AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- <u>Pedestrians Accidents</u>
  - 15 to 45 percent of traffic accidents
  - Rates in North America are among the lowest (12 to 18%)
  - Pedestrians deaths represent 13 to 17% over past two decades (about 5900 fatalities every year)
  - 84,000 pedestrians are injured every year
  - Pedestrian alone was culpable in 43.2% of accidents
  - Driver alone was culpable in 34.8% of accidents

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- <u>Corridors with Audible/Countdown Equipment</u>
  - Rose
  - Portage
  - Oakland
  - W. Michigan
  - Burdick
  - Crosstown Parkway
  - Howard
  - Whites and Parkview
  - Douglas (partially upgraded)
  - Paterson (scheduled for 2009)
  - Water Street (scheduled for 2009)
  - Mills Street (scheduled for 2010)

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

Hawthorne Effect

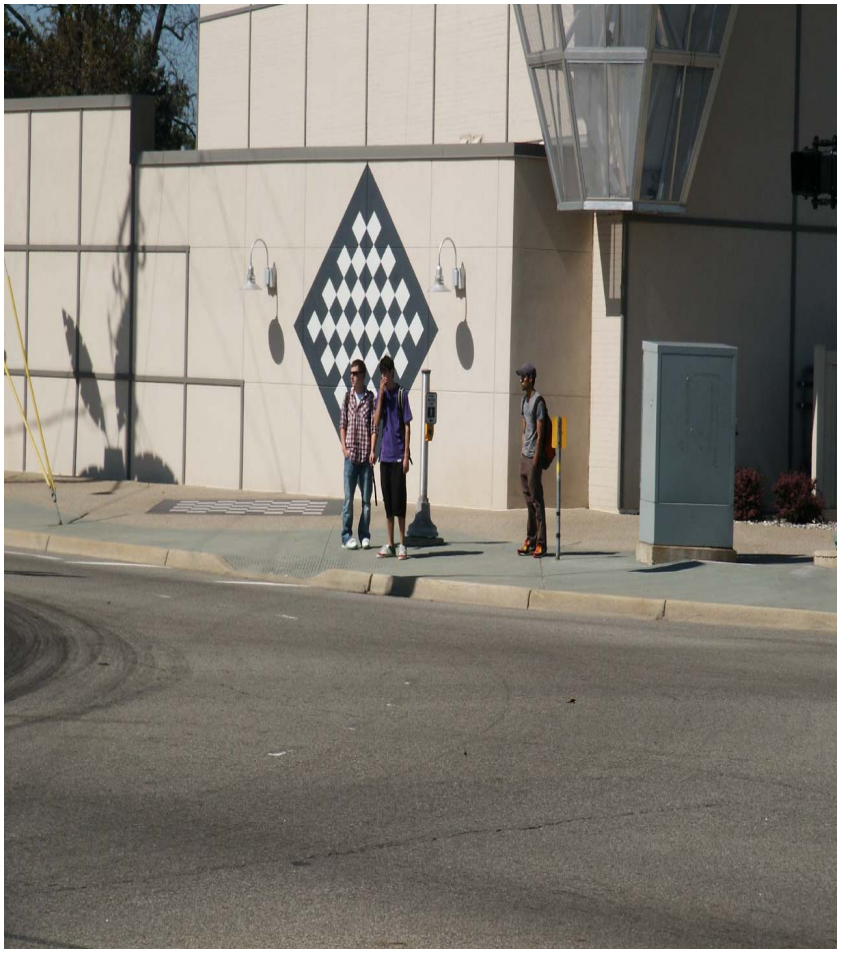
"Virtually any reasonable change has a positive impact on productivity".

