes

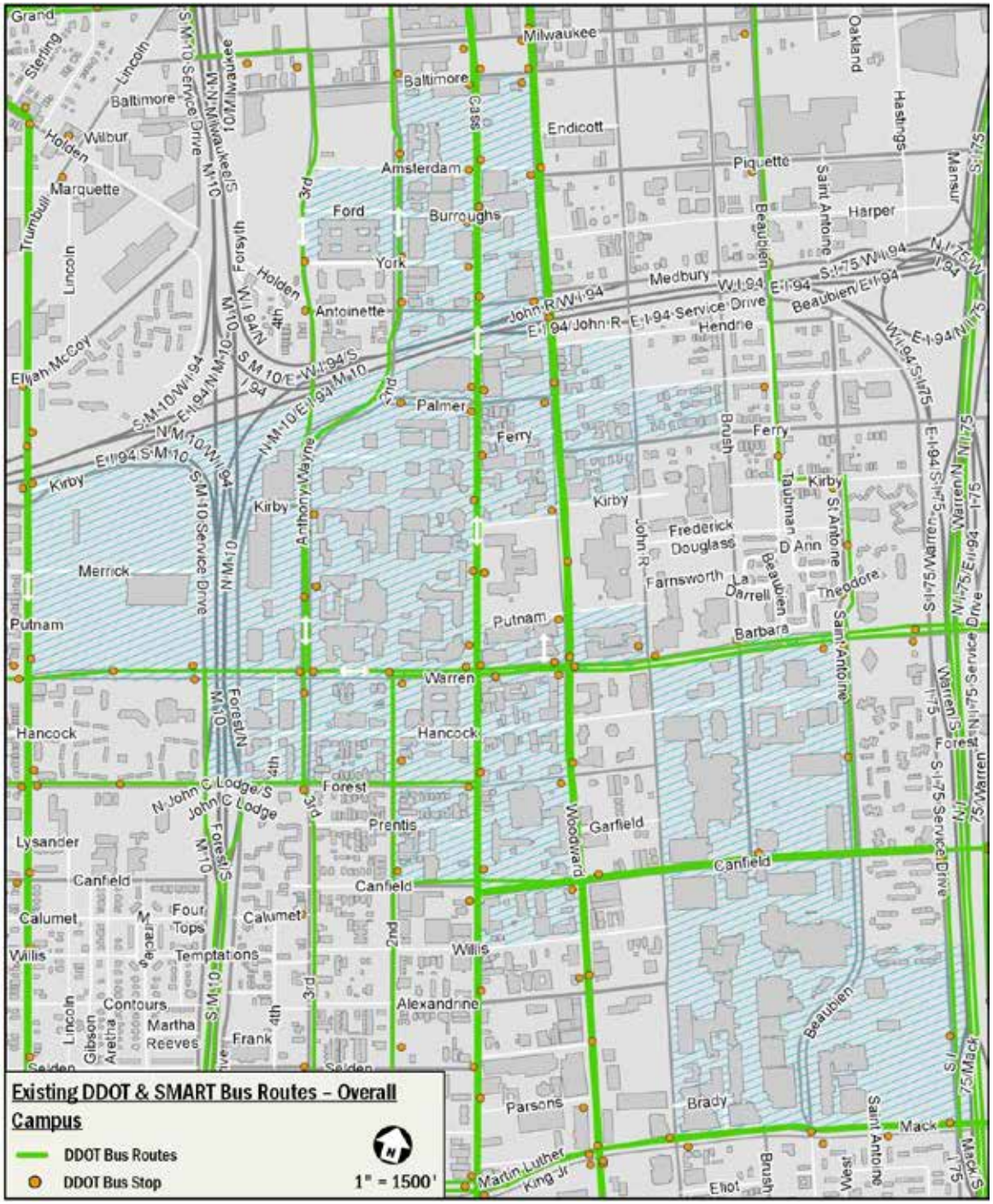


Figure 22: Existing DDOT SMART Bus Routes

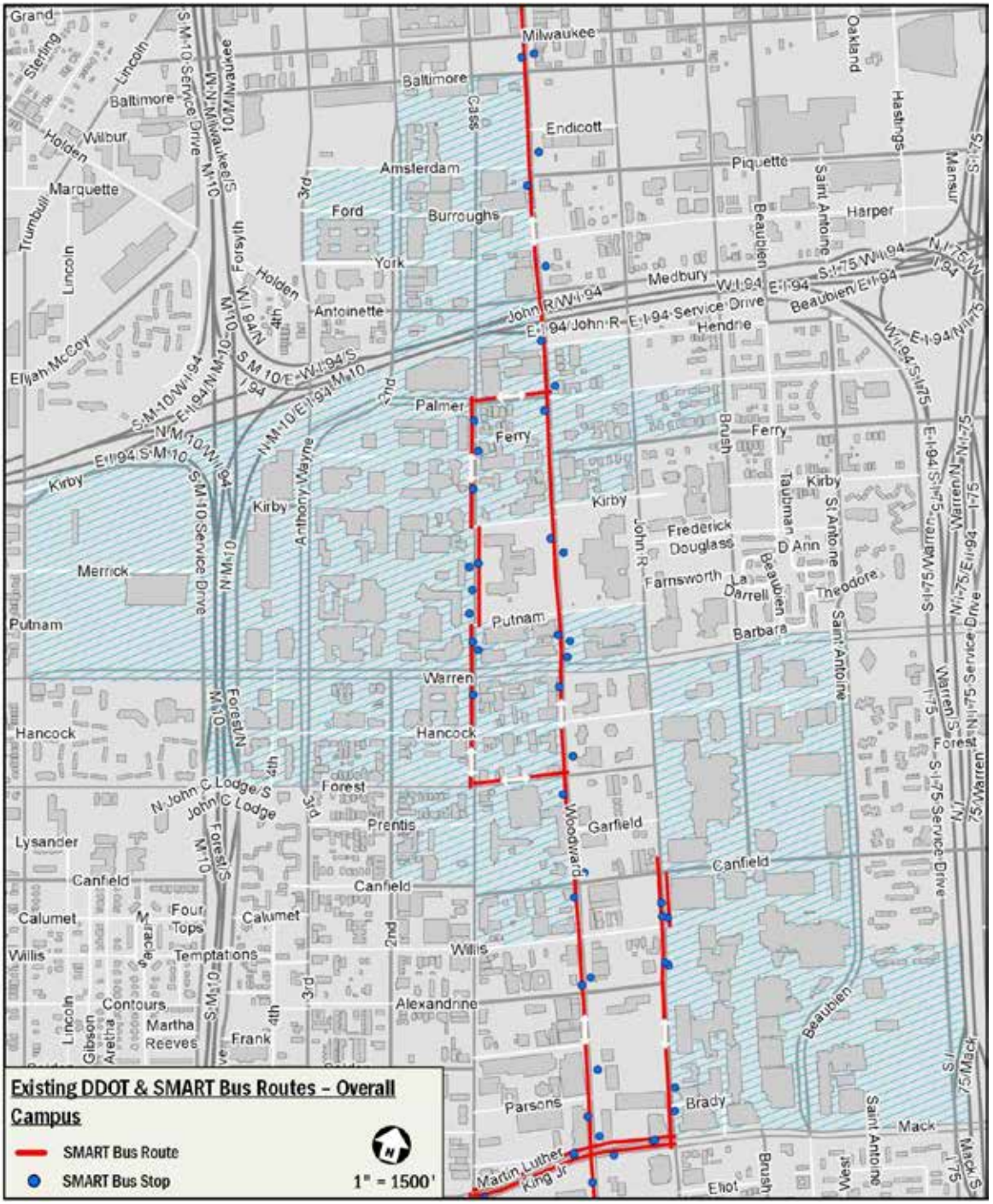


Figure 21: Existing Campus Shuttle Routes

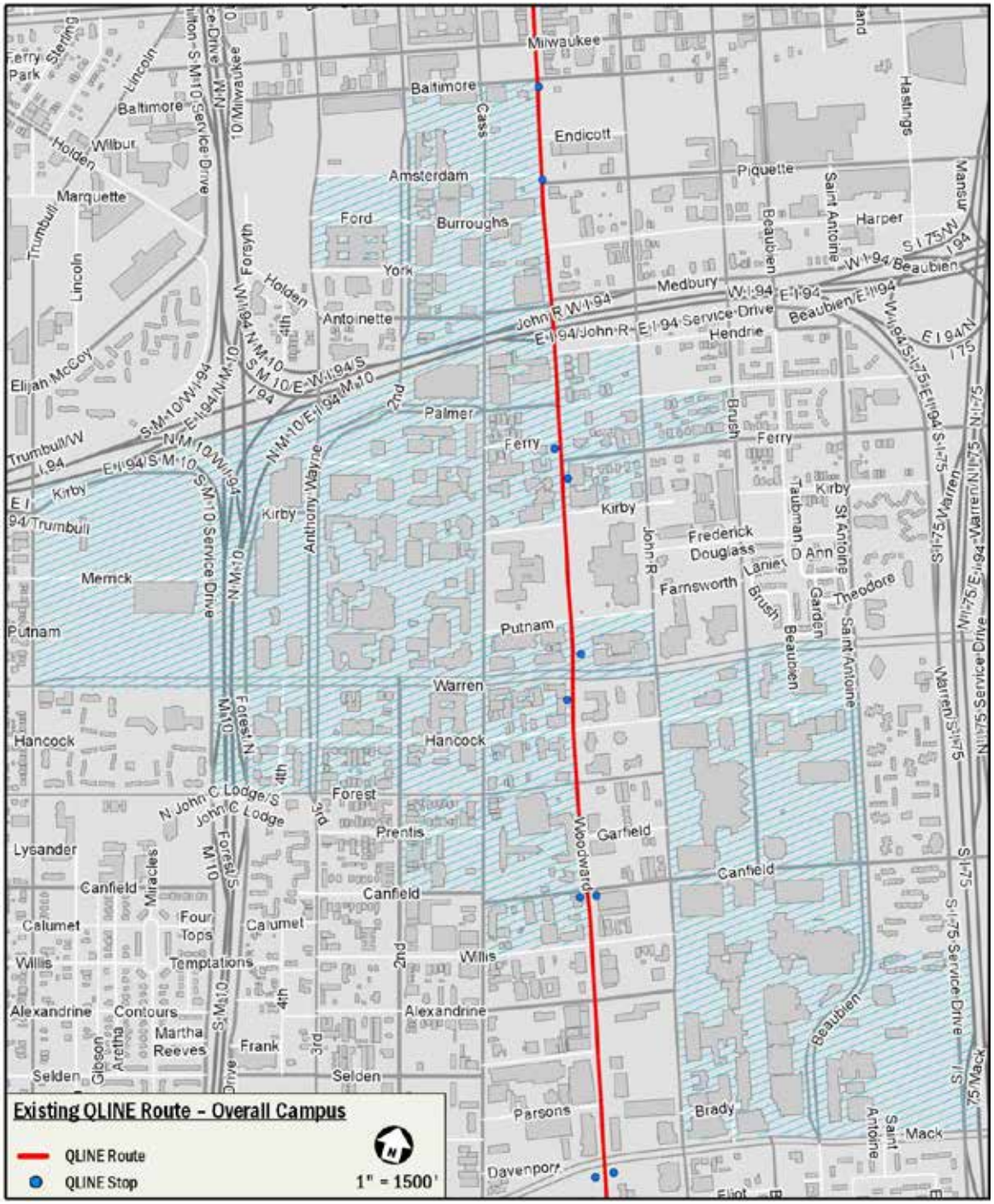


Figure 22: Existing DDOT SMART Bus Routes

Route Number	Route Name	Service Hours		Headway
8	Warren Line	Weekdays	24 hours	20 - 60 min
		Weekend	24 hours	40 - 60 min
16	Dexter Line	Weekdays	24 hours	12 - 60 min
		Weekend	24 hours	30 - 60 min
23	Hamilton/John R Line	Weekdays	5:55 am - 11:14 pm	40 - 60 min
		Weekend	7:10 am - 9:10 pm	60 min
42	Mid-City Loop	Weekdays	5:46 am - 8:43 pm	25 - 60 min
		Weekend	7:44 am - 6:44 pm	60 min
80	Villages Direct Line	Weekdays	Westbound: 6:05 am - 9:59 am Eastbound: 3:05 pm - 7:56 pm	30 - 35 min
89	Southwest Direct Line	Weekdays	Northbound: 6:08 am - 10:07 am Southbound: 2:56 pm - 7:52 pm	40 min
SMART 610	Kercheval-Harper Line	Weekdays	Northbound: 6:05 am - 8:37 am & 3:25 pm - 6:10 pm Southbound : 6:22 am - 9:06 am & 3:06 pm - 6:27 pm	40 min
QLINE	Woodward Avenue	Mon - Thur	6:00 am - 12:00 am	15 - 25 min
		Friday	6:00 am - 2:00 am	15 - 25 min
		Saturday	8:00 am - 2:00 am	15 - 25 min
		Sunday	8:00 am - 11:00 pm	15 - 25 min

Table 2: DDOT, SMART, and QLINE Routes

CRASH & SAFETY

This section reviews the overall crash analysis findings from the most recent three (3) years of crash data obtained from 2015-2017. Crash rates on and surrounding WSU were reviewed finding that multiple intersections on and near campus exhibited high crash rates, especially within a university setting.

CRASH DATA ANALYSIS

The crash data obtained was used to create a crash density map shown on Figure 25. This map shows a high density of crashes on Warren Avenue. With the exception of the higher observed crashes on Warren Avenue, no other significant crash patterns were observed on or surrounding campus.

Combining crash data with available traffic volume data helps discern patterns by determining crash rates at an intersection (the number of crashes per vehicles that enters the intersection). This yields a crash rate per Million Entering Vehicles (MEV). A crash rate per MEV exceeding 1 is considered an elevated rate. This does not mean that that a problem exists but that the intersection should be further evaluated. As reported in Table 3, 16 study area intersections have a crash rate exceeding 1 crash per MEV. This includes intersections on or adjacent to campus. The crash rates represented in Table 3 are also shown on Figure 26. The larger the circle, the higher the crash rate. As shown in Table 3 and Figure 26, Warren Avenue, Anthony Wayne Drive/3rd Avenue, and 2nd Avenue show a pattern of elevated crash rates.

CRASH ANALYSIS FINDINGS

In general, crash rates in the study area are elevated at a majority of study area intersections. The observed high crash rate can be due to wide streets and improperly timed pedestrian crossings, especially along Warren Avenue. Additionally, Anthony Wayne Drive/3rd Avenue and Palmer Avenue are very wide for intra-campus streets and have elevated crash rates.

It has been observed that the intersection of Palmer Avenue and Anthony Wayne Drive/3rd Avenue causes confusion for drivers and pedestrians. Although a high crash rate was not observed at this intersection, it should be further evaluated.

MASTER PLAN IMPLICATIONS

The master plan should seek to address the safety of internal campus streets along with streets adjacent to campus, most notably Warren Avenue. The master plan should also seek to address major changes to vehicular and pedestrian crossing patterns that will result from changes made to internal and adjacent roadways. The proper design of all transportation facilities will be crucial in ensuring unsafe conditions are avoided. To assist in the design of transportation facilities, placemaking or gateways could be used to create a sense of place and alert drivers that they are near or within a college campus.

