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A NATIONAL INVESTIGATION ON THE IMPACTS OF LANE WIDTH ON TRAFFIC SAFETY:

CCST
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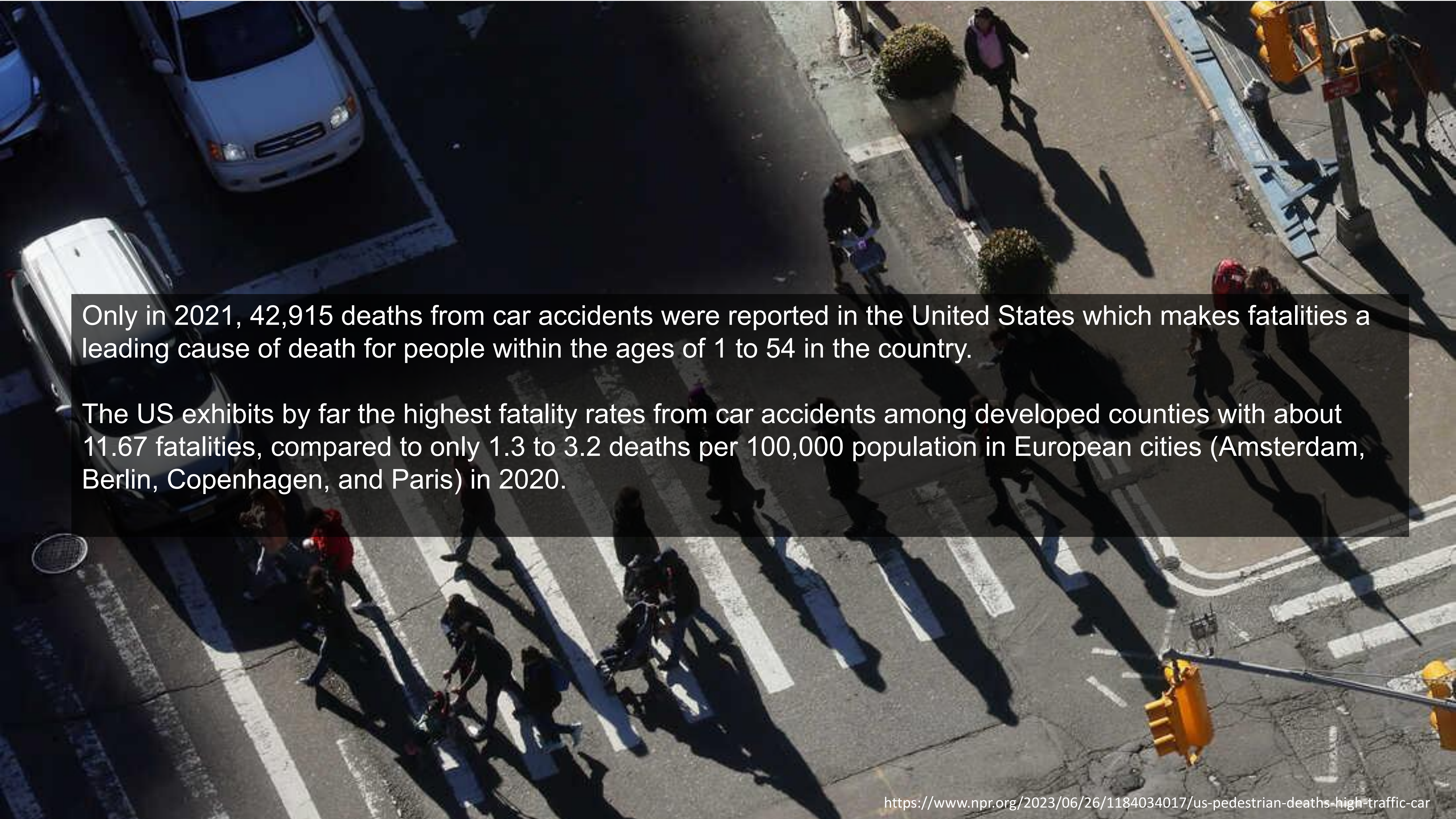
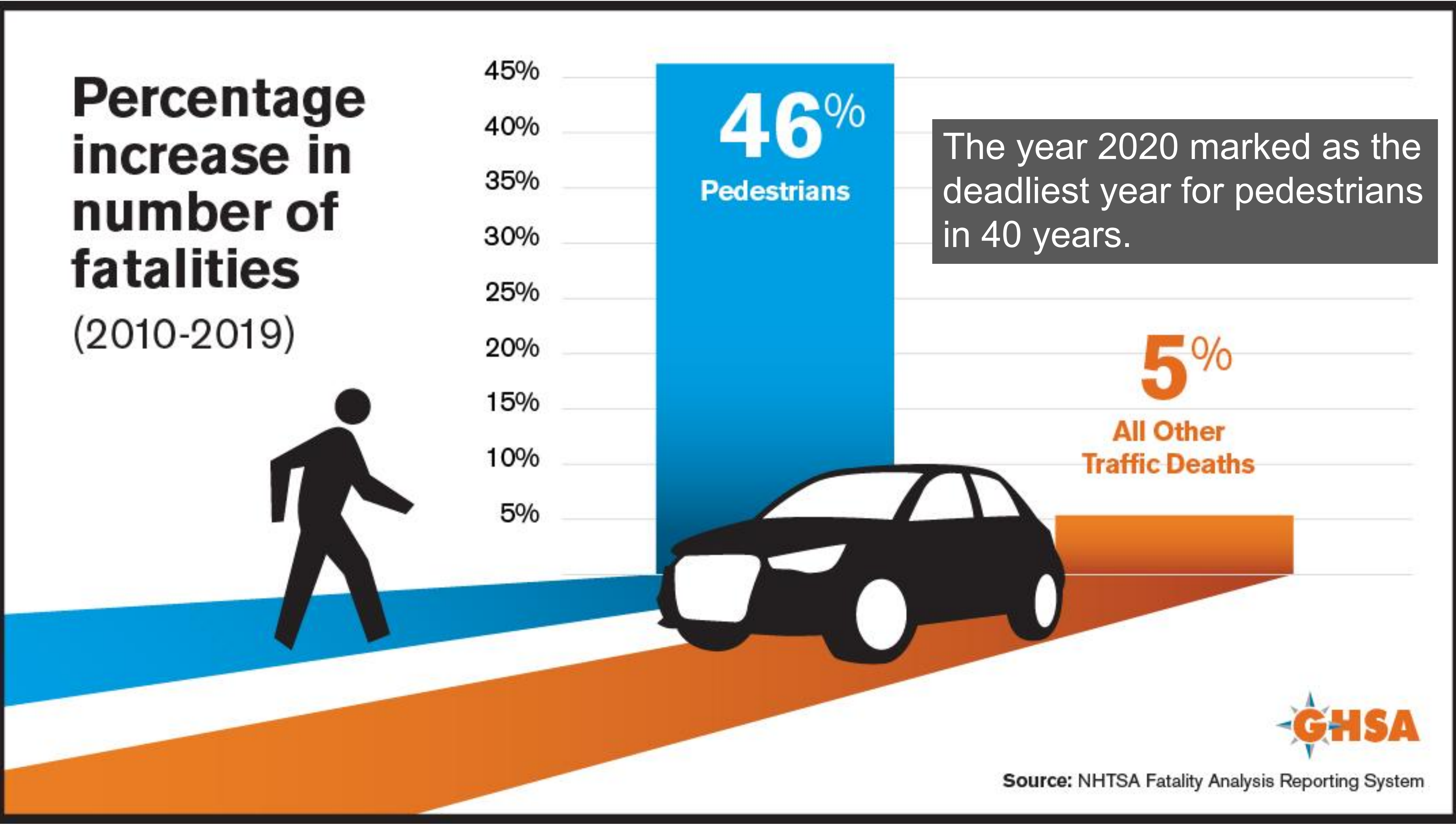


