

Application of Alternative Intersection Designs

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Overview

- Purpose
- Literature Review
- Methodology
- Analysis
- Pending Work
- Results
- Recommendations
- Other considerations

Purpose

Determine the feasibility of implementing alternative intersection designs to alleviate congestion and improve current and future level of service (LOS) at the intersection of N. Tryon St and W.T. Harris Blvd.



Literature Review

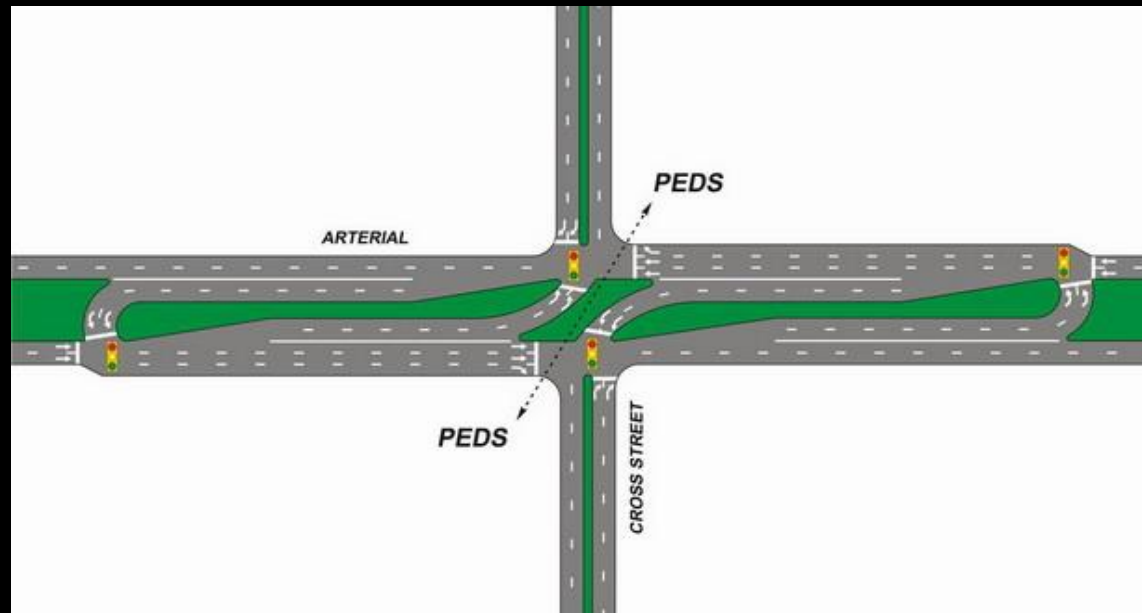
- Median U-Turn (MUT)
- Superstreet
- Continuous Flow
- Quadrant
- Continuous Green “T”
- Echelon
- Center-Turn Overpass (CTO)

Median U-Turn (MUT)