Figure 25: Crash Density (2015-2017)

Intersection	Total Crashes	Ped Crashes	Bike Crashes	Rate per MEV*
2nd Avenue & Hancock Street	17	0	0	3.67
Warren Avenue & Anthony Wayne Drive	90	2	0	3.52
Anthony Wayne Drive & Kirby Street	28	2	0	3.46
2nd Avenue & Canfield Street	12	0	2	2.85
Cass Avenue & Canfield Street	21	0	1	2.80
Warren Avenue & John R Street	71	2	2	2.68
Warren Avenue & Cass Avenue	57	7	1	2.26
John R Street & Palmer Street	18	0	0	2.19
Trumbull Avenue & Warren Avenue	36	0	2	1.93
Forest Avenue & John C Lodge Service Drive	38	1	0	1.62
Warren Avenue & Woodward Avenue	65	1	1	1.61
Forest Avenue & John C Lodge Service Drive	25	0	1	1.60
2nd Avenue & Amsterdam Street	9	0	0	1.45
Cass Avenue & Palmer Street	16	0	0	1.43
Woodward Avenue & Canfield Street	27	0	2	1.06
Cass Avenue & Amsterdam Street	6	2	0	1.05
Warren Avenue & John C Lodge Service Drive	12	0	0	0.65
John R Street & EB I-94 Off Ramp	5	0	0	0.59
Warren Avenue & 2nd Avenue	11	1	0	0.58
Trumbull Avenue & Edsel Ford Service Drive	6	0	0	0.56
Woodward Avenue & Palmer Street	16	0	0	0.55
2nd Avenue & Amsterdam Street	1	0	0	0.53
2nd Avenue & Palmer Street	4	0	0	0.53
Warren Avenue & John C Lodge Service Drive	12	0	0	0.51
Trumbull Avenue & I-94 Entrance	4	0	0	0.51
John R Street & Edsel Ford Service Road	5	0	0	0.48

** - Million Entering Vehicles; Volumes estimated based on turning movement count data*

Table 3: Crash Rate per Million Entering Vehicles

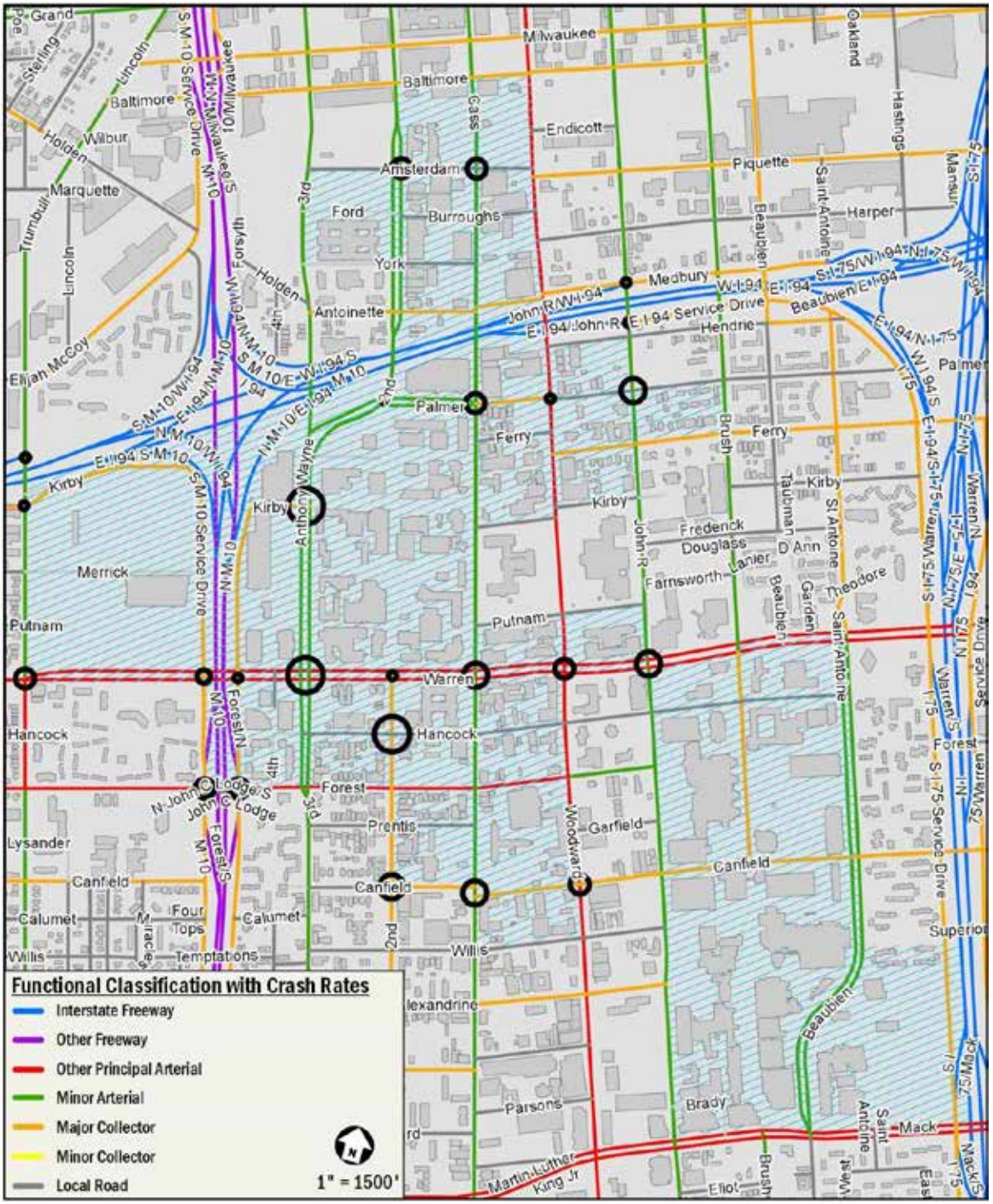


Figure 26: Study Intersection Crash Rates

STREET INTERVENTION IDEAS

ROAD DIET ALONG WARREN AVE

- Road diets narrow wide roadways with excess capacity, converting the excess width from vehicular travel lanes into multimodal corridors, effectively "right sizing" them
    - Road diets promote safety and multimodal uses by adding designated bicycle facilities, reducing crosswalk distances, and enhancing the overall pedestrian experience
- Road diets are common solutions to increase quality of other modes, where excess capacity exists on the vehicular network
- The design/operations of Warren Avenue is consistent with moving large numbers of vehicles across it, and not conducive to side street vehicular access, or pedestrian or bicycle traffic on it or crossing it. This may have been appropriate at one time, but it does not fit within an urban campus context

Does this work? Yes, throughout the corridor.

- Gorove/Slade tested recommendations in traffic model of commuting peak hours
- The road diet is not merely a narrowing of the road, but included a wholistic review of Warren Avenue operations (i.e. changes to signals were made that benefit bike lanes and pedestrian crossings)
- Signal optimization was performed at a planning level to maintain peak performance along the corridor

Existing geometry

Proposed geometry

Warren Avenue parking versus travel lane

Advantages

- Maintains current expectations of on-street parking along Warren Ave
- Provides additional buffer for bicycle lanes
- Opportunity to provide bulb-out, reducing pedestrian crossing distance

Drawback

- Either a reduction in capacity along Warren Ave (it replacing a travel lane), or a increase in additional roadway curb-to-curb

Warren Avenue road diet – trade offs

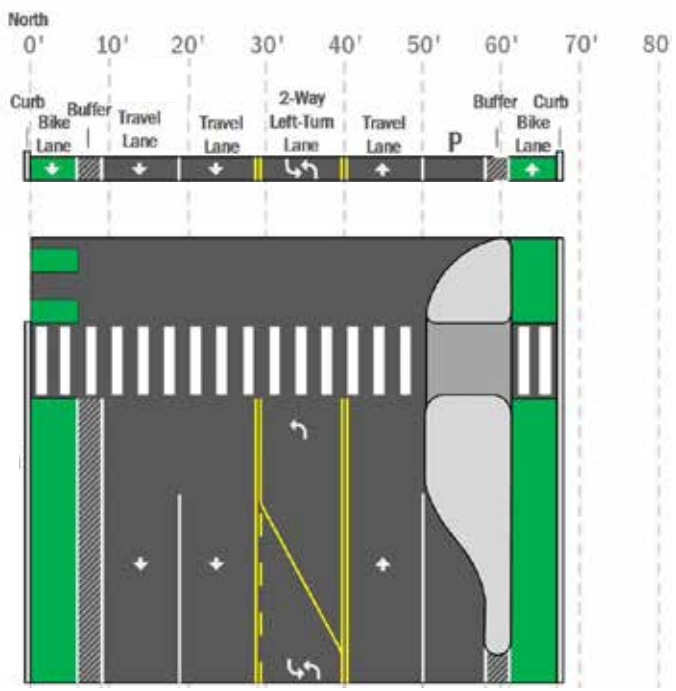
Advantages

- Reduction in ped crossing distance
    - Existing crossing distance: 110' with ~20 seconds of crossing time
    - Proposed crossing distance: 73' with ~20 seconds of crossing time
    - This means 1 stage crossing versus existing 2 stage crossing
- Additional space for development, amenities, pedestrian area, landscaping, etc.
- Additional bike infrastructure
- Protected turns

Drawback

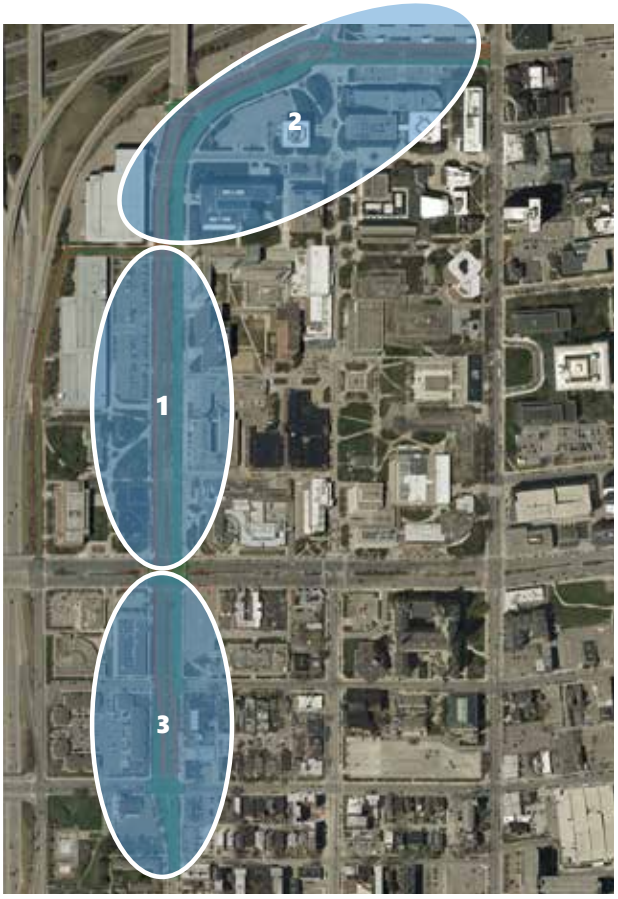
- Minimal increased corridor delay
- The increase in corridor delay along Warren Ave does not exceed industry levels for acceptable delay
- Preliminary results shows an increase in travel times of less than 25 seconds in both directions during the AM and PM peak periods
    - to/from John R St and Trumbull Ave (~1 mile)
    - assumes 2nd Ave closure

Conceptual W Warren Ave



ROAD DIET ALONG ANTHONY WAYNE DRIVE

- Anthony Wayne Dr, and Palmer Ave are very wide for intra-campus streets and have elevated crash rates
- The intersection of Anthony Wayne Dr and Palmer Avenue is very confusing (Gorove/Slade observed multiple cars going the wrong way)
- Road diet and realignment is recommended:
    - Expand the main campus core
    - Provide bike lanes along the corridor
    - Shorter pedestrian crossings
    - Standardizing intersection of Palmer Ave and 2nd Ave
    - Expand campus spine



The traffic needs of this corridor fall into three distinct areas.

1. Anthony Wayne Dr from Kirby St to Warren Ave and John C Lodge from Anthony Wayne Dr to Warren Ave
2. Palmer Ave/Anthony Wayne Dr from Cass Ave to Kirby St
3. Anthony Wayne Dr from Warren Ave to Forest Ave

Roadway idea - area 1

Works as proposed

- Higher volume segment, especially SB during the afternoon

Needs

- Two southbound lanes to handle afternoon exiting traffic.
- Dedicated right turn lane SB on Anthony Wayne Dr at Warren

Thoughts

- HAWK signal could be upgraded to enable coordination with upstream and downstream signals

- Boulevard is possible as long as it is activated properly (see follow up slide for further thoughts)
- John C Lodge supplements/compliments lanes on Anthony Wayne Drive
- It is feasible to convert one of three lanes to SB
    - Analysis results show that delay does not increase to unacceptable levels
    - WB Kirby St can work with fewer lanes because of new options for drivers
    - Traffic models shows a need to maintain two NB lanes on John C Lodge

Advantages

- Reduction in ped crossing distance
    - Existing crossing distance: ~110' – 120' with ~20 seconds of crossing time
    - Proposed crossing distance: 53' with ~20 seconds of crossing time
- Additional space for development, amenities, pedestrian area, landscaping, extension of main campus, etc.
- Additional bike infrastructure

Drawbacks

- Increased corridor delay
    - The increase in delay along Anthony Wayne Dr does not exceed industry levels for acceptable delay
    - Preliminary results show increase in travel times by approximately 16 seconds in both directions during the AM peak hour.
    - Southbound travel times on Anthony Wayne Drive are expected to increase, but this is alleviated by new route via John C Lodge.

Area 1

Existing

Proposed

Roadway idea - area 2

Works as shown

- Relatively low volume segment

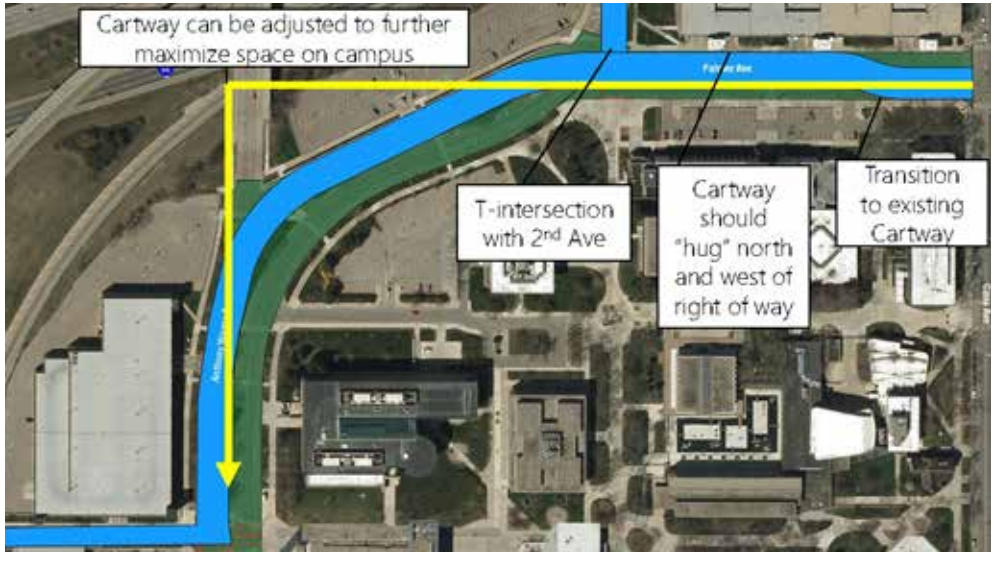
Needs

- One travel lane in each direction
- Bike lane

Wants

- Buffered bike lane
- On-Street parking
- Boulevard could be installed but doesn't make total sense given current mix of uses on either side of the street

Area 2
Existing



Proposed

Roadway idea - area 3

Works as shown

- Dependent on what happens in other areas especially with 2nd Ave

Needs

- One travel lane in each direction
- Bike lane
- With the closing of 2nd Ave we will need to take a closer look at potentially installing a left turn pocket from Anthony Wayne Dr to Hancock St

Wants

- Buffered bike lanes

Area 3

CLOSING OF 2ND AVENUE

Works as shown

- Closing 2nd Ave extends the ped friendly Gullen Mall in the heart of WSU
- The intersection of Warren Ave with 2nd Ave will maintain the existing crosswalks and the signal will add a ped phase to cross Warren Ave creating the opportunity for diagonal crossings seen in the example

The closing of 2nd Avenue

- The closing of 2nd Ave would require an alternative entrance to be built to access Lot 54
- The alley may need to be altered to accommodate trucks
- The fire lanes in the alley adjacent to Lot 54 would need to be reevaluated if vehicles will be accessing the lot from the alley

Advantages

- Provides a pedestrian friendly extension of the Gullen Mall
- Pedestrians will have the option to cross Warren Ave with an all pedestrian phase

Drawbacks

- The Lot 54 entrance will need to be relocated
- The alley around Lot 54 will need to be reevaluated as a fire lane by the marshal as well as ensure that trucks can still maneuver

CAMPUS SHUTTLE

Average Weekday Daily Ridership*

- 92 riders per day on Main Campus
  - 4 riders per trip
  - Bus 17% occupied
- 142 riders per day on Medical Campus
  - 5 riders per trip
  - Bus 22% occupied
- 467 riders per day on MISB Express
  - 9 riders per trip
  - Bus 38% occupied

Why is ridership low on the Main Campus and Medical Campus routes?

- They provide good campus coverage but don't run frequently enough to be very useful.
- They run in one-way loops, necessitating circuitous paths if destination is "the long way" around the loop.

Coverage vs. Ridership

- Shuttles currently serve the coverage goal at the expense of the ridership goal.
- Moving from *one-way, looped, low-frequency, coverage-oriented service* to *two-way, linear, high-frequency, ridership-oriented* service could make shuttles more useful.

