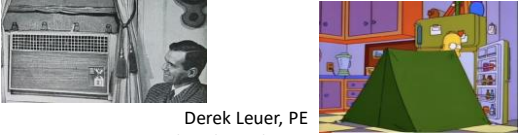


TOWARD ZERO DEATHS MINNESOTA **TOWARD ZERO DEATHS**

Air Conditioning, Land Development, Access Management, Pedestrian Fatalities? How are they Connected?



Derek Leuer, PE
Wednesday, July 19, 2023
minnesotatzd.org

TOWARD ZERO DEATHS MINNESOTA **TOWARD ZERO DEATHS**


Agenda

- World War II
- Air Conditioning
- Access Management
- Development
- Pedestrian Fatalities
- What did we learn?
- Lessons Learned




TOWARD ZERO DEATHS First... let's hop into the way-back machine!

- 1942-1944 – Europe
- Extensive Campaign to cripple the German War Machine
- Bombing of industrial centers and infrastructure Day and Night
- Bombers were taking heavy casualties
- 30 missions – 71% KIA/MIA
- Pushing human psychological limits



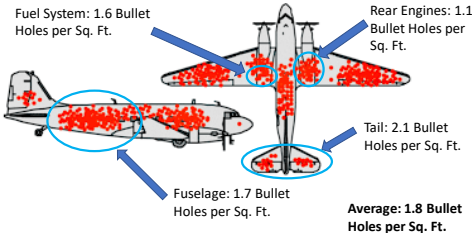
TOWARD ZERO DEATHS First... let's hop into the way-back machine!

- 1943 - Enter Abraham Wald
- Generals asked "What can we do to increase the survival of our airmen, pilots, and planes returning?"
- Add Armor!
 - Too little – useless
 - Too much – slow down/sluggish
- Where to add the Armor?



TOWARD ZERO DEATHS First... let's hop into the way-back machine!

• **Army Air Force had lots of Data!**



Fuel System: 1.6 Bullet Holes per Sq. Ft.

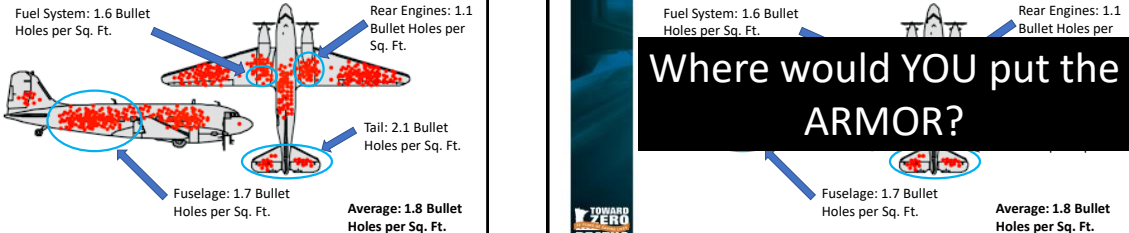
Rear Engines: 1.1 Bullet Holes per Sq. Ft.

Tail: 2.1 Bullet Holes per Sq. Ft.

Fuselage: 1.7 Bullet Holes per Sq. Ft.

Average: 1.8 Bullet Holes per Sq. Ft.

TOWARD ZERO DEATHS First... let's hop into the way-back machine!



Fuel System: 1.6 Bullet Holes per Sq. Ft.

Rear Engines: 1.1 Bullet Holes per Sq. Ft.

Where would YOU put the ARMOR?

Fuselage: 1.7 Bullet Holes per Sq. Ft.

Average: 1.8 Bullet Holes per Sq. Ft.

First... let's hop into the way-back machine!

Fuel System: 1.6 Bullet Holes per Sq. Ft.

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TOWARD ZERO DEATHS

Now... let's go even further in the way-back machine!

- 1902 – Sackett and Wilhelm Lithographing Company
- Summer Issues with heat and humidity
- Ink would smear, paper was “wet” and would “curl”

TOWARD ZERO DEATHS

DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF HEALTH

Air Conditioning

- Willis Carrier
- System of pumps that moved air over metal coils
- Used ammonia
- Pulled the moisture out of the air in the enclosed room!
- Unanticipated – it cooled the room as well!