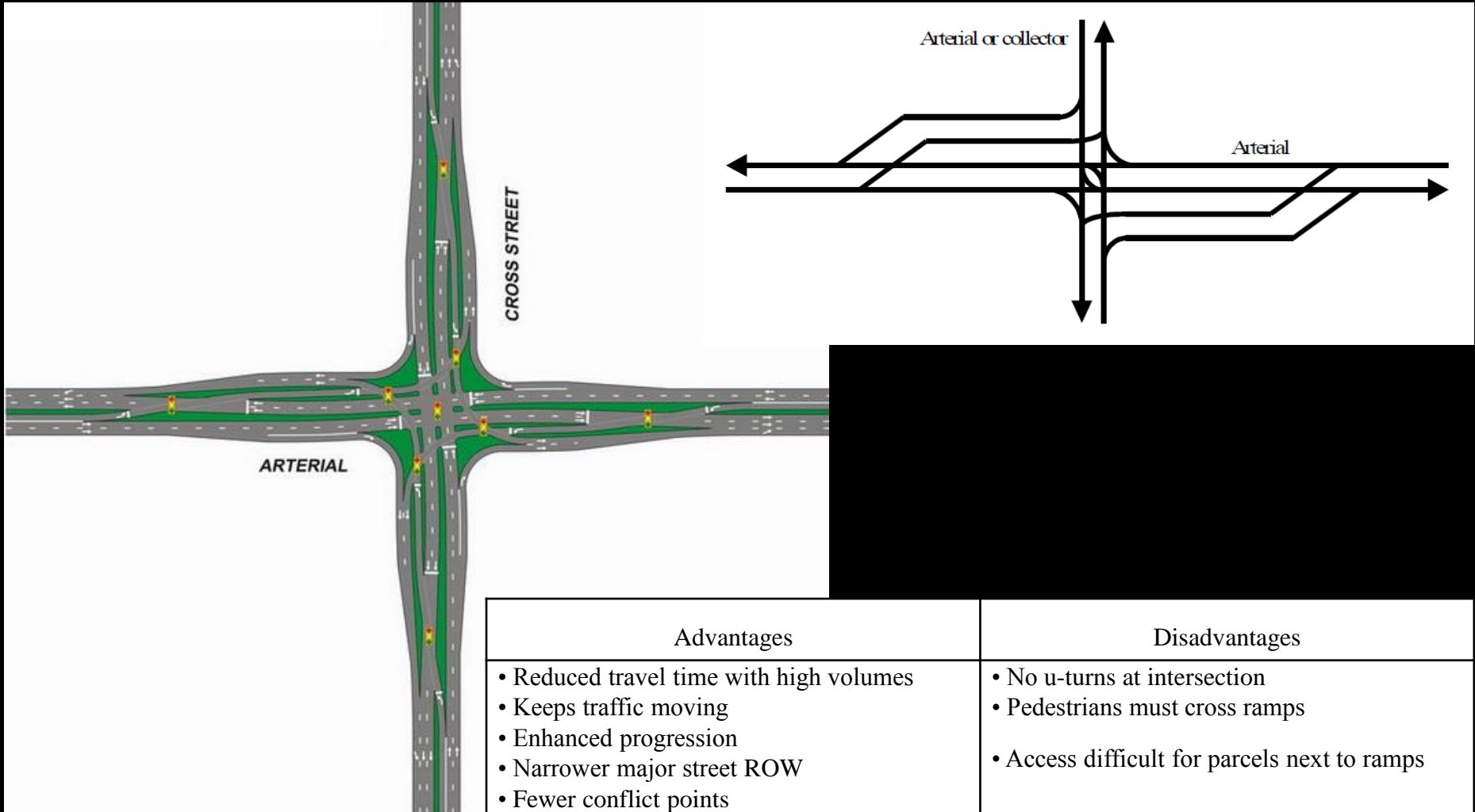
Advantages	Disadvantages
<ul style="list-style-type: none">• Increased capacity• Reduced travel time• Enhanced progression• Fewer threats to pedestrians• Fewer conflict points• Lower collision rates	<ul style="list-style-type: none">• Left turn delay• Left turn travel distance• Left turn stops• Wider right-of-way• Higher minimum green time for pedestrians• Indirect left turns into businesses• Wide median means less business visibility

Superstreet



Advantages	Disadvantages
<ul style="list-style-type: none">• Perfect two-way progression with any signal spacing!• More efficient with light minor street volumes• Should be safer• All pedestrian crossing controlled• Works well on an arterial lined with development	<ul style="list-style-type: none">• Less efficient with heavy minor street volumes• Wider right-of-way• Two stage pedestrian crossing• Indirect left turns into businesses• Wide median means less business visibility