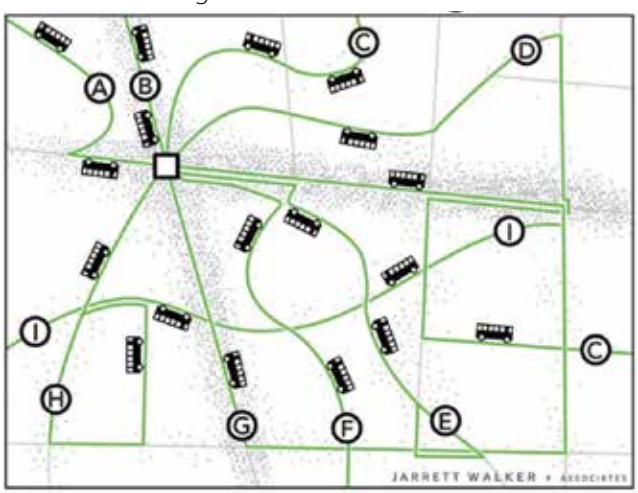
Lose

- Greater coverage of campus area
- One-seat rides between most destinations

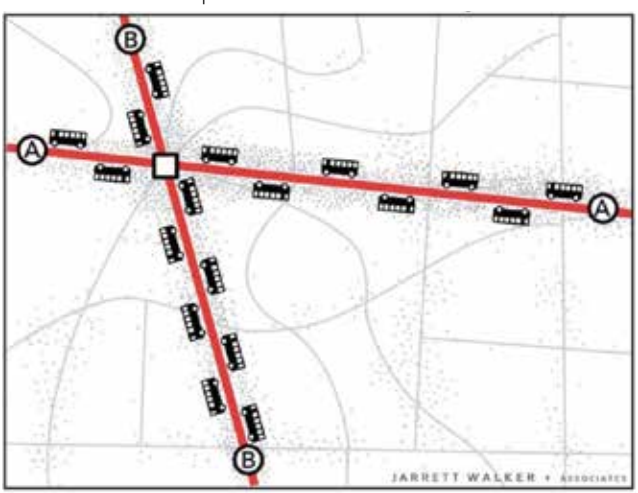
Gain

- Frequent, reliable service
- Direct, simple routes

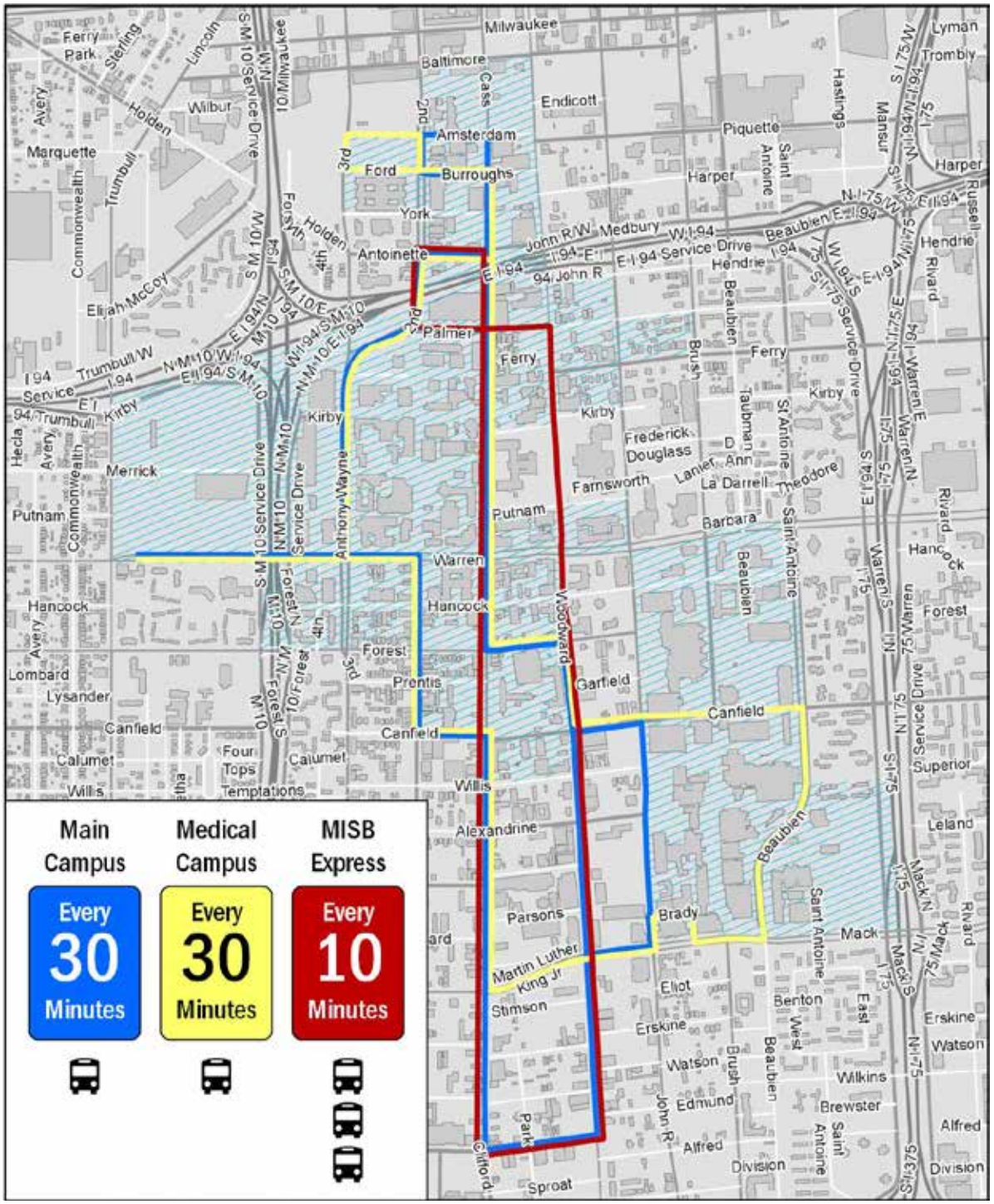
Maximum coverage



Maximum ridership

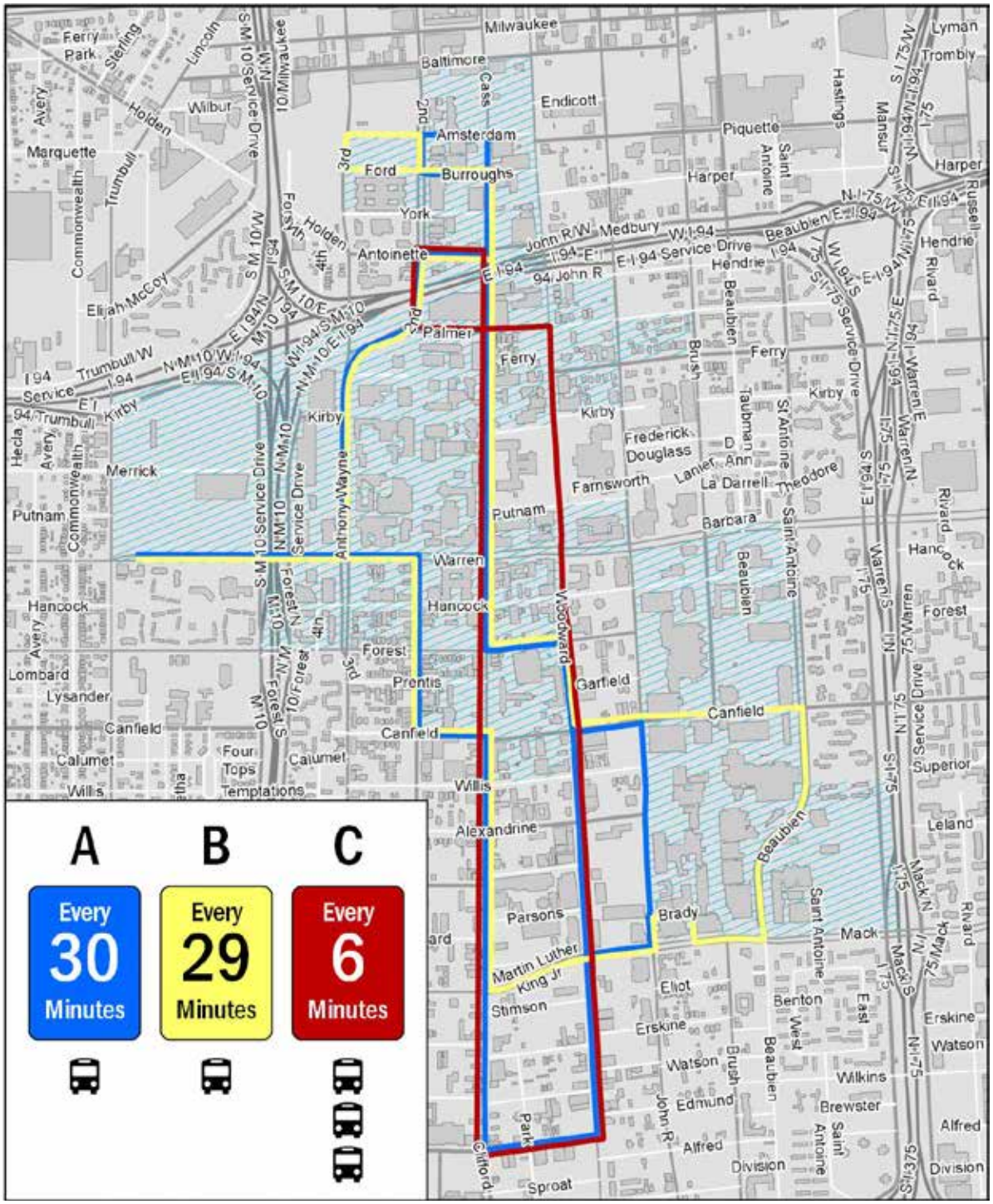


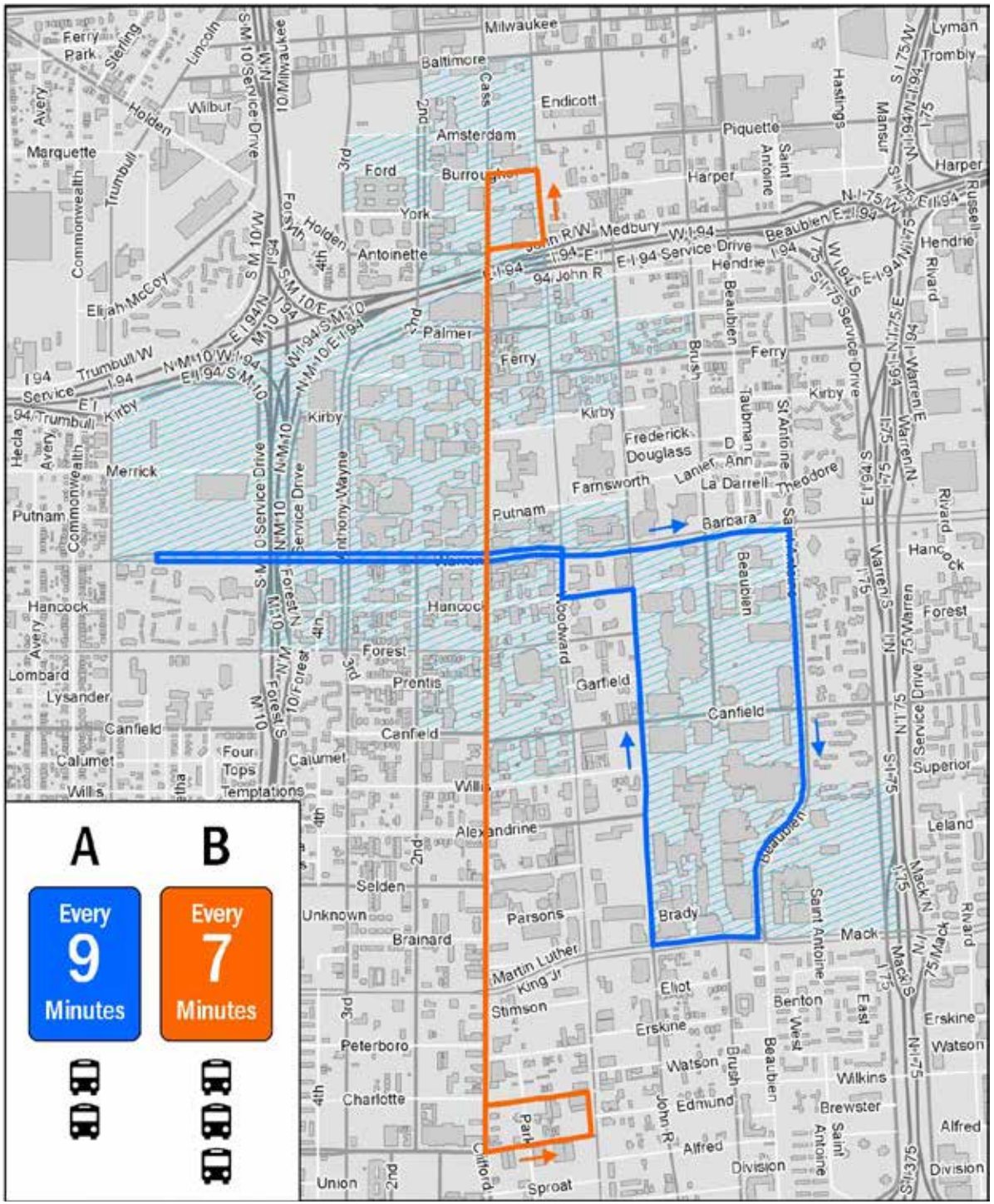
** Per WSU ridership data for weeks of 9/3 - 9/7/18 and 9/10 - 9/14/18*



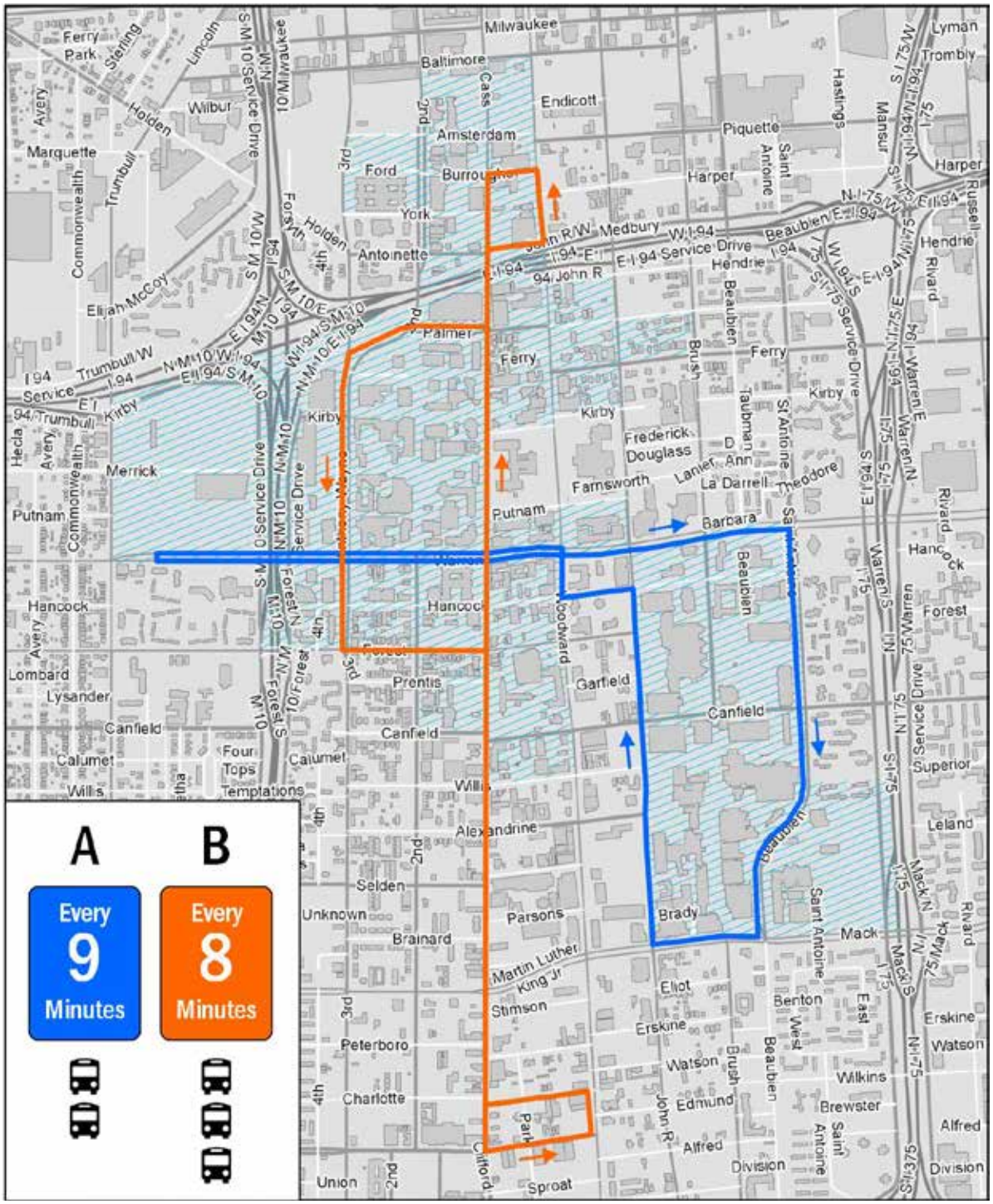
Existing model
One-way, low-frequency, overlapping loops for Main Campus and Medical Campus;
Direct, linear, high-frequency route for MISB Express

Existing model
Adjusted for possible frequencies based on vehicles per route distance