TOWARD ZERO DEATHS

DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF HEALTH

Air Conditioning

- Expensive to run....
- But it worked!
- Favorite place to eat lunch!

Carrier asked himself,
 “How else can I market and sell this?”

AIR CONDITIONING
 public utility & energy

TOWARD ZERO DEATHS

DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF HEALTH

Air Conditioning

- First – Movie Theatres!
- Expensive, Bulky, Luxury!

This was not transformative overnight. But more efficiency and cheaper power changed everything!

“Air conditioning and cooling for summer may become a necessity rather than a luxury, and we will look upon present times as marking the end of that ‘dark age’ in which there was but relatively little cooling for human comfort.” – Willis Carrier, 1929.

Especially across the Southern US!

TOWARD ZERO DEATHS

DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF HEALTH

Air Conditioning

abc NEWS EXTREME HEAT THIS AFTERNOON

EXCESSIVE HEAT WARNING

HEAT ADVISORY

TOWARD ZERO DEATHS

DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF HEALTH

Air Conditioning

The New York Times

How Air-Conditioning Conquered America (Even the Pacific Northwest)

After the 1950s, air-conditioning enabled not just the construction of millions of Southern homes, but also the economic development of the South. It made possible industrial work like printing, food processing and electrical manufacturing that would be hard to manage in sweltering heat. And it created the possibility for white-collar jobs in mechanically cooled office buildings.

"It's hard to imagine that, say, Birmingham would be a big center of health care industry, or that Atlanta would have the world's busiest airport, or that Jacksonville would be a center for insurance if people were sitting under ceiling fans in hot, humid offices,"

Air Conditioning

So HOW did Air Conditioning change life in the South?

(and much of the world?)

Three Examples:

1. The Baby "Dip"
2. Vernacular and Thermal Architecture
3. Population Shift

Air Conditioning

The Baby "Dip"

In much of the US, birth rates dropped in the 9 months after the hot summer months.

a. Effect of daily mean temperature 9 months later

b. Predictions, by census region

Barreca, Alan; Deschenes, Olivier; Galdi, Melanie (2018). "Maybe next month? Temperature shocks and dynamic adjustments in birth rates". *Demography*, 55 (4)

Air Conditioning

The Baby "Dip"

After the wider deployment and continued use of Air Conditioning, this phenomena gradually receded (but still exists)

If you were born between March and May (and younger than 50), Air Conditioning may be to thank for your arrival!

Barreca, Alan; Deschenes, Olivier; Galdi, Melanie (2018). "Maybe next month? Temperature shocks and dynamic adjustments in birth rates". *Demography*, 55 (4)

Air Conditioning

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Air Conditioning




Vernacular and Thermal Architecture

For most of human history, we lived without Air Conditioning! But How?!?!?

Air Conditioning

Vernacular and Thermal Architecture

<p>Buildings Before:</p> <ul style="list-style-type: none"> Shading Air movement Breezeways Cupolas "Thermal Mass" Small Doors/Windows 	<p>Buildings After:</p> <ul style="list-style-type: none"> Shading Air-movement Breezeways Cupolas "Thermal-Mass" Small Doors/Windows Seal up the Building BRUTE FORCE (with AC)
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Air Conditioning

Vernacular architecture





Air Conditioning has allowed us to build mega-cities in the middle of deserts! (Vegas, Phoenix, Etc)










Air Conditioning

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Air Conditioning

Most Importantly - Population Shift

The south had always been a low density, low population region of the US. Up until the 1960's, the south was in Decline.

Region	1900	1910	1920	1930	1940	1950	1960	1970
WEST	33.4	32.0	29.9	27.9	26.5	25.2	23.8	22.4
SOUTH	22.3	22.0	21.5	20.8	21.6	21.8	22.2	22.7
MIDWEST	34.7	32.5	29.2	25.4	23.3	21.3	20.4	19.4
NORTHEAST	27.7	28.1	28.1	28.0	27.3	26.2	24.9	23.5




Air Conditioning

Most Importantly - Population Shift – The Great Migration

From 1910-1970, over 6 million African Americans fled the South

Numerous Reasons:




- Few Economic Opportunities – industrial jobs in the North
- Jim Crow Laws – Only in the Southern States (Old Confederacy)
- Lynchings & Racism (Racism still in the North, but not nearly as bad)



African Americans went from being primarily rural farm hands to an urbanized factory working demographic within a few generations.