Continuous Flow



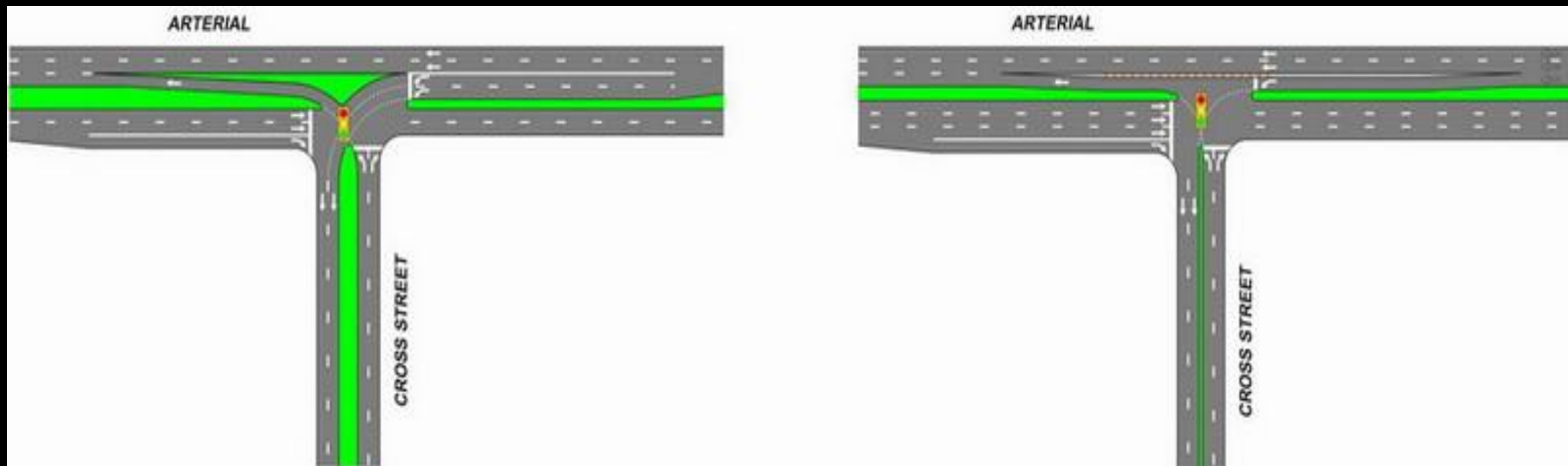
Advantages	Disadvantages
<ul style="list-style-type: none">• Reduced travel time with high volumes• Keeps traffic moving• Enhanced progression• Narrower major street ROW• Fewer conflict points	<ul style="list-style-type: none">• No u-turns at intersection• Pedestrians must cross ramps• Access difficult for parcels next to ramps

Quadrant



Advantages	Disadvantages
<ul style="list-style-type: none">• Typically vies with median u-turn as most efficient unconventional design• Major and minor streets can have narrow rights-of-way• Connector road provides development opportunity• Some pedestrians have shorter, simpler crossing	<ul style="list-style-type: none">• Some left turns have more travel time, distance, stops• ROW for connector road• No u-turns at main intersection• No driveways opposite ends of connector road• Some pedestrians must cross connector road too

Continuous Green "T"



Advantages	Disadvantages
<ul style="list-style-type: none">• Lower travel times• Narrow ROW	<ul style="list-style-type: none">• Median design difficult• Right-in-right-out driveways only on top of the T

Echelon



Advantages	Disadvantages
<ul style="list-style-type: none">• Much higher capacity than at-grade intersections• Much lower travel time than at-grade intersections• Enhanced progression for both streets• Meters traffic to help downstream signals	<ul style="list-style-type: none">• High structure cost• Access impaired to 3 quadrants• No u-turns at or near interchange• Pedestrians must climb grades or cross streets unprotected by signals

Center-Turn Overpass (CTO)



Advantages	Disadvantages
<ul style="list-style-type: none">• Much higher capacity than at-grade intersections• Much lower travel time than at-grade intersections• Enhanced progression for both streets• Meters traffic to help downstream signals• Direct pedestrian crossing• Access to roadside businesses similar to conventional intersection with medians	<ul style="list-style-type: none">• High structure cost• Difficult to design if streets are not perpendicular• Visibility to businesses blocked by structure• Cost to obtain rights to design