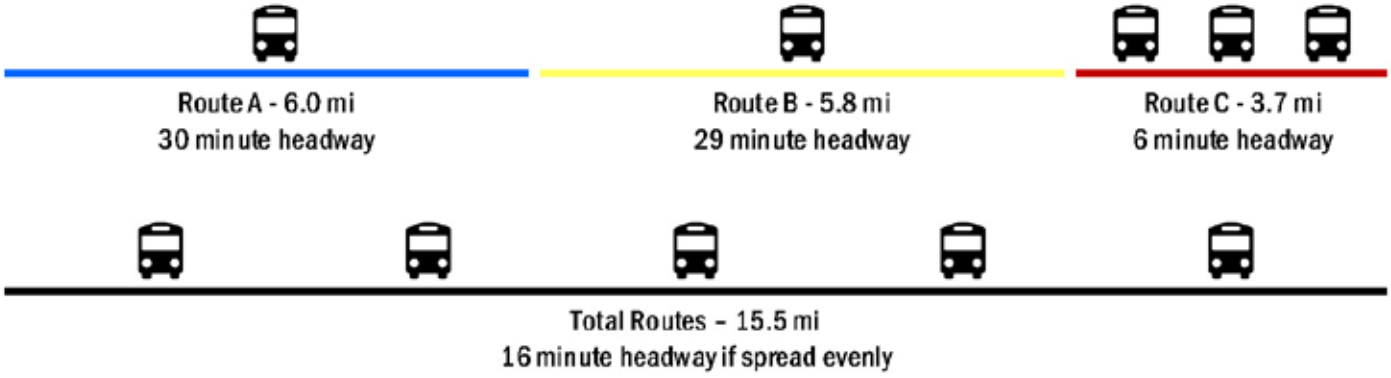


Proposed model
Ridership model; Two-way, linear, high-frequency, ridership-oriented service

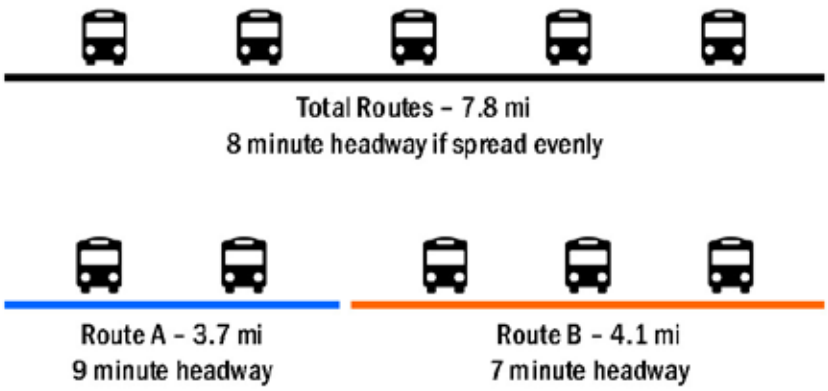


Proposed model
Add a bit of coverage in exchange for headway and route directness

Coverage (existing) model



Ridership (proposed) model



BUILDING ASSESSMENT

GHAFARI

SCOPE AND METHOD OF BUILDING ASSESSMENT

SELECTED BUILDINGS

Highest Priority
- Scott Hall
- State Hall
- Old Main

Historically Relevant
- Maccabees (5057 Woodward)
- Deroy Auditorium
- Education
- Linsell House

Reinvestment Strategy
- Manoogian
- Science Hall
- Shapero Hall
- Law Classroom Building
- General Lectures
- FAB
- AAB

Suitability
- Life Science
- 5425 Woodward
- Custodial

Library Strategy
- Reuther Library
- Undergraduate Library
- Purdy Library
- Kresge Library

Vacant
- 110 E Warren
- Bowen House (5435 Woodward)
- Marie Donaldson House
- Music Annex

SYSTEMS EVALUATED

Plumbing
- Fixtures
- Water Piping Inside Building
- Sanitary / Vent Piping
- Water Service
- Storm Piping
- Hot Water Source
- Natural Gas Piping
- Laboratory Piping

HVAC
- Fuel Oil System
- Primary Heating Source
- Primary Cooling Source
- Primary Air System – Equipment
- Air System Distribution
- Hydronic Piping
- Steam Piping
- Building Controls
- Laboratory Exhaust System
- Laboratory Hoods / Controls
- Computer Room AC Equipment

Fire Protection
- Fire Service
- Standpipes
- Sprinkler System

Electrical
- Service Entrance
- Distribution
- Exit Signs
- Fire Alarm System
- Emergency Egress Lighting
- Lighting Controls
- Security Systems
- Emergency Power
- Phone / Data Systems
- Quantity of Receptacles

CONDITION RATINGS SCALE

Excellent

- Systems all fall within "excellent" or "adequate" categories
- No renovations are required at this time

Adequate

- System rankings can fall within all 4 categories, with majority of items being in the "excellent" or "adequate" categories
- Renovations may be required on some portions of the building

Poor

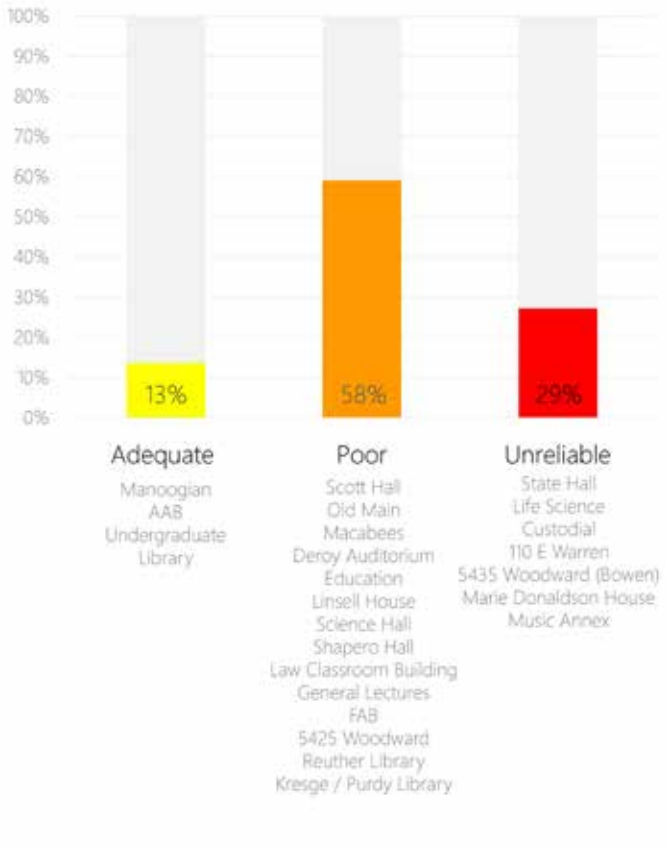
- Majority of item rankings fall within the "poor" category, with some "unreliable" and some "adequate" rankings
- At a minimum, building systems should be upgraded with next major renovation

Unreliable

- Majority of rankings fall in the "unreliable" category with some "poor" rankings
- Building systems would require major rework/ replacement to bring up to "adequate" state
- The need to replace is immediate

CONCLUSIONS

- The majority of the assessed buildings are in varying states of disrepair with aging and obsolete infrastructure.
- Urgent mechanical and electrical work is required for State Hall and Life Science
- Manoogian and Undergraduate Library scored relatively well with an "Adequate" rating
- All vacant buildings require significant investment (110 E Warren, 5435 Woodward, Marie Donaldson House, and Music Annex)



SUMMARY OF BUILDING ASSESSMENT

BUILDING	ASF	BUILT	PRIMARY USE(S)	SYSTEM RATINGS				MAJOR OBSERVATIONS	
				PLUMB	HVAC	FIRE PROT.	ELEC	MECHANICAL	
HIGHEST PRIORITY BUILDINGS									
Scott Hall	264,435	1971	SOM, research labs	31.25	36.98	45.00	71.25	Most HVAC systems are original to the building very old inefficient; double deck supply ductwork. Many systems needs replacement. Some asbestos insulation. Controls need to be upgraded, most are pneumatic. Chillers and cooling towers are at end of their service life. Need to replace 3-way valve on cooling tower system. Many roof leaks.	
State Hall	71,542	1948	Classroom	30.88	27.63	25.00	50.00	Most HVAC systems serving 1st and 3rd floors need to be replaced, as they are original to the 1940s building. Asbestos insulation. Controls are pneumatic. Very old rusty valves and actuators need to be upgraded. Low pressure issue on domestic water serving 2nd & 3rd floors, need to provide new booster pump. Need to evaluate system capacity of steam boilers for possible adding additional boiler. No fire protection fo building, except 4th floor.	
Old Main	200,622	1896	Teaching labs, office, classroom	48.53	41.12	40.00	62.50	HVAC systems are old, inefficient, and poor design. Fan coil units and pnuematic valves for heating and cooling need replacement. Many leaks from roof. Some fire protection sprinkler heads are more than 50 years old and need to be replaced. Chiller installed in 1995 might need replacement in 5 years. Emergency refrigerant monitoring is inoperable.	
HISTORICALLY RELEVANT BUILDINGS									
Maccabees 5057 Woodward	149,040	1927	Office, research labs	51.47	43.75	55.00	60.00	HVAC system is heat pump. Over 200 heat pumps need continuous maintenance. Damaged wall near natural gas main pipe entering the building. This main is new abandoned district main steam pipe. Corroded support at the base of the cooling tower, need evaluation for replacement. Outside Air provided by air handling units through ductowork. Heating provided by steam. No outside air provided during the summer for some parts of the building. The Outside air damper needs to be closed during the summer due to no cooling coil on air handling unit. Need to install cooling coil on these air handling units,	
Deroy Auditorium	8,422	1964	Classroom	50.00	36.62	0.00	48.53	All hydronic piping should be replaced due to scale build up. Intake louvers embedded in concrete cannot balance or clean. Reflecting pool needs to be sealed and has not been filled in 20 years. If pool is to be filled, new mechanical equipment for pool is required. No fire protection system.	
Education	98,269	1960	Office, classroom	39.71	30.63	25.00	66.18	Old inefficient HVAC system, double deck system with hot and cold ductwork. Old pneumatic controls, corroded valves, dampers are hard to operate and need replacement. Plumbing systems are outdated and difficult to find replacement parts. Fire protection is provided only for a couple of rooms in the basement. New fire protection sprinkler system needs to be evaluated (possible grandfather option). Low pressue on domestic cold water on upper floors. Many leaks from roof.	

	MAJOR OBSERVATIONS		OVERALL BUILDING SCORE	RELATIVE COST OF RENOVATION	BUILDING
	ELECTRICAL	BUILDING DEPENDENCIES			
	The incoming service to this building is 13.2 KV, with a 480V distribution system. The panelboards are in good condition with the concern of having enough future spare capacity. There is no automatic means of lighting control in the building which does not meet current energy codes. There are no major electrical problems.		48.63	High	Scott Hall
	The main incoming service to this building needs an upgrade to a more reliable DTE provided 13.2 KV service. The distribution panels are aging with little to no spare capacity. This building needs an major electrical distribution overhaul from the incoming service to the distribution panelboards. There is no automatic means of lighting control in the building which does not meet current energy codes.		35.85	High	State Hall
	The incoming service to this building is 13.2 KV, with a 480V distribution system. The panelboards are in good condition and were updated around 1995 with the concern of having enough future spare capacity. There is no automatic means of lighting control in the building which does not meet current energy codes. Emergency lighting should be updated to meet life safety code.		49.97	Med/High	Old Main
	Incoming service to the building is 13.2 KV, with a 480V distribution system. The infrastructure is aging at over 30 years old, however do have spare capacity. There is no automatic means of lighting control in the building which does not meet current energy codes. There are no major electrical problems.		52.11	Med/High	Maccabees 5057 Woodward
	This facility is in need of a major electrical distribution system upgrade. The auditorium is fed from Prentis hall with a switchboard that has had constant water dripping on it. The fire alarm system is also fed and monitored from Prentis hall. There is no means of automatic lighting control and emergency lighting do not meet current life safety codes.	All hydronic piping and domestic hot and cold water piping comes from Prentis. The auditorium electrical is fed from Prentis hall.	39.80	High	Deroy Auditorium
	The main incoming service to this building needs an upgrade to a more reliable DTE provided 13.2 KV service. There is no automatic means of lighting control in the building rooms and office areas which does not meet current energy codes. Need to upgrade lighting in 4th floor corridor. 1st floor lighting needs to be revised.		44.32	High	Education

BUILDING	ASF	BUILT	PRIMARY USE(S)	SYSTEM RATINGS				MAJOR OBSERVATIONS	
				PLUMB	HVAC	FIRE PROT.	ELEC	MECHANICAL	
Linsell House	TBD	1904	Office	28.13	33.70	0.00	61.76	High water table around building / basement, pump replaced a couple of years ago. Gravity storm galvanized piping from 1st and 2nd floors. Sewer blocked in boiler room a couple of years ago. Cooling provided by window unit types. Heating provided via low pressure steam radiators. Large amount of piping replaced with copper in mechanical room. No info if the piped is replaced in the 1st and 2nd floors. Some lead piping.	
RE-INVESTMENT STRATEGY									
Manoogian	100,844	1970	Classroom, office	72.06	63.16	75.00	54.17	Boilers scheduled for re-tubing, water softener system should be evaluated. Operators are running building manually, controls should be replaced.	
Science Hall	123,868	1949	Teaching labs, classroom	43.75	46.09	50.00	65.00	Needs new hot water source. Domestic water piping should be replaced. Labs need new lab air compressor. Not all lab hoods have controls. Lab vacuum system does not function and needs replacement. Siemens controls on food and nutrition lab hoods only. Steam to booster coils no hydronic water. Steam condensate needs to be replaced. No fire umps. City water pressure for sprinklers in storage areas.	
Shapero Hall	38,078	1965	Teaching labs	54.41	33.45	25.00	68.75	Single chilers, cooling tower, air handling unit, supply fan, and return fan. No back-ups for equipment failure. Three heating hot water boilers installed in 2007 are in good working condition. No fire protection sprinkler system in the building. New fire protection spinkler system needs to be evaluated (possible grandfather option).	
Law Classroom Building	17,689	1966	Classroom	46.88	45.72	0.00	43.06	Leakages in the stam to the heating hot water heat exchanger. No fire protection. Only fire alarm provided. Evaluate adding new fire protection sprinkler system (possible grandfather option).	
General Lectures	27,779	1971	Auditorium/ assembly	75.00	62.50	50.00	53.13	Fire pump is old and needs to be replaced. Perimeter radiators need replacing. Steam piping needs to be replaced. Operators are running building manually, controls should be replaced.	
FAB	158,065	1990		51.47	39.75	50.00	69.74	New DDC (direct digital controls) for rooftop unites installed in 2015 are not working well. The rest are pnuematic and need to be replaced. Many leaks from roof.	

	MAJOR OBSERVATIONS		OVERALL BUILDING SCORE	RELATIVE COST OF RENOVATION	BUILDING
	ELECTRICAL	BUILDING DEPENDENCIES			
	Updated and adequate lighting. Power distribution was more along the lines of a residential dwelling than commercial building.	Main domestic cold water from State Hall.	39.04	HIgh	Linsell House
	The incoming service is 4.8KV, with a 480V distribution system. Some of the panelboards are old and rusty. Electrical distribution system needs to be upgrade. There is no automatic means of lighting control in Basement 3rd, 4th and 5th floors and emergency lighting do not meet current life safety codes. Lighting controls and emergency lighting are adequate for the 1st and 2nd floor.	Manoogian Boilers and chlled water feed General Lectures.	62.98	Medium	Manoogian
	Building needs a major electrical distribution upgrade. Incoming service is 4800V provided by Public Lighting. The entire building is backed up by a 500KW generator	Steam and chilled water comes from Chemistry building.	52.63	Med/High	Science Hall
	New transformer and switchgear. There is no automatic means of lighting controls in the building which does not meet current energy codes. Need to upgrade the fire alarm and lighting system and lighting controls in this building.		49.15	High	Shapero Hall
	The incoming power is coming from the Law Library, as well as the fire alarm control panel. There is an inadequate amount of panelboards, there were only (2) observed. There is no automatic means of lighting control in the building which do not meet current energy codes.	Chilled water and heating hot water are provided from mechanical room in the Library Building. Incoming power and fire alarm control panel is coming from Law Library.	40.45	Med/High	Law Classroom Building
	The incoming power is 13.2KV, with 480V distribution system. There is no automatic means of lighting controls in the building which does not meet current energy codes. Need to upgrade lighting, controls and fire alarm system in the building. Need to upgrade distribution panels in the building.	Steam and chilled water comes from Manoogian	60.47	Medium	General Lectures
	The incoming is 13.2KV, with a 480v distribution system. There is no automatic means of lighting controls in rooms and offices in the building which does not meet current energy codes. There are lighting controls in rest rooms and corridors. Exit signs are old and to be replaced and fire alarm system needs to be upgraded as the present strobes and speakers are old.		53.62	Med/High	FAB

BUILDING	ASF	BUILT	PRIMARY USE(S)	SYSTEM RATINGS				MAJOR OBSERVATIONS	
				PLUMB	HVAC	FIRE PROT.	ELEC	MECHANICAL	
AAB	134,678	1995		94.12	64.44	100.00	69.44	Overall mechanical systems are fine, with exception to outside air provided through ductwork connected to air handling units serving each floor. The supply fan of the air handling unit serving the 1st floor is operating on its max Amps and HP capacity.	
Life Science	14,285	1960	Primarily unassigned, 5,500 ASF research lab	30.00	33.14	25.00	31.94	The entire building needs a major mechanical overhaul. Domestic hot and cold water piping needs to be replaced. Need new hot water source. Natural gas piping has some leaky valves. Hydronic piping needs replacing. Steam piping needs replacing. Existing chiller and cooling tower abandoned. Labs need new lab air compressor. Lab vacuum does not function and needs to be replaced. Lab hoods have no controls. Fire pump abandoned, no sprinkler system. Ductwork needs to be cleaned. Cold rooms not functioning. 4th floor cold room roof has leaks.	
5425 Woodward	20,176	1958	Office	48.53	43.75	55.00	51.25	Current HVAC system needs to be evaluated for replacement with simplified and more efficient system. Need to replace 1 of 2 chillers. Need to replace domestic hot water heat exchanger. Some steam, condensate, heating hot water, domestic hot water, chilled water piping, and valves need to be replaced.	
Custodial				28.13	25.00	25.00	58.82	HVAC units, unit heaters, and ductwork are old. Pneumatic controls need to be replaced. Boiler is old, corroded, and has some of its parts removed. Old back flow preventer is not to code. Corroded piping. A majority of the fire protection system is old, with some added in recent years.	
LIBRARY STRATEGY									
Reuther Library	47,595	1974	Stacks, office	57.35	34.43	80.00	69.12	No temperature or humidity controls currently installed for spaces with old collections of photgraphs, microfilms, glass plate negatives, film negatives and storage spaces. Study was performed in recent years for HVAC systems improvements, but no recommendations were implemented.	
Undergraduate Library	207,338	1997	Study, stacks, office	65.63	69.01	75.00	88.89	Dock area storm piping leak to be addressed in spring 2019. Large cold area at open entrance area on all four floors. Heating and cooling needs to be evaluated for additional requirements.	
Purdy Library		1952	Study, stacks, office	30.88	36.84	0.00	66.18	Refrigerant monitoring is not working. A leak exists in one of the cooling tower's basin (plan is to replace soon). Induction air handling units that provide heating and cooling for perimeter rooms are original to the building. No control on room temperature. Fan coil units serving rooms are not working due to corroded valves and scales. Leakage from roof storm piping (or possibly domestic cold water piping) above lighting. Old pneumatic control and manual controls need to be upgraded.	