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS



AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- <u>Purposes / Objectives of Study</u>
  - Reduction in pedestrian collisions
  - Change in pedestrians' behavior – start and finish crossing
  - Change in drivers' behavior – right turn on red and red light running
  - Leaving curb on countdowns/flashing red/clearance interval
  - Validation of audible messages
  - ADA needs and requirements
  - Maintenance and installation issues

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- <u>Pilot Locations / Intersections</u>
  - Pedestrian collision record
  - Pedestrian volume
  - Traffic volume
  - Crossing distance
  - Input from ADA community
  - Public complaints
  - Perceived safety
  - Diversity of physical and social environments

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- Data Collection
  - Pedestrian collisions
    - 14 Intersections
    - 4 years before
    - 4 years after
  - Pedestrians Behavior
    - Compliance
    - Leaving Curb
    - Finishing Crossing
    - Running / Aborting Crossing

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- Data Collection (con't)
  - Pedestrians' attitude and knowledge
    - Whether respondents noticed audible tone, messages, and countdowns
    - How helpful respondents found these messages
    - How audible countdown signals compared with conventional pedestrian signals
    - Whether respondents thought they were crossing differently due to audible countdown messages
    - Whether respondents knew that to start crossing on flashing red hand or countdowns is a violation of vehicle code
  - Drivers' Behavior
    - Yielding to pedestrians
    - Running red light
  - Maintenance

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- Results
  - Pedestrian collisions
    - 72% reduction with audible countdown
    - 52% reduction with countdown type only
  - Finishing crossing before conflicting green
    - 89% with audible countdown type signals
    - 47% with conventional signals
  - Compliance Rate
    - 91% with audible countdown type signals
    - 52% with conventional signals

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- Results (con't)
  - Entering street on flashing red
    - 71% with audible countdown type signals
    - 51% with conventional signals
  - Running to cross
    - 17% with audible countdown type signals
    - 8% with conventional signals
  - Knowledge
    - 19% with audible countdown type signals
    - 63% with conventional signal

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

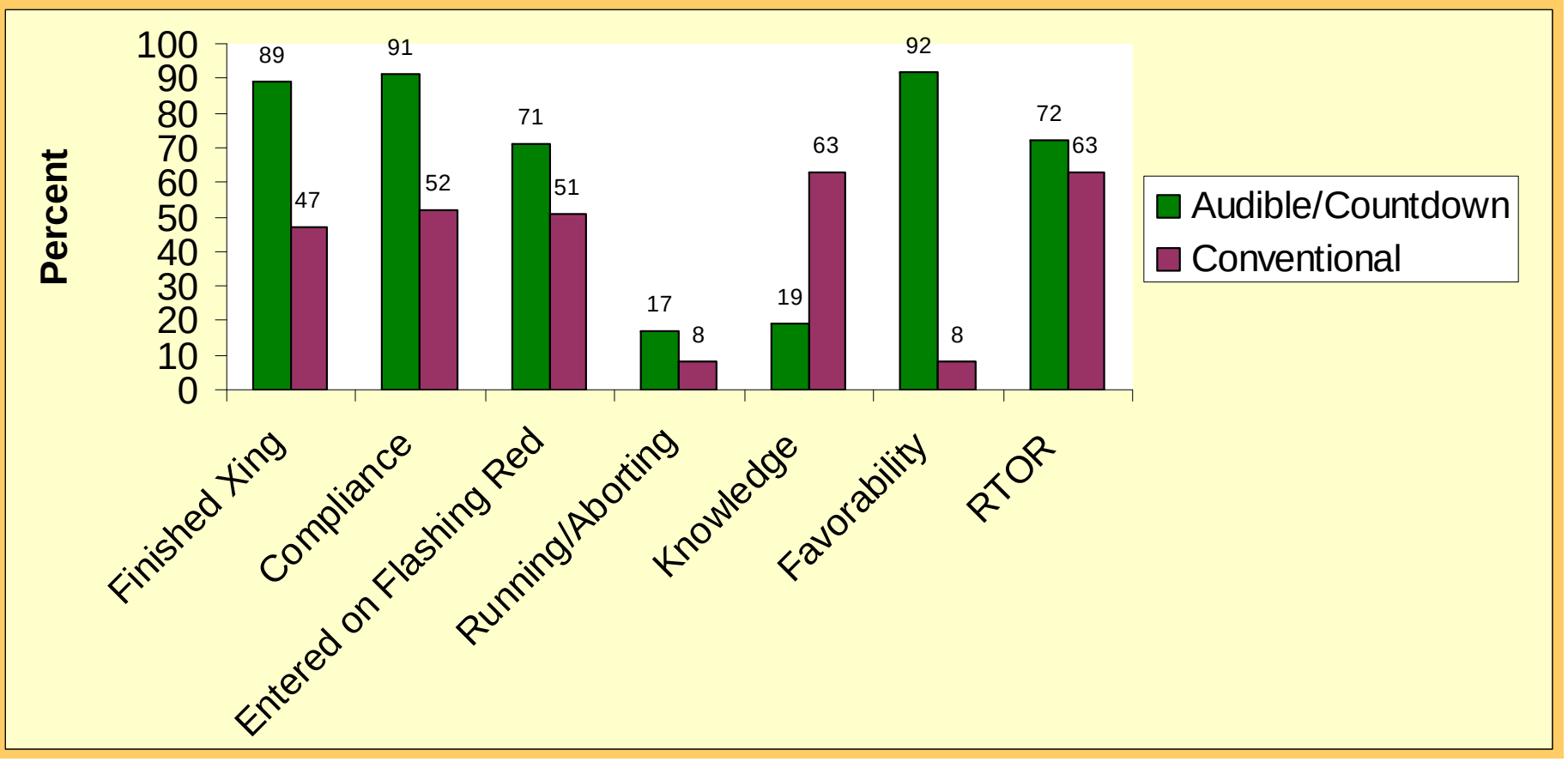
- Proposed 2009 MUTCD Change - Pedestrians Entering Street On Flashing Red:

  "*If a countdown pedestrian signal is shown, pedestrians shall be permitted to leave the curb if they are able to travel to the far side of the traveled way or to a median by the time a conflicting vehicular movement is allowed to proceed.*"

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- Results (con't)
  - Favorability
    - 92% with audible countdown type signals
    - 8% with conventional signals
    - ADA 100%
  - Drivers Behavior
    - 72% yielded to pedestrian with audible countdown signals
    - 63% yielded to pedestrian with conventional signals
    - Running a red light – no significant change

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS



AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- **Conclusions**
  - Audible countdown signals appeared to reduce pedestrian collisions. An improvement in safety is clearly indicated by the study.
  - Significant increase was noticed in pedestrians finishing crossing before Do Not Walk signal
  - A significant increase was noticed in the pedestrians entering the intersection on countdowns / flashing red (clearance interval).
  - Countdown appears to imply to a substantial proportion of pedestrians that it is proper to start crossing on the countdown.
  - A substantial increase in the proportion of motorists yielding to pedestrians in the crosswalk was noticed.

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- **<u>Conclusions</u>** (con't)
  - They did not result in an increase in drivers running red light.
  - A large number of pedestrians pushed the audible pushbutton and waited for walk message before leaving the curb.
  - Audible countdown signals are viewed very favorable by the pedestrians, especially by ADA community for providing additional information on crossings. They are better understood and obeyed than conventional signals.

AUDIBLE COUNTDOWN PEDESTRIAN SIGNALS

- **<u>Conclusions</u>** (con't)
  - Energy savings – LED countdown signals use 9 to 10 watts as compared to 67 watts for conventional signals.
  - Audible messages / noise produced by audible countdown pedestrian signals are a concern if installed in a residential area.
  - Present generation of audible countdown signals require frequent maintenance. In the absence of technical expertise, it is difficult to maintain these signals. Reliability is questionable at this time.

TRAFFIC SIGNAL DESIGN

TRAFFIC SIGNAL DESIGN

- Box design with near and far signals
- LED Signals
- GPS controllers
- Lag Left Turns (Permissive-Protected)
- Signal timing plans
- Speed

Far-side signals in Michigan – common use

Far-side signals in Michigan – common use

LEFT
LEFT
Campus Cantina
George
APPLIANCE CO.
CF 52745

JIMMY JOHN'S
GOURMET SANDWICHES
Boflios
7
ELEVEN
PEPSI

TRAFFIC SIGNAL DESIGN

- Box design with near and far signals
- LED Signals
- GPS controllers
- Lag Left Turns (Permissive–Protected)
- Signal timing plans
- Speed

TRAFFIC SIGNAL DESIGN

- Box design with near and far signals
- LED Signals
- GPS controllers
- Lag Left Turns (Permissive–Protected)
- Signal timing plans
- Speed