The Great Migration was one of the largest and most rapid mass [internal movements](#) in history—perhaps the greatest not caused by the immediate threat of execution or starvation. In sheer numbers, it outranks the migration of any other ethnic group—Italians or Irish or Jews or Poles—to the United States. For Black people, the migration meant leaving what had always been their economic and social base in America and finding a new one.

- Nicholas Lemann








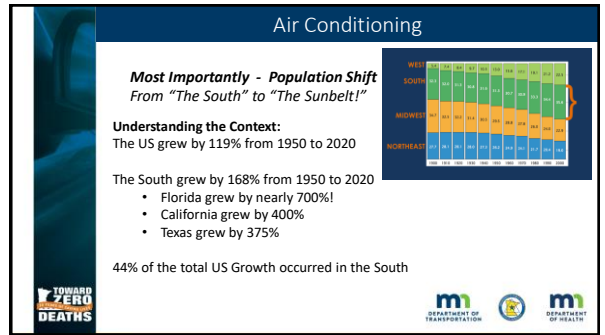
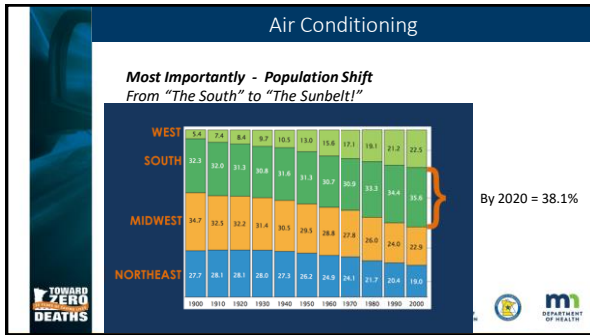
Air Conditioning

Most Importantly - Population Shift

After the 1960's, population growth in the south became much more prevalent:

- Civil Rights Act of 1960, 1964, and 1968
- Voting Rights Act of 1965 (Reversing the Great Migration)
- Underdeveloped and Cheap Land
- Low Taxes
- **Affordable Air Conditioning!**



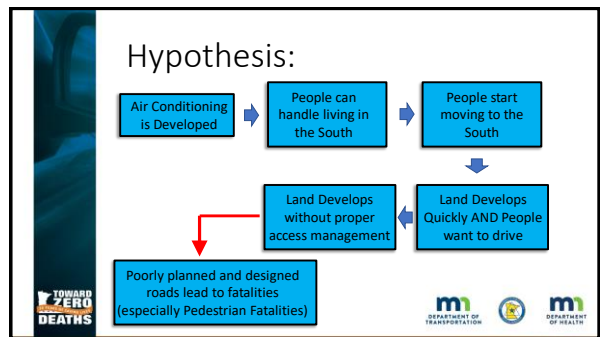
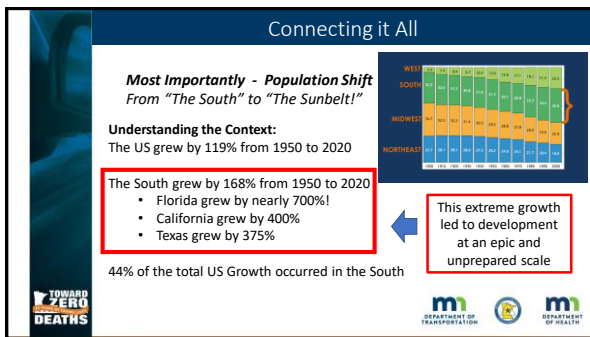
Air Conditioning

So HOW did Air Conditioning change life in the South?
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Three Examples:

1. The Baby "Dip"
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TOWARD ZERO DEATHS | DEPARTMENT OF TRANSPORTATION | DEPARTMENT OF HEALTH



Access Management and Land Development

Some basic Transportation 101

- Transportation has two functions:
 - Mobility and Access
- With Roads... these two directly conflict with each other.
 - As access goes up (residential neighborhood) mobility goes down (low speed)
 - If mobility is needed, access needs to be constrained (remove conflict, but increased speeds)

Access Management and Land Development

Some basic Transportation 101

- All Mobility - Interstates (full access control) tend to be the safest (per VMT)
- All Access – residential streets also the safest
 - Function, Speed, Expectations
- When we mix access and mobility – we get more crashes!
 - More conflict, more speed, more distraction

Access Management and Land Development

Minnesota and the South developed differently; likely due to just timing and history!