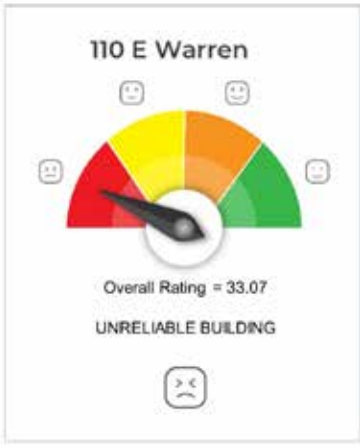
	MAJOR OBSERVATIONS		OVERALL BUILDING SCORE	RELATIVE COST OF RENOVATION	BUILDING
	ELECTRICAL	BUILDING DEPENDENCIES			
	The incoming is 13.2 KV, with spare capacity. There is no automatic means of lighting control in the building which does not meet current energy codes.		75.68	Low	AAB
	The entire building needs a major electrical overhaul. Unable to access the incoming power room, which is operated by Public Lighting. The incoming service is 4800V and should be upgraded to a more reliable DTE provided 13.2KV service. There is no working fire alarm system, and is currently using fire watch personnel.	Steam comes from Chemistry Building. Chilled water commes from Chemistry Building.	31.28	High	Life Science
	Unable to gain entry into the switchgear room - unable to determine incoming voltage. Secondary power distribution panels are in poor condition with little capacity for future loads. Fire alarm system has audio signaling only with a bell system. There are no visual signaling devices per ADA for hearing impaired occupants. Entire building is backed up by a generator.		48.46	Medium	5425 Woodward
	Not sure where the incoming power is fed from. Old panelboards and little spare capacity in the power distribution. Emergency lighting and exit signage do not meet current code.	Very old main city water line serves protection line and domestic water line.	37.46	High	Custodial
	Unable to access the incoming power room, exit signage spacing does not meet current codes and lighting is outdated and has very dim lighting levels. There is no automatic means of lighting control in the building which does not meet current energy codes.		55.71	Medium	Reuther Library
	The incoming power is (2) 4800V lines incoming into a medium voltage switchgear for 480V distribution. Although this is not a 13.2KV service, it is understood that there is a redundant line and service has been reliable. There are no major electrical concerns, however there is no automatic means of lighting control in the building which does not meet current energy codes.	Heating hot water comes from Bio building.	75.89	Low	Undergraduate Library
	Aging incoming power and power distribution, with panelbords with little spare capacity. There is no automatic means of lighting control in the building which does not meet current energy codes.	Chillers serving Purdy, Kresge and parts of other buildings.	42.23	High	Purdy Library

BUILDING	ASF	BUILT	PRIMARY USE(S)	SYSTEM RATINGS				MAJOR OBSERVATIONS	
				PLUMB	HVAC	FIRE PROT.	ELEC	MECHANICAL	
Kresge Library	68,272	1952	Study, stacks, office	39.71	40.79	0.00	66.18	Outdated pneumatic controls need to be replaced. Some equipment controlled manually. Induction air handling units provide heating and cooling for perimeter rooms, which make it difficult to control room temperatures.Original motors may fail at any time (bearing was replaced recently). Many roof leaks.	
VACANT BUILDINGS									
110 E Warren	TBD	1980	Vacant	30.88	29.65	50.00	32.89	Many leaks from roof. When remove damaged ceiling tiles they release asbestos. Air handling units' coils are corroded, blocked and have burst coils. Building engineer keeps door open to prevent coils piping from freezing. Two air handling units serving the Annex are not working and have burst coils. Controls consist of some pneumatic controls and some Siemens direct digital controls. Many controls are not working. Refrigerant monitoring is not working. Many leaks in domestic cold water piping. One of the two domestic cold water main lines is blocked and some parts of the building have had no water for two years. Leaks from steam and condensate piping. Many clogged water closets. Need to evaluate working condition of fire pumps due to corroded parts.	
Bowen House 5435 Woodward	TBD	1928	Vacant	25.00	25.00	0.00	30.26	Need to replace heating system related piping and radiators. Add cooling and ventilation system. Possible asbestos.	
Marie Donaldson House	TBD	TBD	Vacant	25.00	25.00	0.00	44.12	Replace heating system related piping and radiators. Add cooling and ventilation system. Possible asbestos.	
Music Annex	TBD	TBD	Vacant	25.00	25.00	0.00	39.71	Domestic water piping needs to be replaced. Steam piping and radiators need to be replaced. No cooling system. No fire protection system.	

	MAJOR OBSERVATIONS		OVERALL BUILDING SCORE	RELATIVE COST OF RENOVATION	BUILDING
	ELECTRICAL	BUILDING DEPENDENCIES			
	Aging incoming power and power distribution, with panelbords with little spare capacity. There is no automatic means of lighting control in the building which does not meet current energy codes.		45.38	Medium	Kresge Library
	Incoming power is sufficient for future development, all other electrical components have been abandoned and need to be replaced.		33.07	High	110 E Warren
	Entire electrical infrastructure should be upgraded.		24.34	High	Bowen House 5435 Woodward
	Entire electrical infrastructure should be upgraded.	Electrical feed comes from adjacent building.	29.19	High	Marie Donaldson House
	Entire electrical infrastructure should be upgraded.	Electrical feed comes from adjacent building.	27.65	HIgh	Music Annex

110 E WARREN

Key takeaway: The systems at 110 E Warren cannot support office operations without significant investment.



Year of Construction: 1980
Type: Vacant
Area: TBD SF

MAJOR OBSERVATIONS:

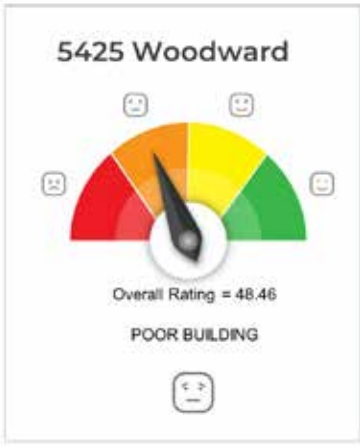
- Many leaks from roof.
- Damaged ceiling tiles release asbestos when removed from the ceiling.
- Air handling unit coils corroded, blocked, and have burst coils
- Building engineer keeps the doors opened to prevent coils piping from freezing.
- Two Air handling units serving Annex are not working due to burst coils.
- Cooling towers need replacement, one of the chillers has not been working for years.
- Leaks from steam and condensate piping.
- Need to evaluate the working conditions of the fire pumps, there are some corroded parts.

TECHNICAL OBSERVATIONS:

- This building was upgraded when Wayne State University purchased it back in 1995.
- Boilers installed in 2007.
- Some pneumatic controls and some Siemens digital direct controls (DDC) as well, many controls not working.
- Refrigerant monitoring not working.
- Many leaks in domestic cold water [DCW] piping. One of two DCW main lines blocked, no water for 2 years now for some parts of the building.
- Wall and floor mounted flush valves are ADA compliant. Many blocked water closets.
- No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code require to installing new overflow roof drain system when replacing roof.
- Animal lab exhaust not working.

5425 WOODWARD

Key takeaway: The systems at 5425 Woodward cannot support office activity without significant investment.



Year of Construction: 1958
Type: Office
Area: 20,176 SF

MAJOR OBSERVATIONS:

- Current HVAC system needs to be evaluated for replacement with simplified and more efficient system.
- Need to replace one of the two chillers.
- Need to replace domestic hot water heat exchanger.
- Some steam, condensate, heating hot water, domestic hot water, chilled water piping and valves need to be replaced.
- Unable to gain entry into switchgear room – unable to determine incoming voltage
- Secondary power distribution panels are in poor condition with little capacity for future loads
- Fire alarm system has audio signaling only, with a bell system. There are no visual signaling devices per ADA for hearing impaired occupants.
- Entire building is backed up by a generator

TECHNICAL OBSERVATIONS:

- Boilers were installed in 2007 and have many years left in their service life time.
- Two air cooled chillers. One of them needs to be replaced, compressor is not working.
- Many rooms served from (4) HVAC systems; FCUs installed near walls, outside air provided thru FCUs in the ceiling via ceiling diffusers, ceiling mounted FCU and wall mounted A/C unit. This inefficient HVAC system wastes energy and adds maintenance.
- Air Handling Units (AHUs) in the basement installed in 2005, one of them provides 100% outside air.
- The steam heat exchanger (HX) for domestic hot water (DHW) is broken and needs to be replaced.
- Pneumatic controls have a lot of leaks from compressed air piping.
- Main domestic cold water split to serve fire protection line and cold water to the building, some leaks in this piping and needs to be replaced.
- Hot heating water (HHW) HXs working fine, but as it is original to the building might need replacement in the coming years. Some leaks from piping.
- Condensate return working fine, but as it is original to the building might need replacement in the coming years. Some leaks from piping.
- Wall and floor mounted flush valves. Many blocked water closets. Water closets are ADA compliant.
- No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code requires installing new overflow roof drain system when replacing roof.
- Need to evaluate the working conditions of the fire pumps, there are some corroded parts.
- Shallow floor in basement mechanical room under pumps, need to evaluate the strength and stability of this floor.
- Exit signage are not spaced to meet current egress codes
- Older lighting fixtures, some with burned out/missing lamps and discolored lenses
- There are no means of automatic lighting control
- There is a functional building security system with cameras

AAB

Key takeaway: The systems at AAB are in overall adequate or excellent conditi

Year of Construction: 1995
Type: Office
Area: 134,678 SF

MAJOR OBSERVATIONS:

- Overall mechanical systems are fine, with exception to outside air provided through ductwork connected to air handling units serving each floor.
- The supply fan of the air handling unit serving the 1st floor is operating on its max Amps and HP capacity.
- The incoming is 13.2 KV, with spare capacity. There is no automatic means of lighting control in the building which does not meet current energy codes.

TECHNICAL OBSERVATIONS:

- This building has a 13.2kv incoming primary service, 1 feeder normally open and 1 feeder normally closed.
- Secondary power distribution panels are original to the building with less than adequate spare capacity.
- All lighting fixtures are fluorescent, parabolic with T5 lamps. There is no automatic means of shutting off the lighting, including occupancy sensors, daylight harvesting sensors or an Energy Management System.
- Emergency egress lighting in this building uses batteries in the troffers, and exit signs have fluorescent lamps with many that are burned out and are not spaced sufficiently.
- Fire alarm system has audio/visual signaling devices and automatic and manual initiating devices located throughout the building.
- There is no emergency generator for this building.
- Security cameras are inoperative and are considered "decoy" cameras.
- AHU serving each floor: CHW for cooling & HHW for heating. VAV-boxes throughout the building with HHW re-heat.
- The outside provided thru ductwork connected to AHUs serving each floor. OA air flow to 1st floor is not sufficient, because the OA duct is smaller than what needed. The supply fan of AHU serving 1st floor operating on its max AMPs and HP capacities
- (2) Air cooled chillers installed outdoor, 185 ton each, installed in 1995, on the edge of their expected service live time, consider replacement in couple years.
- DDC controls working fine.
- Fire pump replaced couple years ago, water pressure was reaching only 1% of required pressure, because the piping was filled with gravel. Now it is working fine.
- Fire protection sprinkler system provided throughout the building.
- All toilet rooms are ADA comply. Flush valve fixtures.
- DHW provided by several electric hot water heaters at each floor, they are working fine.
- No overflow roof drain, consider adding them when replacing roof.

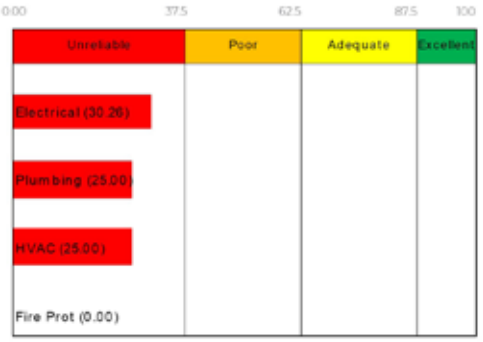





BOWEN HOUSE

Key takeaway: The systems at Bowen House cannot support office operations without significant investment.

Year of Construction: 1928
Type: Vacant
Area: TBD SF



MAJOR OBSERVATIONS:

- Need to replace heating system related piping and radiators.
- Add cooling and ventilation system.
- Possible asbestos.
- Entire electrical infrastructure should be upgraded.

TECHNICAL OBSERVATIONS:

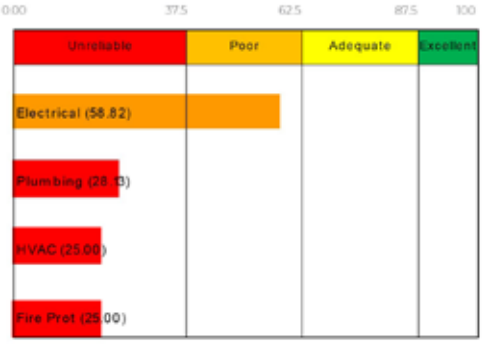
- No cooling,
- Radiator for heating is leaking.
- Domestic hot water (DHW) from steam HX.

BUILDING DEPENDENCIES:

- Steam and Domestic Cold Water provided from other building.
- Electrical feed comes from adjacent building.

CUSTODIAL

Key takeaway: The systems at the Custodial Building cannot support maintena operations without significant investment.



Year of Construction:
Type: Maintenance Operations
Area: TBD SF

MAJOR OBSERVATIONS:

- Old rooftop HVAC units, unit heaters, and ductwork.
- Pneumatic controls need to be replaced.
- Old corroded boiler with some of its parts removed.
- Very old main city water line serving protection line and domestic water line. Old back flow preventer, not per code. Corroded piping.
- Most of the fire protection system is old, but some has been added in recent years.

TECHNICAL OBSERVATIONS:

- Very old main city water line serving protection line and domestic water line.
- Old back flow preventer, not per code. Corroded piping.
- Most of the fire protection system is old, but some was added in later years.
- Per building occupants, asbestos might exist.
- Restrooms fixtures are not ADA compliant.

BUILDING DEPENDENCY:

- Very old main city water line serves protection line and domestic water line.

DEROY AUDITORIUM

Key takeaway: The systems in Deroy Auditorium can not support classroom activity without significant investment.

Year of Construction: 1964
Type: Classroom
Area: 8,422 SF

MAJOR OBSERVATIONS:

- Heating hot water, chilled water, domestic hot water, and domestic cold water comes from Prentis Building.
- Reflecting pool around building leaks into basement and mechanical rooms, pours in when it rains.
- Reflecting pool needs to be sealed and has not been filled in 20 years. If pool is filled, new mechanical equipment for pool is required.
- Building air intakes are obstructed, louvers are poured in concrete
- Controls are pneumatic and need to be replaced.
- The building heating hot water piping is being replaced because of scale build up restricting flow.
- No fire protection system.
- Major electrical distribution system upgrade is required.
- The auditorium electrical is fed from Prentis Hall with a switchboard that has had constant water dripping on it.