Only in 2021, 42,915 deaths from car accidents were reported in the United States which makes fatalities a leading cause of death for people within the ages of 1 to 54 in the country.

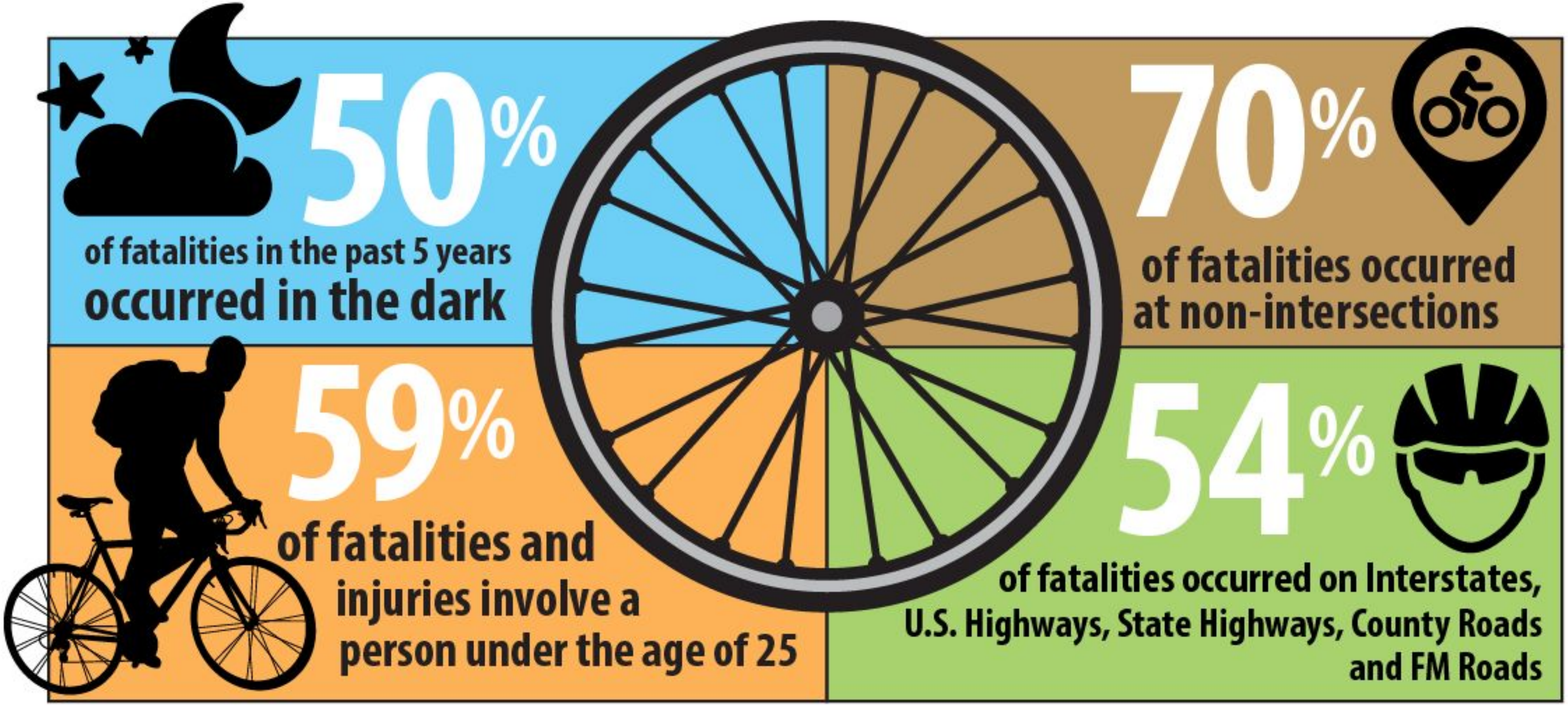
The US exhibits by far the highest fatality rates from car accidents among developed counties with about 11.67 fatalities, compared to only 1.3 to 3.2 deaths per 100,000 population in European cities (Amsterdam, Berlin, Copenhagen, and Paris) in 2020.

https://www.npr.org/2023/06/26/1184034017/us-pedestrian-deaths-high-traffic-car



Percentage increase in number of fatalities
(2010-2019)
45%
40%
35%
30%
25%
20%
15%
10%
5%
46%
Pedestrians
The year 2020 marked as the deadliest year for pedestrians in 40 years.
5%
All Other Traffic Deaths
GHSA
Source: NHTSA Fatality Analysis Reporting System

Biking fatalities are no exception and have experienced an increase of more than 44% from 2010 to 2020.