South – quick development

Minnesota has been able to work with local transportation and land development to ensure this hierarchy of transportation is followed (mostly).

Access Management and Land Development

Well Planned– We can say “We are in the Mobility Business – get your access from the locals!”

South – give the access to promote development!

Why Act Now?

Access Management and Land Development

[Introduction to Stroads - You Tube](#)

Access Management and Land Development

Why Act Now?



Access Management and Land Development

10 Deadliest Congressional Districts

District	Area(s)	Annual Fatal Crash Rate	
1	Arizona 7th	West and South Phoenix	4.5
2	Nevada 1st	Las Vegas and south suburbs	4.2
3	South Carolina 6th	Parts of Charleston and Columbia and rural areas in-between	4.1
4	Florida 24th	Northern suburbs of Miami	4.0
5	Florida 13th	Clearwater and St. Petersburg	3.9
6	Florida 5th	Tallahassee-to-Jacksonville	3.8
7	Texas 35th	San Antonio-to-Austin	3.6
8	Michigan 13th	Detroit plus some western suburbs	3.4
9	Florida 10th	Northern, western and southern suburbs of Orlando	3.4
10	Florida 6th	South Jacksonville suburbs to North Orlando suburbs	3.4
U.S. Average		1.6	



Access Management and Land Development

10 Deadliest Congressional Districts

District	Area(s)	Annual Fatal Crash Rate	Growth (1950-2020)
1	Arizona 7th	West and South Phoenix	725%
2	Nevada 1st	Las Vegas and south suburbs	2600%
3	South Carolina 6th	Parts of Charleston and Columbia and rural areas in-between	234%
4	Florida 24th	Northern suburbs of Miami	545%
5	Florida 13th	Clearwater and St. Petersburg	776%
6	Florida 5th	Tallahassee-to-Jacksonville	572%
7	Texas 35th	San Antonio-to-Austin	
8	Michigan 13th	Detroit plus some western suburbs	
9	Florida 10th	Northern, western and southern suburbs of Orlando	
10	Florida 6th	South Jacksonville suburbs to North Orlando suburbs	
U.S. Average		1.6	

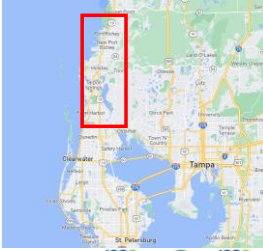

How does it all tie together?

The deadliest road in America
Being speedier than the US was already dangerous, it's getting even more so.

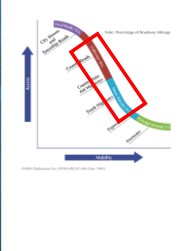
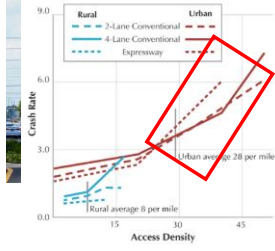
<https://www.vox.com/23178764/florida-us19-deadliest-pedestrian-fatality-crisis>

How does it all tie together?

- US 19 in Pasco County, Florida
- North of Clearwater/Tampa
- Dense Land Use
- Little Access Management
- High Speed (45-55 MPH)
- 6 lanes + Turn Lanes

How does it all tie together?

MDOT Research Report 1998-27
"Statistical Relationship Between Vehicular Crashes and Highway Access"

Rural refers to a non-municipal area and ones with a population less than 5,000.

How does it all tie together?

- Not really a highway
- Not really a street
- Plentiful Access
- Transit
- Apartments/Dense Residential
- Many Lanes
- High Speed



48 Pedestrians Killed from 2017-2022 (in Pasco County alone)



How does it all tie together?

- Not really a highway
- Not really a street
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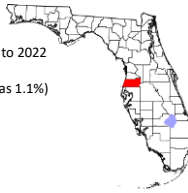



48 Pedestrians Killed from 2017-2022 (in Pasco County alone)



How does it all tie together?