TRAFFIC SIGNAL DESIGN

- Box design with near and far signals
- LED Signals
- GPS controllers
- Lag Left Turns (Permissive–Protected)
- Signal timing plans
- Speed

TRAFFIC SIGNAL DESIGN

- Lag Left Turns: **Motorist** Perspective
  - **Easy rules.** Both directions of through traffic start at same time.
  - **Relaxed left turn.** In permissive phase, LT driver under no pressure to complete his turn, knowing protected green arrow is next up.
  - **Safe gap selection** for Left-turners.
  - **Never caught in intersection**, finish turn during protected LT phase.
  - **Fewer left turn-angle crashes (AZ)**

TRAFFIC SIGNAL DESIGN

PROBLEM: LT drivers stranded in the intersection

- Occurs when drivers attempt to make **permissive left turn, after a protected leading left turn phase**. Typically, they have entered the intersection on a permissive green, waiting to make a left turn when sufficient gaps occur in opposing through traffic. In the absence of gaps in the opposing through traffic, these drivers must complete their turn during clearance interval – against possible fast-moving through traffic - or be stranded in the intersection.“

PROBLEM: LT drivers stranded in intersection

TRAFFIC SIGNAL DESIGN

- Lag LT: **Pedestrian** Perspective
  - **Reduce delay** - Pedestrians can start crossing immediately on green ball
  - **Vehicle/Pedestrian separation** – most pedestrians will cross during green ball phase, prior to protected LT phase.
  - **Relaxed LT drivers** – during green ball phase, left turning drivers under no pressure to complete turn knowing that a protected green arrow is next up.

Traffic Signal Design

- <u>Lag LT: **System Operator** Perspective</u>
  - **LT Capacity:** Opportunity for left turn vehicles to clear during the through green display
  - **Progression:** Cut off platoon stragglers, platoon movements along coordinated corridor more effective
  - **Safety:** Effective platoon movement provides gap for safe ingress and egress to unsignalized streets/driveways along corridor
  - **Other Benefits:** Reduce delays, fuel consumptions, pollutant air emissions, driver frustration and likelihood of red light running
  - **Flexible Design:** Flexible system timing

TRAFFIC SIGNAL DESIGN

- Box design with near and far signals
- LED Signals
- GPS controllers
- Lag Left Turns (Permissive–Protected)
- Signal timing plans
- Speed

TRAFFIC SIGNAL DESIGN

- Signal timings and plans
  - Yield time
  - Dynamic max
  - Virtual split
  - Coord adopted split
- Modified controllers for flashing red
- Exclusive pedestrian phase

TRAFFIC SIGNAL DESIGN

- Box design with near and far signals
- LED Signals
- GPS controllers
- Lag Left Turns (Permissive–Protected)
- Signal timing plans
- Speed

Crash Reductions

Year	Crashes	Crashes Reduced	Percent Crashes Reduced
2002	3218		
2005	2403	815	25.3%
2006	2127	1091	33.9%
2007	2017	1201	37.3%

Injury Crash Reductions

Year	Crashes	Crashes Reduced	Percent Crashes Reduced
2002	723		
2005	501	222	30.7%
2006	597	226	31.3%
2007	477	246	34.0%

Fatal Crash Reductions

Year	Crashes	Crashes Reduced	Percent Crashes Reduced
2002	4		
2005	2.7	1.3	32.5%
2007	2.5	1.5	37.5%

Fuel and Emission Savings

Street	VOC (Tons/Yr)	NOX (Tons/Yr)	CO (Tons/Yr)	Total Emissions (Tons/Yr)	Fuel (Gals/Yr)	Fuel Savings ($/Yr)
Oakland Drive	9.53	6.59	37.78	53.9	495047	1633655.1
Portage Street	11.64	7.44	46.11	65.19	598740	1975842.0
Crosstown & Burdick	7.38	4.769	28.48	40	367382	1212360.6
W. Michigan	12.34	7.88	48.88	69.1	634652	2094351.6
Totals	40.89	26.679	161.25	228.19	2095821	6916209.3

In addition, the cost savings from reduction of vehicle emissions equals to $26.42 Million over the design of the projects