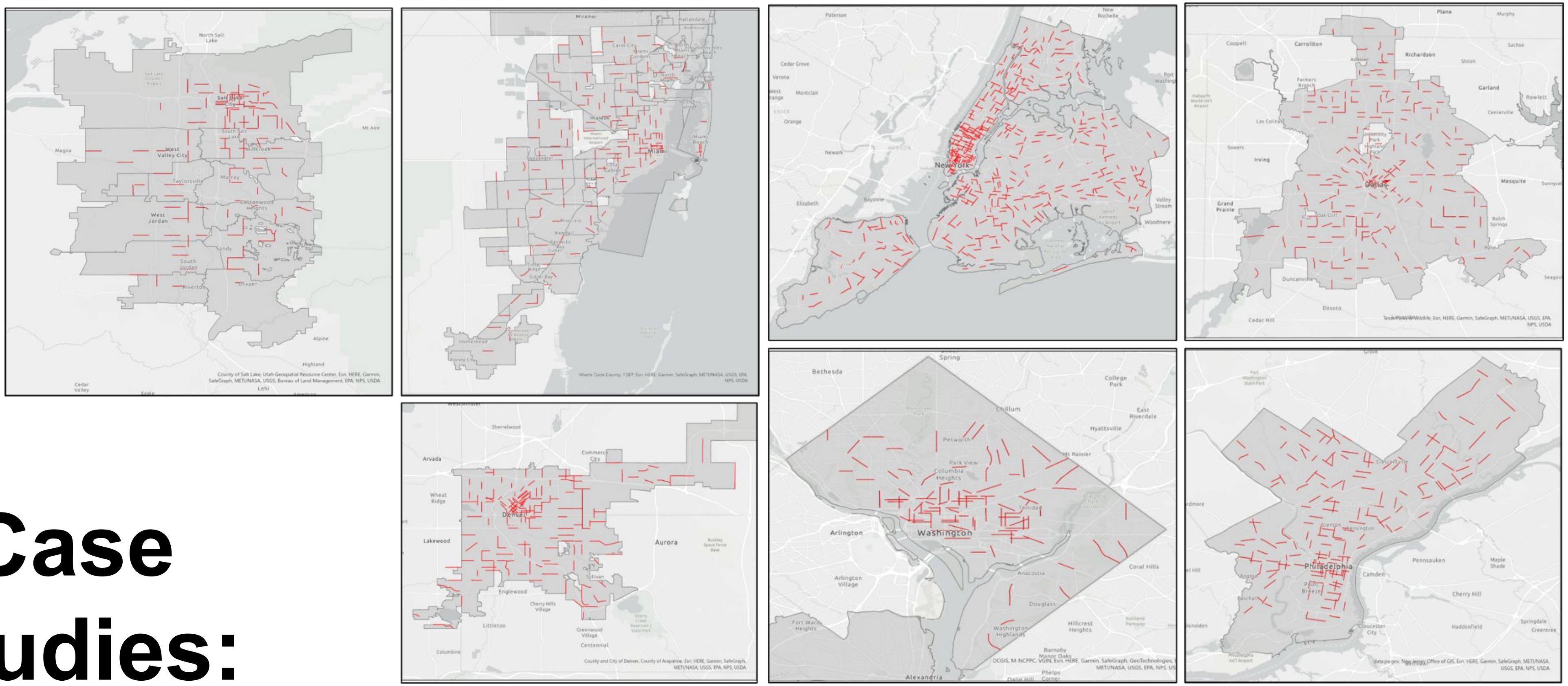
Car-oriented Street Design (Forgiving Design Paradigm)

Lack of Pedestrian and Cyclists Infrastructure

Wide Streets & Wide Lanes

Case Studies:

New York City NY,
Philadelphia PA,
Denver CO,
Salt Lake City UT,
Dallas TX,
Washington DC



City	Sample Size	Mean section length	Minimum section length	Maximum section length
New York City, NY	266	0.571	0.150	1.374
Dallas, TX	184	0.663	0.178	1.68
Washington DC	96	0.493	0.179	0.992
Denver, CO	141	0.701	0.325	1.76
Miami, FL	165	0.83	0.163	1.48
Philadelphia, PA	159	0.640	0.346	1.372
Salt Lake City, UT	106	0.881	0.299	1.78

Data & Variables:

Variable name	Description	Data Sources
crash	Total number of all non-intersection crashes	State DOTs (2017-2019 crash data);
Traffic volume (AADT) in 000s	Annual average daily traffic (AADT) in 1000s	State DOTs (2017-2019)
section length	Length of section (miles)	ArcMap Pro (authors)
lane width	Lane width at a representative point within a section (ft) 9= travel lane width of 9ft or narrower 10= travel lane width of 10 ft 11= travel lane width of 11 ft 12= travel lane width of 12 ft 13= travel lane width of 13 or wider	State DOTs, Google Earth, Google Street View
number of lanes	Number of alignment-specific travel lanes	
median width	Median width at a representative point within a section (ft)	
median type	0 = no median 1 = traversable median (e.g., painted (flush)) 2 = non-traversable median (e.g., depressed, raised, curbed, landscaped, guardrail, etc.)	
Shoulder width	Right shoulder width at a representative point within a section (ft)	
Shoulder type	0 = no shoulder 1 = shoulder on one side of roadway 2 = shoulder on both sides of roadway	
Sidewalk	0 = no sidewalk 1 = sidewalk on one side of roadway 2 = sidewalk on both sides of roadway	
Sidewalk width	Sidewalk width at a representative point within a section (ft)	
Bike lane	0 = no bike lane 1 = bike lane on one side of roadway 2 = bike lane on both sides of roadway	
Bike lane width	bikelane width at a representative point within a section (ft)	
Number of bus stops	Total number of bus stops within the section	
On-street parking	0 = no on-street parking 1 = on-street parking on one side of roadway 2 = on-street parking on both sides of roadway	
On-street parking width	On-street parking width at a representative point within a section (ft)	
Percent parked car	Percentage of park lanes occupied on both sides of roadway	

Left-turn lane	0 = no left-turn lane 1 = at least one left-turn lane	
Right-turn lane	0 = no right-turn lane 1 = at least one right-turn lane	
Street curvature	the curve length divided by the Euclidean distance between two end points (normalized)	
Sky view	Proportion of the sky ahead view at a representative point within a section of the section	
Visual sense of motion	Level of roadside detail (street objects) that provides drivers with cues for vehicle movements and speeds (binary) 1 = the section is very little surrounded by street objects (e.g., buildings, trees, bus shelters, parked cars, etc.) 2= the section is surrounded by both static and dynamic objects (trees, shelters, street furniture, etc.), pedestrians etc.	
Intersection	Number of 3-way and 4-way intersections within a section	
Speed limit	Posted maximum speed limit 25 = posted speed limit of 20-25 mph 35= posted speed limit of 30-35 mph 40= posted speed limit of 40-55 mph	
City ID	Unique identifier for cities where a section is located: 8031 = Denver CO 11001= Washington DC 36061= New York City NY 42101= Philadelphia 48113 = Dallas TX 49035= Salt Lake City UT	

Model 1
Lane Width & the Number of Non-Intersection Crashes

- The number of crashes does not significantly change in streets with a lane width of 9 ft compared to streets with lane widths of 10 ft or 11 ft, after controlling for cross-sectional and street design confounding factors
- The difference becomes noticeable once changing the lane width from 9 ft to 12 ft which, in fact increases the number of crashes.

Variable	B	Std. Error	Wald Chi-Square	Exp(B)	Sig.
(Intercept)	0.441	0.4504	0.958	1.554	0.33
[lane width=13]	0.135	0.2219	0.368	1.144	0.54
[lane width=12]	0.404	0.2071	3.799	1.497	0.049
[lane width=11]	0.215	0.1954	1.207	1.240	0.27
[lane width=10]	0.182	0.1985	0.837	1.199	0.36
[lane width=9] *reference category*				1	
traffic Volume (AADT) in 000s	0.017	0.0052	11.170	1.017	<0.001
street curvature	0.495	0.3247	2.328	1.641	0.13
section length	0.728	0.1990	13.374	2.070	<0.001
number of bus stops	0.036	0.0097	13.920	1.037	<0.001
percent parked cars	0.003	0.0015	3.601	1.003	0.05
number of lanes	0.253	0.0443	32.592	1.288	<0.001
sky view	-0.003	0.0026	1.702	0.997	0.19
intersection	0.030	0.0193	2.335	1.030	0.13
bike lane width	-0.010	0.0175	0.304	0.990	0.58
[visual sense of motion =2]	0.207	0.1199	2.983	1.230	0.084
[visual sense of motion =1] *reference category*				1	
[speed limit=45]	0.332	0.1935	2.952	1.394	0.086
[speed limit=35]	0.178	0.1021	3.050	1.195	0.081
[speed limit=25] *reference category*				1	
[median type=2]	-0.354	0.1329	7.103	0.702	0.008
[median type=1]	0.217	0.1195	3.304	1.242	0.069
[median type=0] *reference category*				1	
[City ID =49035]	0.355	0.1770	4.018	1.426	0.045
[City ID =48113]	0.110	0.1509	0.531	1.116	0.47
[City ID =42101]	-0.498	0.1515	10.801	0.608	0.001
[City ID =36061]	1.662	0.1403	140.203	5.268	<0.001
[City ID =11001]	-0.268	0.1874	2.045	0.765	0.15
[City ID =8031]	0[a]			1	