TECHNICAL OBSERVATIONS:

- All hydronic piping should be replaced due to scale build up.
- Intake louvers embedded in concrete cannot balance or clean.
- There are many types of light fixtures in this building, all fluorescent with acrylic lens.
- There is no means of automatic lighting control and emergency lighting, which does not meet current life safety codes.

BUILDING DEPENDENCIES:

- All hydronic piping and domestic hot and cold water piping comes from Prentis.
- The auditorium electrical is from Prentis Hall.
- The fire alarm systems is fed and monitored from Prentis Hall.
- Mechanical equipment for the reflecting pool is located in Prentis and has been abandoned for at least 20 years.

EDUCATION

Key takeaway: The mechanical systems in Education can not support office and classroom activity without significant investment.

Year of Construction: 1960
Type: Office, Classroom
Area: 98,269 SF

MAJOR OBSERVATIONS:

- Old inefficient double deck HVAC system.
- Plumbing systems are old. Hard to find replacement parts for the waste pumps.
- Fire protection is provided only for a couple rooms in the basement. Need to evaluate adding a new fire protection sprinkler system. If building is grandfathered, there might be an option to waive the need for new sprinkler system.
- Low pressure on domestic cold water on upper floors.
- Many roof leaks
- Main incoming service to this building needs an upgrade to a more reliable DTE provided 13.2kV service.
- No automatic means of lighting control in the building rooms and office areas, which does not meet current energy codes.

TECHNICAL OBSERVATIONS:

- Air Handling Units (AHUs) are double deck system. HVAC includes hot and cold ductwork with mixing boxes to serve zones.
- Perimeter fin tube for heating.
- Fan coil units provide heating and cooling and outside air.
- Old pneumatic controls are beside corroded valves and dampers, making it hard to operate. They need to be replaced.
- Fire protection systems includes 1 ¼" riser up to 4th floor, 1" branch for each floor.
- Domestic cold water provided thru storage tank is original to the building, pressurized by pumping cold air (CA) on the top of the tank. Low pressure on domestic cold water (DCW) for upper floors.
- No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code requires installing new overflow roof drain system when replacing roof.
- Need to upgrade lighting in the 4th floor corridor.
- Need to revise lighting on the 1st floor.

FAB

Key takeaway: The mechanical systems at FAB cannot support office activity without significant investment.

Year of Construction: 1990
Type: Office
Area: 158,065 SF

MAJOR OBSERVATIONS:

- Outdated DDC controls on rooftop units
- Many roof leaks
- Incoming power is 13.2KV, with a 480V distribution system.

TECHNICAL OBSERVATIONS:

- The newer DDC controls for roof top units that installed in 2015 not working well, the rest are pneumatic and need to be replaced.
- There is no automatic means of lighting controls in rooms and offices in the building which does not meet current energy codes.
- There are lighting controls in rest rooms and corridors.
- Exit signs are old and to be replaced and fire alarm system needs to be upgraded as the present strobes and speakers are old.

BUILDING DEPENDENCY:

- None

GENERAL LECTURE

Key takeaway: The electrical and fire protection systems at the General Lecture Building cannot support classroom activity without significant investment.

Year of Construction: 1971
Type: Auditorium, Assembly
Area: 27,779 SF

MAJOR OBSERVATIONS:

- Fire pump is old and needs to be replaced.
- Perimeter radiators need replacing.
- Steam piping needs to be replaced
- The incoming power is 13.2KV, with 480V distribution system.
- Electrical system requires upgrades.

TECHNICAL OBSERVATIONS:

- Operators are running building manually, controls should be replaced.
- There is no automatic means of lighting controls in the building which does not meet current energy codes.
- Need to upgrade lighting, controls and fire alarm system in the building.
- Need to upgrade distribution panels in the building.

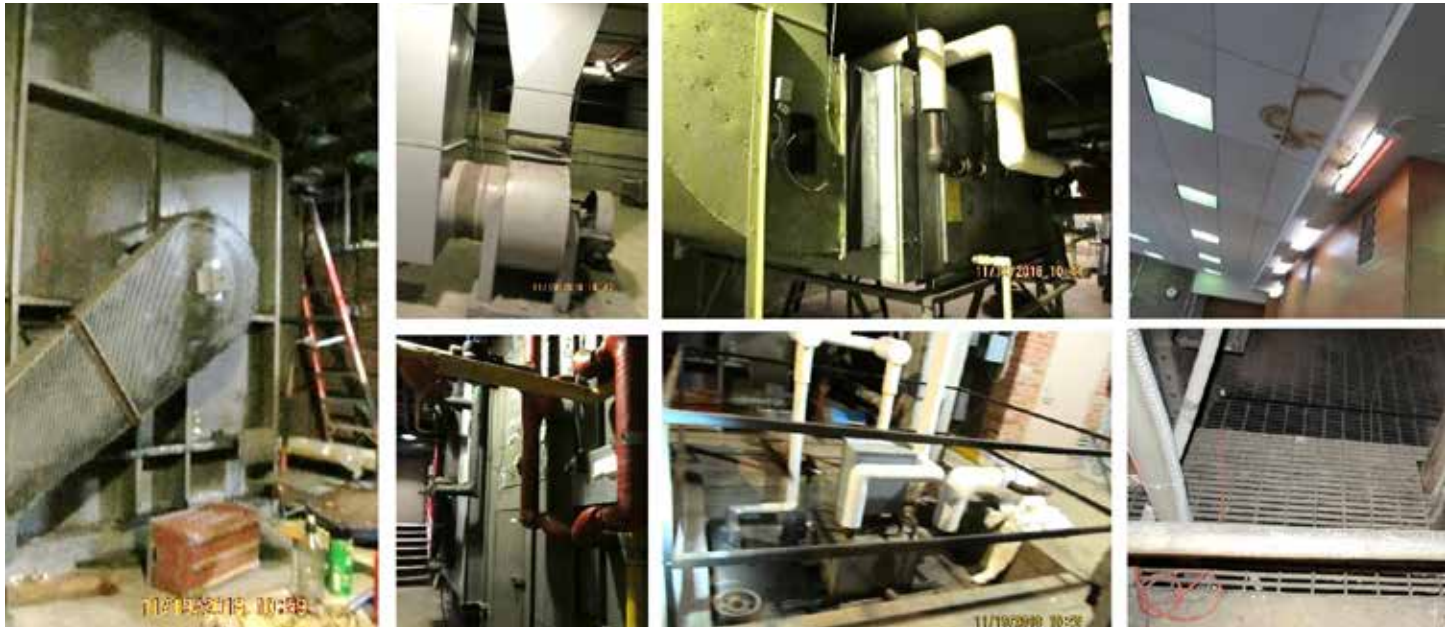
BUILDING DEPENDENCY:

- Steam and chilled water comes from Manoogian.

KRESGE LIBRARY

Key takeaway: The mechanical systems at Kresge Library cannot support libra stacks and office operations without significant investment.

Year of Construction: 1952
Type: Study, Stacks, Office
Area: 68,272 SF



MAJOR OBSERVATIONS:

- Outdated pneumatic controls need to be replaced.
- Some equipment controlled manually.
- Induction Air Handling Units provide heating & cooling for perimeter rooms, which makes it difficult to control room temperatures.
- Original motors may fail at any time (bearing was replaced recently).
- Many roof leaks.
- Aging incoming power and power distribution, with panelboards with little spare capacity.
- There is no automatic means of lighting control in the building, which does not meet current energy codes.

TECHNICAL OBSERVATIONS:

- Low ceiling in mechanical room, also there was no lighting in mechanical rooms.
- Chilled water provided from Purdy library, chilled water pumps with Variable Frequency Drives (VFDs) working fine.
- Asbestos insulation exists.
- Domestic Hot Water system replaced recently due to Legionella infection.
- There are many leaks from roof. No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code requires installing new overflow roof drain system when replacing roof.

BUILDING DEPENDENCY:

- Chillers serving Purdy / Kresge and parts of other buildings.

LAW CLASSROOM BUILDING

Key takeaway: The systems at the Law Classroom Building cannot support classroom activity without significant investment.

Year of Construction: 1966
Type: Classroom
Area: 17,689 SF

MAJOR OBSERVATIONS:

- The incoming power is coming from the Law Library, as well as the fire alarm control panel.
- There is an inadequate amount of panelboards, there were only (2) observed.
- There is no automatic means of lighting control in the building which do not meet current energy codes.
- Leakages in the steam to the heating hot water heat exchanger.
- No fire protection. Only fire alarm provided.
- Evaluate adding new fire protection sprinkler system (possible grandfather option).

TECHNICAL OBSERVATIONS:

- The incoming power for this facility is 13.2kv and is distributed through medium voltage switchgear.
- There are multiple single ended 480V substations located throughout the facility to distribute power to the panelboards.
- The panelboards are in good condition with limited spare capacity in the majority of them.
- The entire building has emergency power supplied by two (2) diesel generators, (generator sizing was not possible at the time of the visit). There is a UPS system that is providing power to multiple labs, this is distributed thru various 208/120V panelboards.
- Lighting in this facility is all fluorescent with acrylic lens with no lighting controls.
- There are fixtures with missing or burned out lamps, and fixtures that have lamps with color temperatures that do not match the rest.
- There are a few area that have occupancy sensors, for the majority of the building there are no lighting controls.
- Exit signs have been upgraded, however the placement and spacing is not sufficient for current codes.
- The emergency lighting for the most part are remote heads attached to the exit signs, therefore the distances apart are not adequate for emergency lighting.
- The fire alarm system is a Simplex 4100ES with phone/microphone for announcements thru the speaker and speaker/strobes.
- Fire alarm signaling and initiating devices in this building are adequate.

LIFE SCIENCE

Key takeaway: The systems at Life Science cannot support classroom, lab or off activity without significant investment.

Year of Construction: 1960
Type: Primarily unassigned, 5,500 ASF research lab
Area: 14,285 SF

MAJOR OBSERVATIONS:

- The entire building requires a major electrical and mechanical overhaul.
- Unable to access the incoming power room, which is operated by Public Lighting. The incoming service is possibly 4800V and should be upgraded to a more reliable DTE provided 13.2KV service.
- There is no working fire alarm system, and is currently using fire watch personnel.
- Domestic hot and cold water piping needs to be replaced.
- Need new hot water source. Natural gas piping has some leaky valves.
- Hydronic piping and steam piping needs replacement.
- Existing chiller and cooling tower abandoned.
- Labs needs new lab air compressor. Lab vacuum not functioning and needs to be replaced. Lab hoods have no controls.
- Fire pump abandoned, no sprinkler system.
- Ductwork needs to be cleaned.
- Cold rooms not functioning.
- Fourth floor cold room roof has leaks.

TECHNICAL OBSERVATIONS:

- All secondary distribution panels are original to the building and in poor shape.
- Lighting fixtures are fluorescent and require updating
- No means of automatic lighting control
- Exit signs updated within past 25 years, however still do not meet current egress codes
- Insufficient quantity of electrical and data outlets.
- Zoned System, difficult to balance.
- Ductwork supply to classrooms need to be cleaned, filters were installed at supply diffusers.
- Abandoned perimeter hot water pumps and heat exchangers.
- Controls are pneumatic need to be replaced.
- Using city water for domestic cold water. Building water pumps are abandoned. If any work required, whole building will need to be shut down because of leaky valves.
- Steam for heating comes from the Chemistry Building.
- Chilled water for cooling comes from Chemistry building. Abandoned chiller in basement. Abandoned cooling tower.
- Lab air compressor does not work, lab air is using instrument air compressor, or Science Building instrument air compressor piping.
- Lab vacuum system has not worked in a long time.
- Cold rooms not working, cold room on 4th floor, roof leaks.
- Elevator pump is new.
- Not using all labs.
- Fire pump abandoned, currently on fire watch, no sprinkler system.
- Learned that a New Fire Protection system is to be installed, mainly smoke detection.

BUILDING DEPENDENCY:

- Steam and Chilled Water comes from Chemistry Building.

LINSELL HOUSE

Key takeaway: The mechanical systems in Linsell House cannot support office activity without significant investment.

Year of Construction: 1904
Type: Office
Area: TBD SF

MAJOR OBSERVATIONS:

- High water table around building/basement, pump was replaced a couple years ago.
- Gravity storm galvanized piping from 1st and 2nd floors.
- Sewer blocked in the boiler room.
- Low pressure steam boiler in the basement.
- Heating provided via low pressure steam radiators.
- Domestic hot water (DHW) provided by water heater
- Updated and adequate lighting.
- Power distribution was more along the lines of a residential dwelling than a commercial building.

TECHNICAL OBSERVATIONS:

- Large amount of piping replaced with copper in mechanical room.
- No info if piping is replaced on the 1st and 2nd floors.
- Some lead piping.
- Cooling is window type units.

BUILDING DEPENDENCY:

- Main domestic cold water from State Hall

MACCABEES

Key takeaway: The systems in Maccabees can not support office and research activity without significant investment.

Year of Construction: 1927
Type: Office, Research Labs
Area: 149,040 SF

MAJOR OBSERVATIONS:

- Aging electrical infrastructure with limited future capacity
- Over 200 heat pump units require continuous maintenance and replacement
- Lack of outside air during summer

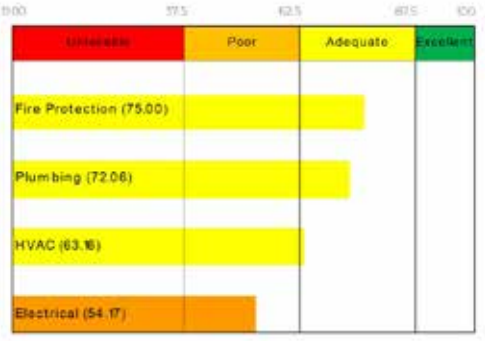
TECHNICAL OBSERVATIONS:

- Maccabees has 13.8kv primary incoming power, with secondary distribution panelboards around 30 years of age. These panelboards however do have sufficient spare capacity for future loads.
- There are many types of lighting fixtures in this building, they are all fluorescent with acrylic lens. Most of them have been upgraded to newer fixture and some are original to the building.
- Emergency egress lighting in this building uses remote heads on the exit sings, or wall mounted emergency battery packs. The spacing and quantity of units is not adequate for proper egress foot-candle levels.
- Fire alarm system has audio/visual signaling devices and automatic and manual initiating devices located throughout the building.
- There is no emergency generator for this building.
- Main domestic cold water provided from city water at 6" pipe. Need to evaluate that the back flow preventer type is per IPC code.
- Building engineer wanted us to report the damaged wall near NG main pipe entering the building, this main is near abandoned district main steam pipe.
- Steam boilers installed in 2007, per building engineer they are working fine.
- (2) Cell cooling tower, 2-stage cooling tower fan, it is better to replace it with VFDs for better control and energy saving. Cooling tower pumps rebuilt in mid-2015. Building engineer reported corroded support base of the cooling tower, need evaluation for replacement.
- HVAC system is Heat Pump HP system, over 200 HPs. Cooling tower water for cooling system and heating hot water for heating. Many HPs replaced over the years.
- Outside Air OA provided by AHUs thru ductwork. During winter, heating provided by steam, but during summer (July) the OA damper close, since the AHU w/o cooling coil, so, in summer, no OA provided to space need to install new cooling coil.
- Control is DDC for most of the building, but there are pneumatic controls for steam - heating hot water heat exchangers, and for the AHU in 15th floor.
- Fire protection main pipe line provided from city water at 6" pipe, need to evaluate if this pipe size is sufficient for this size building and also evaluate the back flow preventer type if it is per IPC code. Fire pump & jockey pump. Detector check BFP & exterior siamese. FM200 provided for record room.

MANOOGIAN

Key takeaway: The systems in Manoogian are in overall adequate condition.

Year of Construction: 1970
Type: Classroom, Office
Area: 100,844 SF












MAJOR OBSERVATIONS:

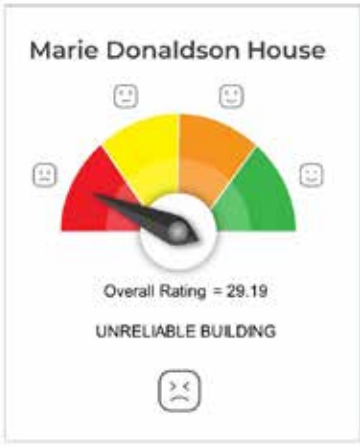
- One of the highest utilization buildings on campus.
- Boilers scheduled for re-tubing, water softener system should be evaluated.
- Operators are running building manually, controls should be replaced.
- The incoming service is 4.8 KV, with a 480V distribution system.
- Some of the panelboards are old and rusty.
- Electrical distribution system needs to be upgraded.
- Emergency lighting does not meet current life safety codes.