- Pasco County grew by **2900%** from 1950 to 2022
- Sustained growth of 4.8% from 1950 (US was 1.1%)

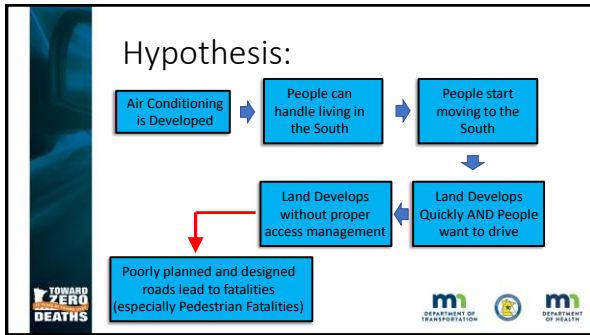



How does it all tie together?

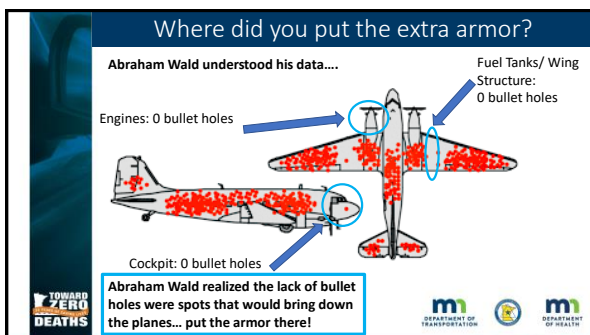
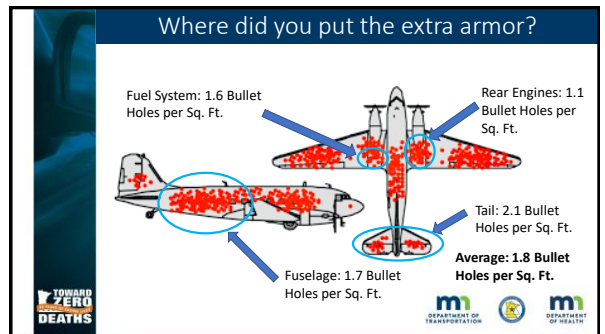
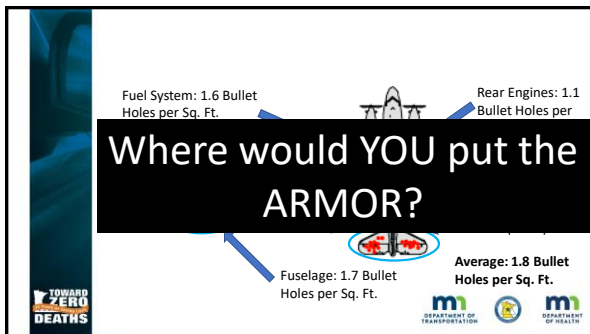
- Not r
- Not r
- Plent
- Trans
- Apar
- Man
- High







- ### Lessons Learned
- Cities and Counties deal with these land development decisions all the time!
 - Traffic Safety isn't always on the top of priorities (or clearly an issue)
 - These issues take years (or decades) to manifest themselves
 - Access Management, Land Development, and Safety are intricately linked
 - Take the time so others understand
 - Cities and Counties want that development (make sure it happens in the right way and at the right place)
 - Once the ship has sailed, it is hard to turn around!
- Logos: TOWARD ZERO DEATHS, MI, DEPARTMENT OF TRANSPORTATION, MI, DEPARTMENT OF HEALTH



- ### Lessons Learned
- Know Your Data! Understand where it is coming from (and what is missing?)
 - No crashes or safety issue doesn't mean there won't be one in the future (where are your bullet holes missing?)
 - We are often subject to forces way beyond our control!
 - (COVID, Smart Phones, Legalization of Marijuana?)
 - Access Management, Land Development, and Safety are intricately linked
- Logos: TOWARD ZERO DEATHS, MI, DEPARTMENT OF TRANSPORTATION, MI, DEPARTMENT OF HEALTH

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<https://99percentinvisible.org/episode/thermal-delight/>
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- Smart Growth for America – Pedestrian Safety Analysis
- Confessions of a Recovering Engineer - Chuck Marohn

TOWARD
ZERO
DEATHS