Model 2
Lane Width & the Number of Non-Intersection Crashes

On the other hand, street sections with 10 ft, 11 ft and 12 ft lanes have significantly higher numbers of non-intersection crashes than their counterparts with 9 ft lanes in the speed class of **30-35 mph**.

Variable	B	Std. Error	Wald Chi-Square	Exp(B)	Sig.
(Intercept)	-0.231	0.7740	0.089	0.794	0.77
[lane width=13]	0.444	0.4361	1.037	1.559	0.308
[lane width=12]	0.850	0.4236	4.024	2.339	0.045
[lane width=11]	0.743	0.4060	3.349	2.102	0.067
[lane width=10]	0.805	0.4019	4.008	2.236	0.045
[lane width=9] *reference category*				1	
traffic Volume (AADT) in 000s	0.017	0.0068	6.463	1.017	0.011
street curvature	0.862	0.4734	3.317	2.368	0.069
section length	0.919	0.2914	9.953	2.507	0.002
number of bus stops	0.022	0.0154	2.086	1.023	0.15
percent parked cars	0.002	0.0023	0.689	1.002	0.407
number of lanes	0.180	0.0645	7.757	1.197	0.005
sky view	1.085E-05	0.0051	0.000	1.000	0.99
intersection	0.008	0.0312	0.065	1.008	0.79
bike lane width	-0.075	0.0277	7.236	0.928	0.007
[visual sense of motion =2]	0.204	0.2031	1.011	1.227	0.32
[visual sense of motion =1] *reference category*				1	
[median type=2]	-0.491	0.1897	6.696	0.612	0.010
[median type=1]	0.231	0.1726	1.792	1.260	0.18
[median type=0] *reference category*				1	
[City ID =49035]	0.396	0.2367	2.795	1.485	0.095
[City ID =48113]	0.305	0.2061	2.190	1.357	0.14
[City ID =42101]	-0.238	0.2287	1.082	0.788	0.29
[City ID =36061]	1.706	0.2310	54.512	5.505	0.000
[City ID =11001]	-0.325	0.3843	0.715	0.723	0.39
[City ID =8031] *reference category*				1	

Discussion and Policy Implications

- Overall, this study found no evidence that narrower lanes are associated with the higher number of crashes and that narrow lanes (9ft. and 10ft.) increase the risk of vehicle accidents, after controlling for cross-sectional street design characteristics and other confounding variables.

- Street sections in the speed classes of 30-35 mph have the greatest potential to be utilized by pedestrians and bicyclists due to their relatively lower speeds.