TECHNICAL OBSERVATIONS:

- Softener controller out of commission and caused boiler tube pitting. Tubes are being replaced in two boilers.
- Variable Frequency Drive (VFD) transducer for Domestic Water is being replaced.
- City water booster pumps have control issues, controls should be upgraded.
- Cooling towers in good shape.
- Tower pump #2 needs rebuilding and has programming issues.
- Perimeter heating pump coupling does not line up, controls are new.
- Variable Frequency Drive (VFD) on #4 air handling unit needs replacing.
- There is no automatic means of lighting control in the basement, 3rd, 4th, and 5th floors.
- Lighting controls and emergency lighting is adequate for the 1st and 2nd floors.

MARIE DONALDSON HOUSE

Key takeaway: The systems at Marie Donaldson House cannot support office operations without significant investment.



Year of Construction: TBD
Type: Vacant
Area: TBD SF

MAJOR OBSERVATIONS:

- Need replace heating system related piping and radiators.
- Need to add cooling and ventilation system.
- Possible asbestos.
- Entire electrical infrastructure should be upgraded.

TECHNICAL OBSERVATIONS:

- Old radiators for heating, no cooling.
- Plumbing fixtures most likely are original to the building, some blocked.
- Service natural gas available in the building for boiler.

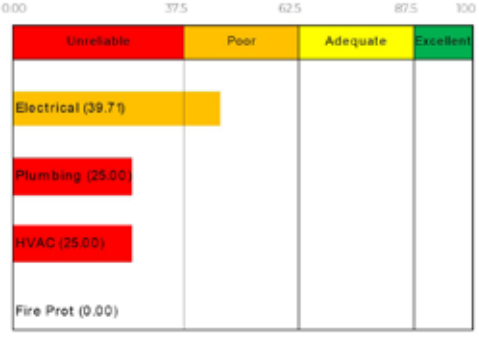
BUILDING DEPENDENCIES:

- Electrical feed comes from adjacent building.

MUSIC ANNEX

Key takeaway: The systems at Music Annex cannot support office operations without significant investment.

Year of Construction: TBD
Type: Vacant
Area: TBD SF



MAJOR OBSERVATIONS:

- Domestic water piping needs to be replaced.
- Steam piping and radiators need to be replaced.
- No cooling system
- No fire protection system
- Entire electrical infrastructure should be upgraded.

TECHNICAL OBSERVATIONS:

- Steam heat, no cooling, may have used window air conditioners.
- Steam not getting to radiators above the basement level, piping could be plugged. The PRV in the basement is acting as control valve. Steam piping has patches in it. Should be replaced.
- Building water piping is a combination of copper and black iron. Should be replaced

BUILDING DEPENDENCIES:

- Electrical feed comes from adjacent building.

OLD MAIN

Key takeaway: The mechanical systems in Old Main can not support office, lab and classroom activity without significant investment.

Year of Construction: 1896
Type: Teaching Labs, Office, Classroom
Area: 200,622 SF

MAJOR OBSERVATIONS:

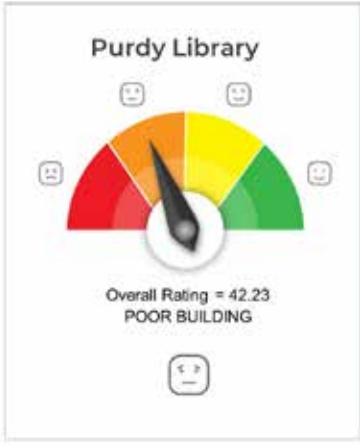
- Emergency lighting is insufficient
- Electrical distribution panels are at least 25 years old
- HVAC is old and inefficient.
- Many roof leaks
- Some fire protection sprinkler heads are over 50 years old and need replacement

TECHNICAL OBSERVATIONS:

- This building has a 13.2kv incoming primary service, with secondary power distribution panels updated around 1995.
- All lighting fixtures are fluorescent with acrylic lenses, some fixtures have been updated within the last 25 years, and others seem to be original. There is no automatic means of shutting off the lighting, including occupancy sensors, daylight harvesting sensors or an EMS (Energy Management System).
- Emergency egress lighting in this building uses remote heads on the exit sings, or wall mounted emergency battery packs. The spacing and quantity of units is not adequate for proper egress foot-candle levels.
- Fire alarm system has audio/visual signaling devices and automatic and manual initiating devices located throughout the building.
- There is no emergency generator for this building.
- Security cameras are inoperative and are considered "decoy" cameras.
- HVAC systems old inefficient poor design; fan coil units in each room for heating and cooling, very hard to work with old pneumatic valves for coils heating and cooling. Outside air provided by AHUs to VAV-boxes thru ductwork, air flow depending on CO2 sensors, controls need to be upgraded.
- There are many leaks from roof. No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code require to installing new overflow roof drain system when replacing roof.
- Some fire protection sprinkler heads are more than 50 years old, passed their service time, need to be replaced.
- (3) Chiller installed in 1995, they are around the end of their service life time, (2) w/R22, 350 ton each, and (1) absorption chillers at 400 ton. Refrigerant monitoring not working.

PURDY LIBRARY

Key takeaway: The mechanical systems at Purdy Library cannot support library stacks and office operations without significant investment.



Year of Construction: 1952
Type: Study, Stacks, Office
Area: 68,272 SF

MAJOR OBSERVATIONS:

- Aging incoming power and power distribution with panelboards with little spare capacity.
- There is no automatic means of lighting control in the building, which does not meeting current energy codes.
- Refrigerant monitoring is not working. There is a leak in one of cooling tower's basin (plan is to replace soon).
- Induction AHUs provide heating & cooling for perimeter rooms are original to the building. There is no control on room temperatures.
- Fan coil units serving rooms are not working due to corroded valves and scales.
- Leakage from roof storm piping (or possibly domestic cold water piping) above lighting.
- Old pneumatic controls, and manual controls, need to be upgraded.

TECHNICAL OBSERVATIONS:

- (4) Chillers serving Purdy, Kresgy and part of other buildings, (1) 180 ton. (2) 250 ton, installed in 1996-1999, there should be more years to serve. Refrigerant monitoring not working. (4) Cooling towers, installed 1996-1999. There is leak in one of cooling tower's basin, the plan to replace soon.
- Induction AHUs provide heating & cooling for perimeter rooms, they original to the building. There is no control for rooms' temps.
- Fan coil units serving rooms, not working fine; corroded valves with scales.
- Boilers installed in 2008, working fine, still many years remaining in their expected service life time.
- Building manger asked us to report the leakage from roof storm piping (or it might be from DCW piping) to the ceiling, the concern this leak is over lighting.
- There are many leaks from roof. No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code requires installing new overflow roof drain system when replacing roof.
- Old pneumatic controls and manual controls, need to be upgraded.

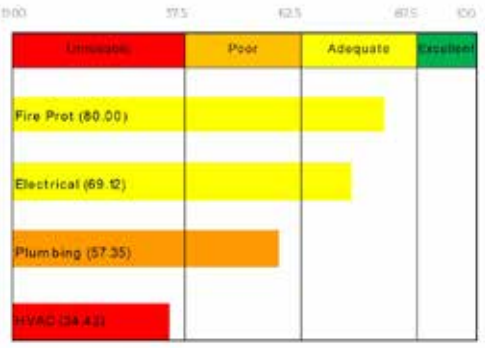
BUILDING DEPENDENCY:

- Chillers serving Purdy / Kresge and parts of other buildings.

REUTHER LIBRARY

Key takeaway: The mechanical systems at the Reuther Library cannot support library stacks and office operations without significant investment.

Year of Construction: 1974
Type: Stacks, Office
Area: 47,595 SF



MAJOR OBSERVATIONS:

- There are no controls on temperature and humidity for critical spaces.
- Outdated lighting with dim lighting levels.

TECHNICAL OBSERVATIONS:

- Unable to access the incoming power room
- Exit signage spacing does not meet current codes
- Lighting is outdated and has very dim lighting levels.
- No automatic means of lighting control in the building which does not meet current energy codes.
- No temperature or humidity controls currently installed for spaces with old collections of photographs, microfilms, glass plate negatives, film negatives and storage spaces.
- RTUs and AHUs provide supply air to each zone by VAV-boxes, they are original to the building, and we are told there is asbestos insulation.
- Need to check if the back flow preventer installed on the main FP line is per code.
- Domestic water heater provided by water heater, no issue reported.
- Study was performed in recent years for HVAC systems improvements, but no recommendations were implemented.

BUILDING DEPENDENCY:

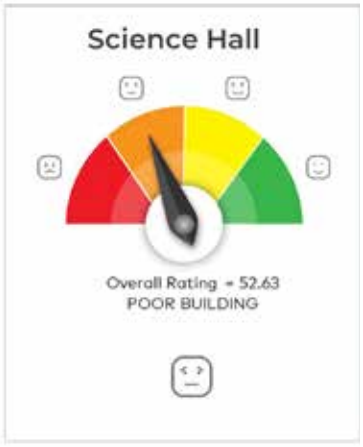
- None






SCIENCE HALL

Key takeaway: The mechanical systems at Science Hall cannot support teaching labs and classroom activity without significant investment.



Year of Construction: 1949
Type: Teaching Labs, Classroom
Area: 123,868 SF

MAJOR OBSERVATIONS:

- The incoming power for this facility is original and operated by Public Lighting and is 4800V. It was observed that this building will be upgraded to a 13.2KV service by DTE within 3 years.
- Corridor mounted panel boards have little spare capacity and are original to the building.

TECHNICAL OBSERVATIONS:

- Needs new hot water source.
- Domestic water piping should be replaced.
- Labs need new lab air compressor.
- Not all lab hoods have controls.
- Lab vacuum system does not function and needs replacement.
- Siemens controls on food and nutrition lab hoods only.
- Steam to booster coils no hydronic water.
- Steam condensate needs to be replaced.
- No fire pumps.
- City water pressure for sprinklers in storage areas.
- Building needs a major electrical distribution upgrade.
- Incoming service is 4800V provided by Public Lighting.
- The entire building is backed up by a 500KW generator

BUILDING DEPENDENCY:

- Steam and chilled water comes from Chemistry building.

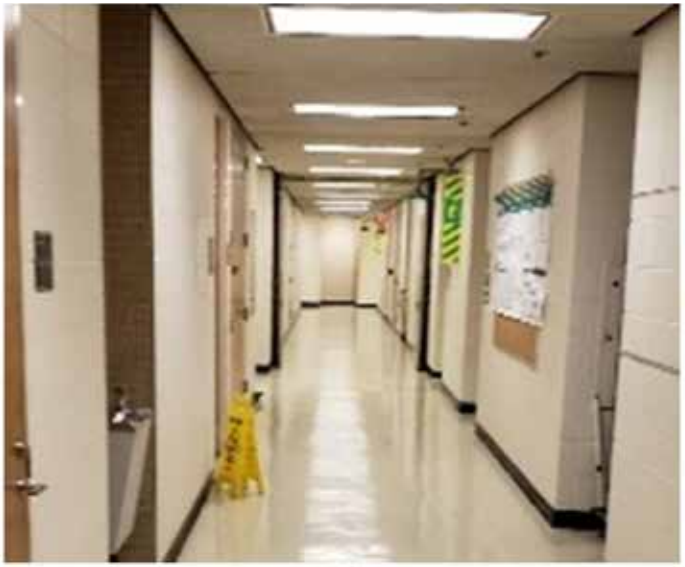




SCOTT HALL

Key takeaway: The mechanical systems in Scott Hall can not support intensive research activity without significant investment.

Year of Construction: 1971
Type: SOM, Research Labs
Area: 264,435 SF



Major Observations:

- Lighting and means of controls are not energy efficient and should be upgraded to current energy code
- Exit signage and emergency lighting are not code compliant with current life safety standards
- Most HVAC systems are original to the building and are beyond equipment life expectancy

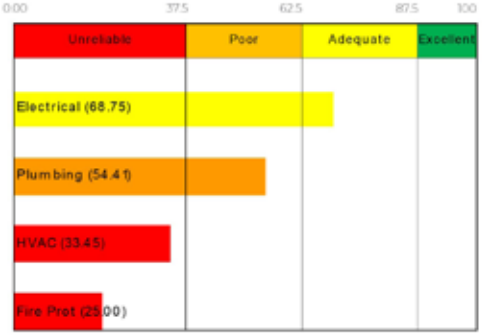
Technical Observations:

- The incoming power for this facility is 13.2kv and is distributed through medium voltage switchgear.
- There are multiple single ended 480V substations located throughout the facility to distribute power to the panelboards.
- The panelboards are in good condition with limited spare capacity in the majority of them.
- The entire building has emergency power supplied by two (2) diesel generators, (generator sizing was not possible at the time of the visit). There is a UPS system that is providing power to multiple labs, this is distributed thru various 208/120V panelboards.
- There are fixtures with missing or burned out lamps, and fixtures that have lamps with color temperatures that do not match the rest.
- There are a few area that have occupancy sensors, for the majority of the building there are no lighting controls.
- The emergency lighting for the most part are remote heads attached to the exit signs, therefore the distances apart are not adequate for emergency lighting.
- The fire alarm system is a Simplex 4100ES with phone/microphone for announcements thru the speaker and speaker/strobes.
- Fire alarm signaling and initiating devices in this building are adequate.
- Most HVAC systems are original to the building very old inefficient; double deck supply ductwork, rusty burst leaking coils, dampers, piping, valves, some replaced, but still many needs replacement. Some asbestos insulation.
- Controls need to be upgraded, most control pneumatic very old.
- Chillers and cooling towers are around their end of service life time. It is very hard to control cooling tower water flow as the 3-way valve on main pipe not working.
- There are many leaks from roof. No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code requires installing new overflow roof drain system when replacing roof.

SHAPERO HALL

Key takeaway: The mechanical systems at Shapero Hall cannot support teaching lab activity without significant investment.

Year of Construction: 1965
Type: Teaching Labs
Area: 38,078 SF



MAJOR OBSERVATIONS:

- New transformer and switchgear.
- There is no automatic means of lighting controls in the building which does not meet current energy codes.
- Single chillers, cooling tower, air handling unit, supply fan, and return fan. No back-ups for equipment failure.
- Three heating hot water boilers installed in 2007 are in good working condition.
- No fire protection sprinkler system in the building.
- New fire protection sprinkler system needs to be evaluated (possible grandfather option).
- Need to upgrade the fire alarm and lighting system and lighting controls in this building

TECHNICAL OBSERVATIONS:

- See above.





STATE HALL

Key takeaway: The systems in State Hall can not support classroom activity without significant investment.

Year of Construction: 1948
Type: Classroom
Area: 71,542 SF

MAJOR OBSERVATIONS:

- Outdated electrical and mechanical system
- Major overhaul required
- Currently lacking fire protection on all floors, except 4th floor

TECHNICAL OBSERVATIONS:

- This building has an older electrical infrastructure, from the incoming power to the distribution panelboards. The majority of the panels have little to no spare capacity for future loads.
- The lighting in this building is fluorescent troffers, mostly surface mounted with acrylic lenses. One floor has been updated with liner fixtures with integrated battery packs. There is no automatic means of shutting off the lighting, including occupancy sensors, daylight harvesting sensors or an EMS (Energy Management System).
- The majority of the buildings exit signs have been updated, however the spacing is not adequate.
- Emergency egress lighting in this building uses remote heads on the exit sings, or wall mounted emergency battery packs. The spacing and quantity of units is not adequate for proper egress foot-candle levels.
- Most HVAC systems serving 1st to 3rd floor need to be replaced, they are original to the building 1946-1956 very old inefficient system; rusty burst leaking coils, dampers, piping, valves, some replaced, but still many needs to be replaced. Return Air [RA] routed thru underground tunnel where steam piping routed, RA temp raised thru this tunnel as some of piping not insulated or insulated with asbestos.
- Also there is asbestos insulation.
- Control is pneumatic, very old rusty valves and actuators, need to be upgraded.
- Domestic cold water piping are original to the building contain lead need to be replaced.
- Booster pump provided for domestic water serving 4th floor only. There is low pressure issue on domestic water serving 2nd and 3rd floor, need to provide new booster pump.
- Steam boilers installed in 2007/2008, not enough capacity, boilers not maintaining required pressure, need to evaluate the system capacity, for possible need for adding additional boiler.
- There are many leaks from roof. No over flow roof drain. New roofing will provide better seal and insulation that will save energy. Code require to install new overflow roof drain system when replacing roof.
- There is no FP for building except 4th floor. Fire pump, stand pipes were added to serve 4th floor when built. Adding new fire protection sprinkler system need to be evaluated, and if possible to grandfather the building, in this case might waive the need for new sprinkler system.

UNDERGRADUATE LIBRARY

Key takeaway: The systems at the Undergraduate Library are in overall adequa
excellent condition.

Year of Construction: 1997
Type: Study, Stacks, Office
Area: 207,338 SF

MAJOR OBSERVATIONS:

- Dock area storm piping leak to be addressed in spring 2019.
- Large cold area at open entrance area on all four floors. Students were wearing their winter coats.
- Heating and cooling needs to be evaluated for additional requirements.
- There are no major electrical concerns, however there is no automatic means of lighting control in the building which does not meet current energy codes.