Methodology

- Selection of Intersection Designs
- Intersection Evaluation

Selection of Intersection Designs

- Continuous Flow
- Echelon
- Center-Turn Overpass

Intersection Evaluation

- Selected Intersections compared to scaled satellite images and Existing signal plans
 - Continuous Flow Intersection found to be too large
 - Other intersection designs also found to be too large
- Determined that disallowing left turns on W.T. Harris Blvd was a viable option.

Analysis: Traffic Volumes

Year	% Growth	Tryon From North (Toward Charlotte)			W.T. Harris (From West)			Tryon From South (Toward Concord)			W.T. Harris (From East)			Growth Rate
		Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
2002	-	47	491	408	272	2018	172	204	835	422	412	1519	228	-
2008	-	169	435	437	191	2017	299	225	784	398	371	1323	196	-
2010	1.7	175	450	452	198	2086	309	233	811	412	384	1368	203	-
2011	2	178	459	461	202	2128	315	237	827	420	391	1396	207	1.02
2012	2	182	468	470	206	2170	322	242	844	428	399	1424	211	1.04
2013	2	185	477	480	210	2214	328	247	861	437	407	1452	215	1.06
2014	2	189	487	489	214	2258	335	252	878	446	415	1481	219	1.08
2015	2	193	497	499	218	2303	341	257	895	454	424	1511	224	1.10
2016	2	197	507	509	222	2349	348	262	913	464	432	1541	228	1.13
2017	2	201	517	519	227	2396	355	267	931	473	441	1572	233	1.15
2018	2	205	527	530	231	2444	362	273	950	482	450	1603	238	1.17
2019	2	209	538	540	236	2493	370	278	969	492	459	1635	242	1.20
2020	2	213	548	551	241	2543	377	284	988	502	468	1668	247	1.22
2021	2	217	559	562	246	2594	385	289	1008	512	477	1701	252	1.24
2022	2	222	571	573	251	2646	392	295	1028	522	487	1735	257	1.27
2023	2	226	582	585	256	2699	400	301	1049	533	496	1770	262	1.29
2024	2	231	594	596	261	2753	408	307	1070	543	506	1806	267	1.32
2025	2	235	606	608	266	2808	416	313	1091	554	516	1842	273	1.35
2026	2	240	618	620	271	2864	425	319	1113	565	527	1878	278	1.37
2027	2	245	630	633	277	2921	433	326	1135	576	537	1916	284	1.40
2028	2	250	643	646	282	2980	442	332	1158	588	548	1954	290	1.43
2029	2	255	655	658	288	3039	451	339	1181	600	559	1993	295	1.46
2030	2	260	669	672	294	3100	460	346	1205	612	570	2033	301	1.49

$$\text{Growth Rate} = 100 * [(A/P)^{(1/n)} - 1]$$

Analysis: Synchro

- Files from Caroline Kone's thesis
- Laneage with respect to existing footprint
- Synchro analysis completed for
 - Existing
 - Echelon
 - CTO
 - No left turn from W.T. Harris Blvd
- LOS D or better required

Pending Work

- Cost analysis
- Construction time

Results

Design	2010 LOS	Failure Year	Years Viable
Existing	E	2010	0
Echelon	B	2028	18
CTO	B	2029	19
N LT Harris	C	2019	9

Recommendations

- Center-Turn Overpass
 - Longest viable lifespan, based on LOS.
 - Best option when considering the Light-rail
 - Smaller ramps; could be built quicker
 - Possibly used in conjunction with disallowing left turns on W.T. Harris Blvd, or entire intersection, during construction.
- Still need to consider cost

Other Considerations

- Light-rail
- Impact on surrounding intersections for each design
- Progression

Questions?