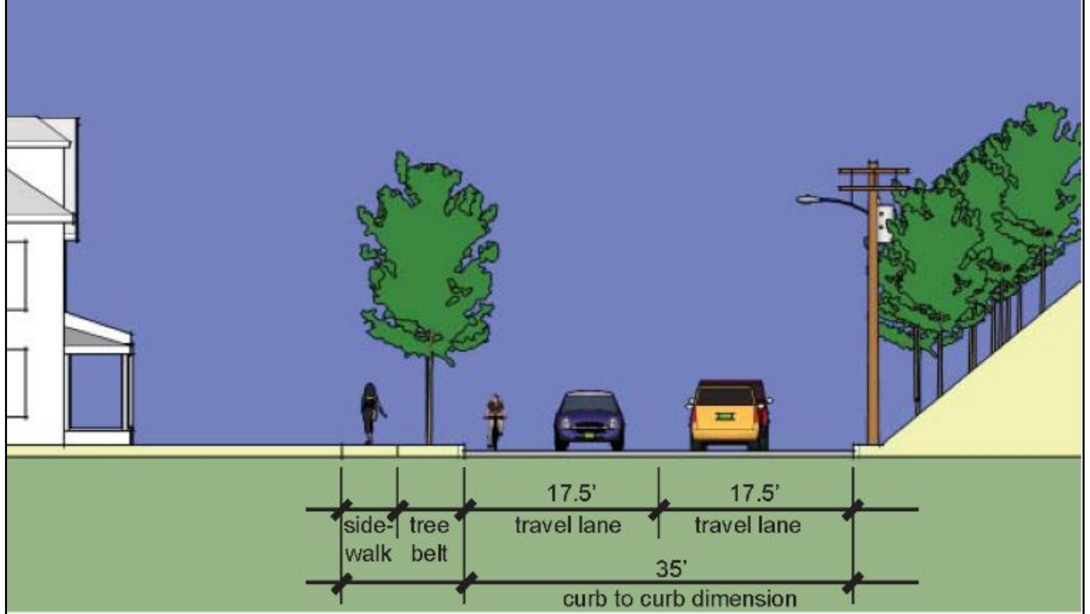
- The most immediate candidates for lane width reduction projects are street sections with lane width of 11 ft, 12 ft or 13 ft in urban street in the class 30-35 mph that do not serve a transit or freight corridor.

- More specifically, of these candidates those that have lower traffic volume (AADT), no or small proportion of on-street parking, low degrees of street curvature, fewer number of lanes, and with no travelable median are the best candidates for the lane width reduction projects, according to our study.

Redesign of Colchester Avenue

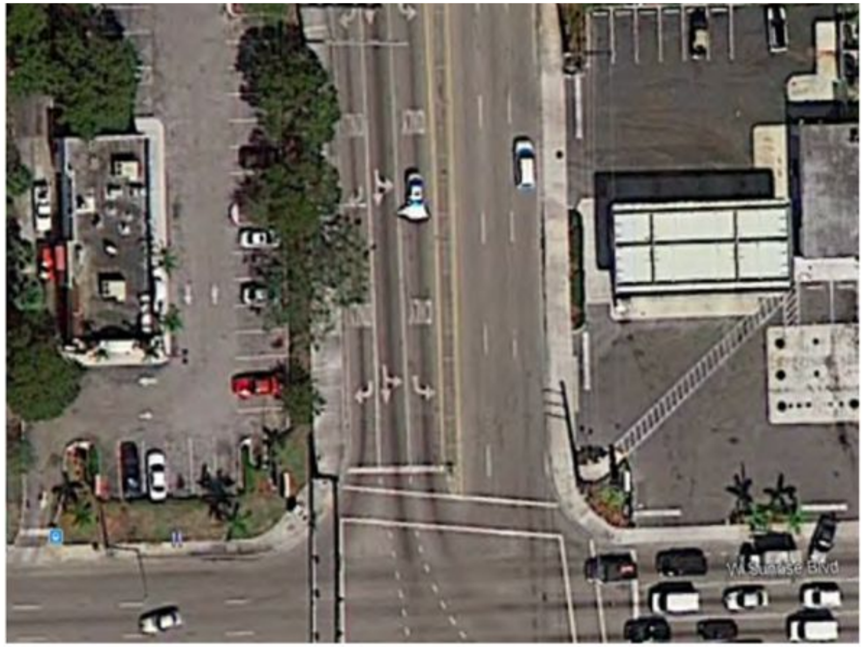
City of Burlington, Vermont

On Colchester Avenue, the presence of a steep slope initially prevented the inclusion of a sidewalk on both sides of the road. Converting the road to a Complete Street reallocates space within the existing roadway zone to make way for two clearly marked bike lanes, two lanes of traffic, and a new sidewalk. The new standard lighting fixture is installed along both sides of the street. www.burlingtonvt.gov/sites/default/files/DPW/TransportationPlan/BTP_Appendix_2_StreetDesign.pdf