TECHNICAL OBSERVATIONS:

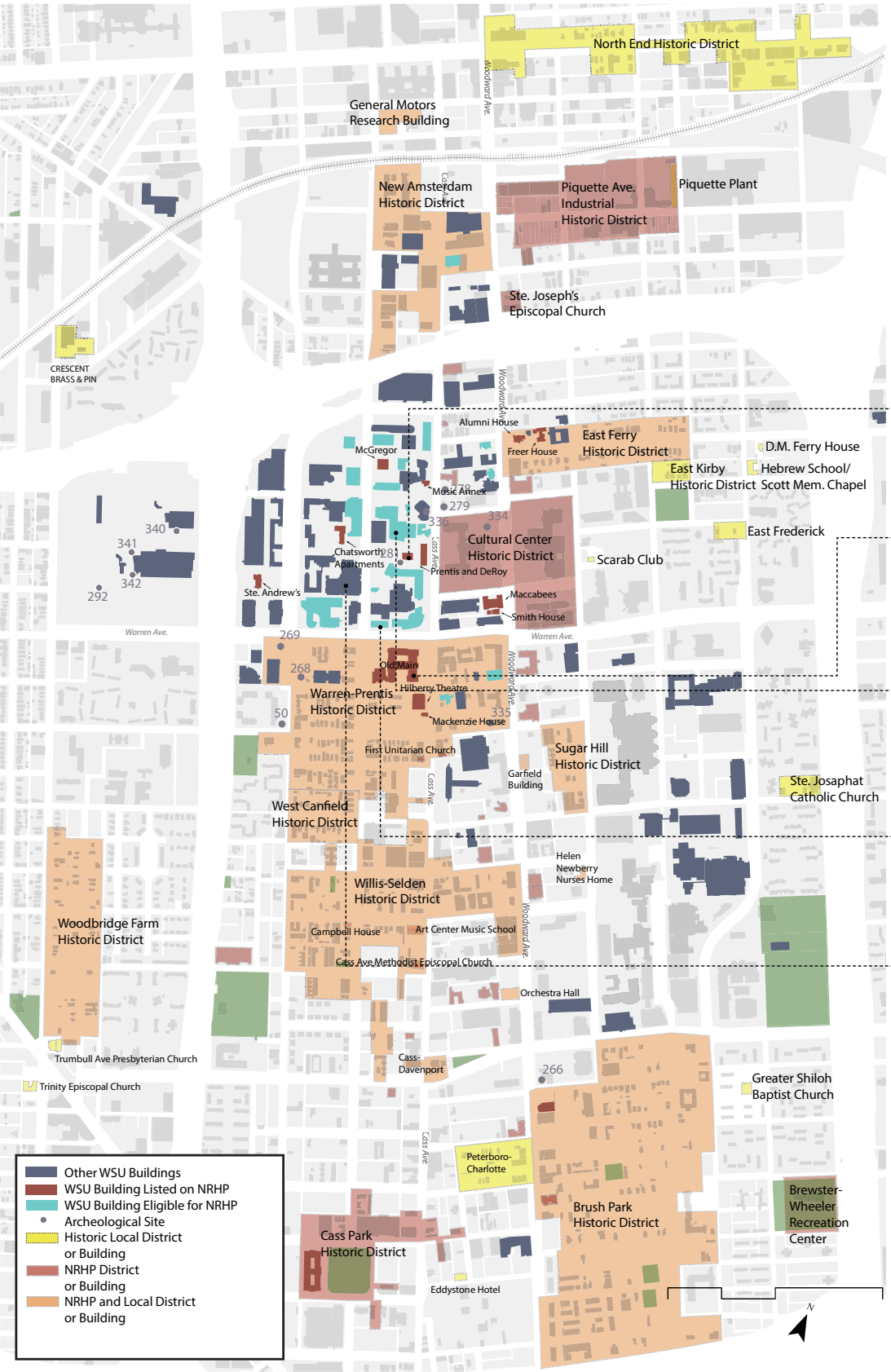
- The incoming power is (2) 4800V lines incoming into a medium voltage switchgear for 480V distribution. Although this is not a 13.2KV service, it is understood that there is a redundant line and service has been reliable.
- Heating hot water pumps were replaced. Operators are very happy with new pumps.
- DDC Controls.

BUILDING DEPENDENCY:

- Heating hot water comes from Bio Science building.

HISTORIC RESOURCES

LORD AECK SARGENT



CAMPUS HISTORIC RESOURCES MAP

FOCUS BUILDINGS:

DEROY AUDITORIUM

Yamasaki & Associates
Construction:1964
Historic designation: National register

OLD MAIN

Malcomson & Higginbotham
Construction: completed 1894, Additions 1908, 1937; renovated 1995
Historic designation: National register

PURDY KRESGE

Pilafian and Montana
Construction:1953
Historic designation: eligible

LIFE SCIENCE

Albert Kahn Assoc
Construction: 1959
Historic designation: eligible

UNDERGRADUATE LIBRARY

BEI ASSOC.
Completed 1997
Historic designation: not eligible

BUILDING TREATMENT APPROACH

PRESERVATION

This approach is used when a historic building or space retains much of its character-defining features and is in stable condition. Maintenance and repair work seeks to retain and protect historic features.

RESTORATION

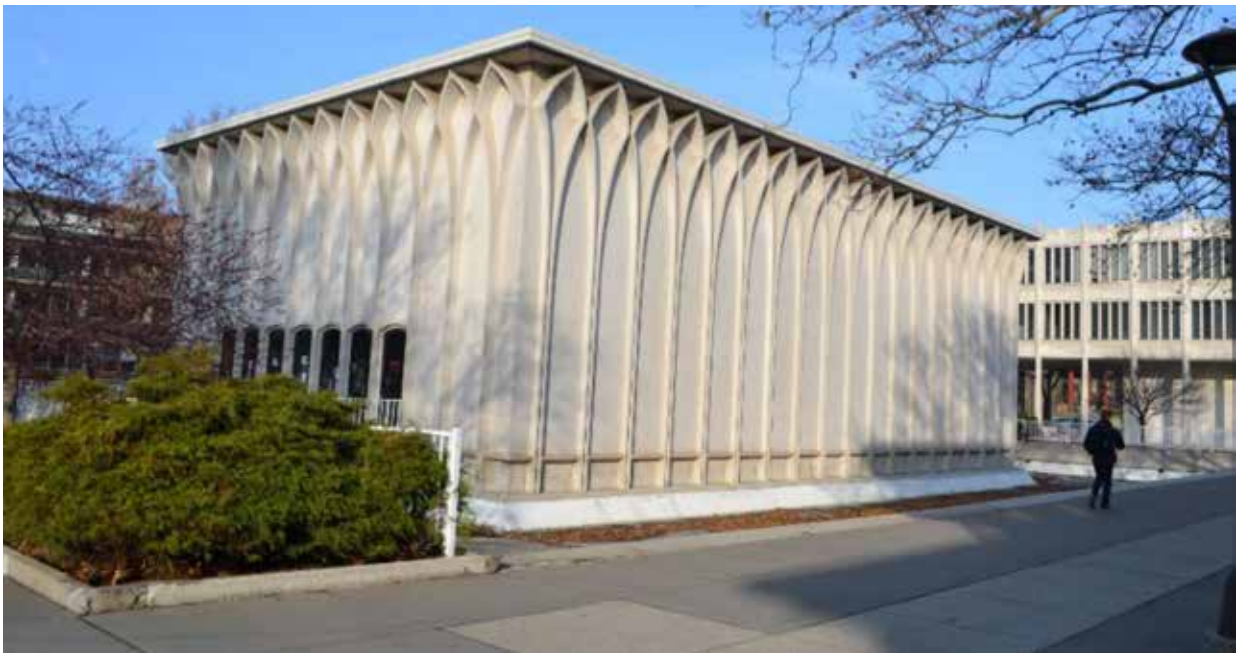
This approach is used when a significant historic building or space has lost some of its character-defining features or where those features are covered or obscured by non-historic work. New projects should seek to restore the historic features with in kind materials and the least invasive approach.

REHABILITATION

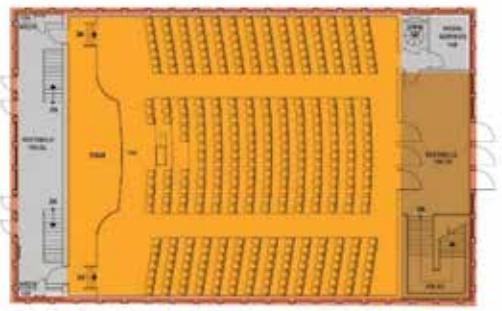
For historic buildings and spaces that retain their character-defining features, but where use, function, or condition require a more significant intervention. New projects should seek to maintain, protect, and/or repair historic features where feasible, while striking a balance with the introduction of new materials, features, systems, or spaces.

RENOVATION

Where the historic building or space has little to no character-defining features. Projects should seek to optimize the building or space according to campus needs. New projects should only consider impacts to adjacent historic buildings or spaces.



Basement level



First floor level

Second floor level

Restoration zone
Rehabilitation zone
Preservation zone
Renovation zone

DEROY AUDITORIUM

OVERALL CONDITION: GOOD

- Localized spalling on precast panels
- Exterior paving damage, handrail corrosion
- Reflecting pool has been drained due to leaks in Prentis basement

POINTS FOR FURTHER DISCUSSION

- Building treatment approach
    - Restoration and Rehabilitation
- Treatment of Reflecting Pool
    - Restoration
    - Sensitive Adaptive use
- ADA access issues – Basement level accessible but through Prentis

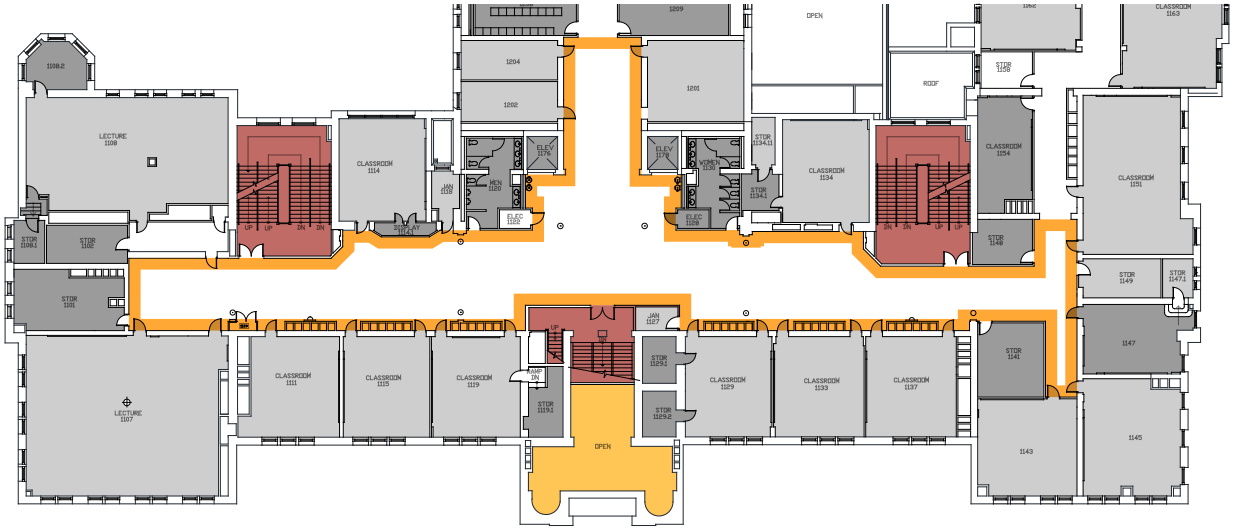
CHARACTER-DEFINING FEATURES

Exterior

- Precast concrete panels with exposed aggregate
- Arched doors and entry sequence
- Aluminum handrails
- Reflecting pool, floating slab, bridges, etc.

Interior

- Light-toned natural wood elements
- Aluminum door hardware
- Light fixtures
- HVAC grills
- Stone flooring and baseboards
- Floating stair
- Wood and aluminum handrails
- Wall recesses and curves


Restoration zone
Rehabilitation zone
Preservation zone
Renovation zone

OLD MAIN

OVERALL CONDITION: GOOD/FAIR

- Localized roof leaks
- Window seal failures
- Areas of organic staining on masonry
- Elevator out of service
- Significant renovations in 1995 – systems and components are likely nearing end of service life

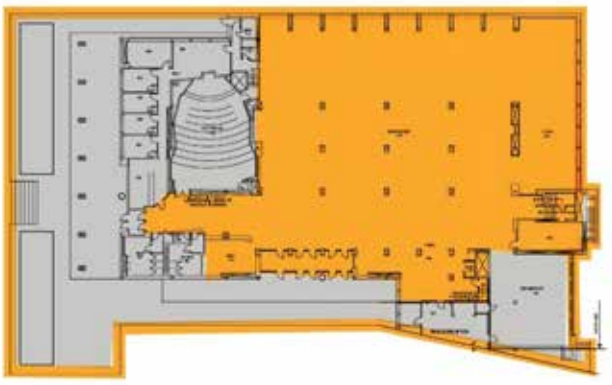
POINTS FOR FURTHER DISCUSSION

- Classroom Utilization – opportunities for efficiencies
- Consolidation of scattered departmental spaces
- Outlier uses – eg: Kinesiology
- Music Department Requirements: sound bleed issues
- Storage/Archival Issues
- Opportunity for purpose designed spaces for Museum, Art Gallery

CHARACTER DEFINING FEATURES

- Exterior
- Interior columns
- Molded plaster ceilings and beams
- Decorative metal elevator surround
- Glazed ceramic tile floor
- Stairs, hand and guard rail, and wainscot in stairwells
- Wainscot, display cases, doors and door frames and other historic woodwork.
- Stone wainscot, iron stairs, terrazzo flooring, and decorative plaster in vestibules.

Purdy first floor level



Kresge first floor level

Restoration zone
Rehabilitation zone
Preservation zone
Renovation zone

PURDY - KRESGE

OVERALL CONDITION: FAIR

- Spalling at eyebrows
- Stone repair in on-going
- Localized leaks
- Roof nearing end of service life
- Sealant failure at windows (asbestos containing material)
- Asbestos floor tiles

POINTS FOR FURTHER DISCUSSION

- Removal of stacks and creation of study space appears to be ad hoc
- Lack of access to outlets hindering usage by students
- Need for additional group study space / rooms
- Storage/archival needs
- Suitability of Kresge 3rd floor office space use (digital media projects)

CHARACTER-DEFINING FEATURES

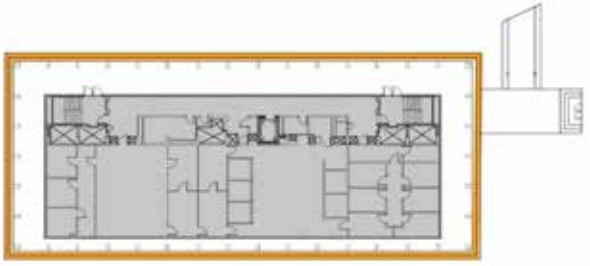
Exterior

- Horizontality
- Projecting floorplates
- Stone trim

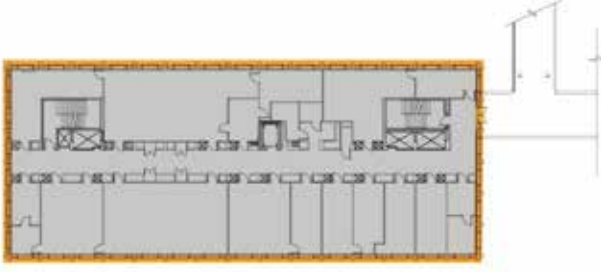
Interior

- Exposed block and brick walls
- Drop beams with integral lighting
- Polychromatic ceramic tile accent walls
- Aluminum handrails
- Light-toned wood panels, columns, and doors
- Large aluminum framed windows
- Terrazzo flooring

Basement level



First floor level



Other typical floor level

Restoration zone
Rehabilitation zone
Preservation zone
Renovation zone

LIFE SCIENCE

OVERALL CONDITION: POOR

- Envelope/cladding/structural issues at ground floor
- Roof at end of service life
- Outdated mechanical systems
- Non-functional fire alarm system

POINTS FOR FURTHER DISCUSSION

- Rehabilitation/Adaptive use potential
- Prominent location at head of Gullen Mall
- Treatment of ground floor
- Possible new (non-laboratory) compatible use
- Entrance and ADA access

UNDERGRADUATE LIBRARY

OVERALL CONDITION: GOOD

- Localized areas of masonry efflorescence on exterior masonry
- Localized window seal failures

POINTS FOR FURTHER DISCUSSION

- Restrooms not sufficient
- Honors College outgrowing space
- Disability Services location not easily accessible
- Storage/capacity
- HVAC/ comfort issues
- Noise issues – the library conducts public programs in the atrium, however the noise migrates to the study areas in the building

THE WAYNE FRAMEWORK 2019 APPENDIX

DUMONTJANKS

Deep Dive Detroit
Gage Cartographics
Ghafari Associates
Gorove/Slade
Lord Aeck Sargent