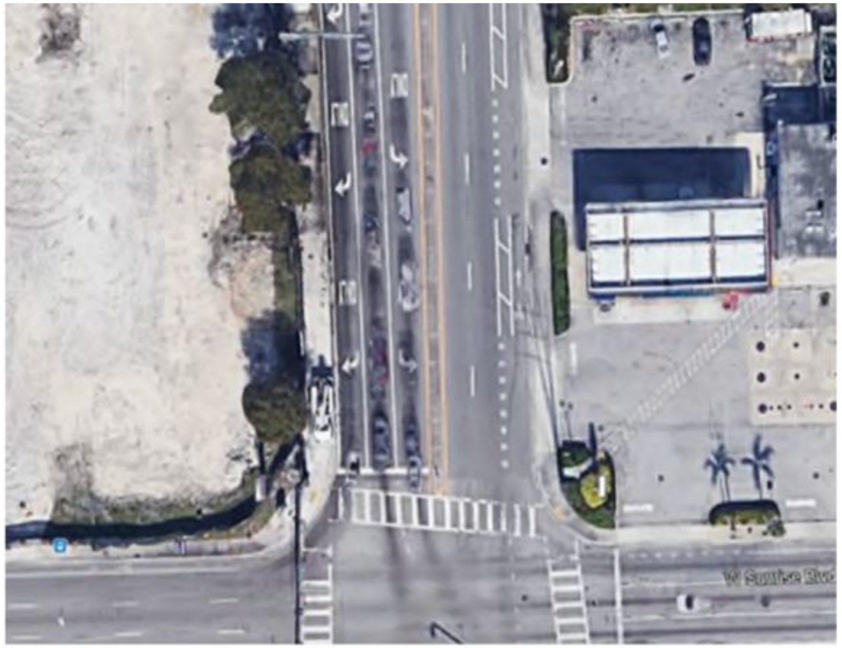


Powerline Road

Fort Lauderdale, Florida



(a) Before



(b) After

4-foot-wide bike lanes were added by **<u>reducing the width of the traffic lanes from 12 feet to 10 feet</u>**

5-foot-wide bike lanes with 3-foot-wide buffers were added by **<u>converting the outside traffic lane to a buffered bike lane</u>**

- Traffic volumes (AADT) remained relatively consistent from 2014 through 2019 (11% increase in this street and surroundings).
- Average daily travel speeds in 2014 in both directions were 27 mph and in 2018, it changed to a little over 25 mph
- Despite slightly more delays in the corridor, the level of service (LOS) has remained at the same level “C”.
- **The level of traffic stress (LTS), has reduced from the highest level, being 4, to one.**

Cleveland Street Road Diet

Newark, Delaware

Reconfiguration of lanes to two through lanes for east and west directions, one center turn lane and bike lanes on both directions

- Vehicle speed was **reduced by 4 mph**. Besides, it has been shown that motorists yield to pedestrians **18 times more**.

- The initial crash data analysis shows a **significant safety improvement**.

Overall Takeaway

Narrowing lanes on its own is not sufficient. **A holistic approach is needed.** Applying multiple speed management strategies can improve results and reduce the average speed of corridors. For instance, in a Florida example, reducing lane width to 11 ft with changing posted speed limit from 50 to 45 mph successfully reduced the average speed by 3 mph. The same trend was observed on Busch Boulevard with the application of Speed Feedback Signs (SFS), median islands, and reducing lane width from 12 ft to 11 ft. Speed reduction is most significant downstream of the boulevard (**4 mph speed reduction**) and SFS signs with narrower lanes, indicating the efficiency of multiple practices in traffic speed management.

- **Public Health Benefits:** Narrowing travel lanes could be the easiest and most cost-effective way to accommodate better sidewalk and bike lane facilities within the existing roadway infrastructure.
- **Safety Benefits:** Our findings confirm that it also improves road safety even for drivers.
- **Equity Benefits:** Other benefits of lane width reduction are increasing roadway capacity and inclusive use of streets by all travel modes.
- **Economic Benefits:** Lane width reduction contributes to minimizing construction/maintenance costs for urban arterials and collectors.
- **Environmental Benefits: N**arrowing lane width would addresses challenging environmental issues by accommodating more users in less space, using less asphalt pavement, less land consumption and smaller impervious surface areas and the consequent effects on the occurrence of urban heat islands in cities.

Center for Climate-Smart Transportation (CCST)

Thank You