

# DC Experience with the HAWK-Hybrid Pedestrian Signal and Rectangular Rapid Flashing Beacons

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# How a HAWK-Hybrid Pedestrian Signal Works:



**Sequence 1:** *Blank Signals upon activation with Steady Don't Walk*



**Sequence 2:** *Flashing Yellow Signals upon activation with Steady Don't Walk*



**Sequence 3:** *Solid RED with Steady Don't Walk*



**Sequence 4:** *Alternating Red with Steady Don't Walk*

**Figure 1: HAWK Signal Sequence**

# HAWK-Hybrid Pedestrian Signal

## Summary

- In August 2009, DDOT installed a HAWK signal at a “T” intersection on a major arterial street, Georgia Ave. NW.
- The land use context is a mixed use commercial/residential node along a commercial corridor.
- Intersection was uncontrolled with high vizibility marked crosswalks on all legs.
- The intersection is approximately 750 ft. from adjacent signalized intersections.
- Community members, especially the elderly, had complained for years that it was difficult and unsafe to cross Georgia Ave. at this location.

# HAWK-Hybrid Pedestrian Signal

## Summary

- The signal was evaluated by conducting a series of three field observations of driver compliance with the signal and pedestrian behavior.
- The main measure of effectiveness was the proportion of drivers stopping/yielding to pedestrians when the signal showed a red indication.
- Evaluation showed an average of 97.1% motorist compliance with the HAWK signal, which is comparable to a standard signal.
- Overall, 49% of pedestrians that crossed at the intersection did so without activating the HAWK signal.

**Table 1: Analysis of Field Data Collection – 1 (July 7th, 2010)**

<b>Begin Time</b>	<b>No. of Ped. Crossing Events Using HAWK Signal</b>	<b>No. of Veh. Yielded/ Stopped for Peds.</b>	<b>No. of Veh. That did not Yield/Stop for Peds.</b>	<b>No. of Vehicles that should have Stopped</b>
12:30 PM	3	12	-	12
12:45 PM	3	12	-	12
1:00 PM	5	18	1	19
1:15 PM	3	12	-	12
1:30 PM	4	9	-	9
1:45 PM	4	11	-	11
2:00 PM	4	14	3	17
2:15 PM	3	12	-	12
2:30 PM	3	4	-	4
<b>**BREAK**</b>	<b>**BREAK**</b>	<b>**BREAK**</b>	<b>**BREAK**</b>	<b>**BREAK**</b>
4:45 PM	7	27	5	32
5:00 PM	4	15	-	15
5:15 PM	4	16	5	21
5:30 PM	6	24	-	24
5:45 PM	3	12	2	14
6:00 PM	3	15	1	16
6:15 PM	1	4	-	4
6:30 PM	4	13	-	13
<b>4-Hr Period</b>	<b>64</b>	<b>230</b>	<b>17</b>	<b>247</b>

$$P = \text{number of vehicles that yielded or stopped for pedestrians} = (230) / \text{number of vehicles that should have stopped (247)} = 93.1\%$$

# Location: Georgia Ave. & Hemlock St. NW Washington, DC







# HAWK GENERAL FIELD OBSERVATIONS:

- Field observations were conducted on typical weekdays for both A.M. and P.M. periods.
- Overall, 97.1% of drivers stopped for pedestrians using the HAWK signals.
- A number of drivers exhibited aggressive driving characteristics, such as hesitating or slowing down briefly for crossing pedestrians to clear the driver's travel path, and then proceeding to drive across the intersection on the flashing red without stopping.
- While waiting to turn onto Georgia Avenue, motorists from Hemlock Street generally yielded to pedestrians using the crosswalk.



# HAWK GENERAL FIELD OBSERVATIONS, CONTINUED:

- On certain occasions, pedestrians did not wait for the operation of the HAWK signal before crossing the intersection after activation and instead used a gap in the vehicular traffic to cross the intersection.
- During instances where pedestrians attempted to cross the intersection without activating the HAWK signal, some drivers acknowledged and yielded to the pedestrians, while other drivers evaded pedestrians and continued through the intersection.

# HAWK-Hybrid Pedestrian Signal

- A significant proportion of pedestrians (49% overall) did not activate the HAWK signal when crossing the intersection.
- This led to pedestrian-vehicle conflicts.

**Table 5: Results of Pedestrian Compliance and Pedestrian –Vehicle Conflicts**

<b>TIME OF DAY</b>	<b>Percentage of Crossing Events where Pedestrians used the HAWK Signal</b>	<b>Percentage of Crossing Events without Activating HAWK Signal and Outside of Crosswalk</b>	<b>Percentage of Crossing Events with Pedestrian – Vehicle Conflicts</b>
<b><i>A.M.</i></b>	50.8%	47.5%	14.7%
<b><i>P.M.</i></b>	65.8%	35.6%	8.7%

- Table 6 shows that crossing without activating the HAWK signal led to substantially more pedestrian-vehicle conflicts than crossing with the signal activated.

Table 6: Qualitative Analysis of Pedestrian – Vehicle Conflicts

BEGIN TIME	PEDESTRIAN – VEHICLE CONFLICTS		
	No. of Conflicts upon Activating HAWK Signal	No. of Conflicts Without Activating HAWK Signal	Total No. of Pedestrian – Vehicle Conflicts
7:00 AM	1	-	1
7:15 AM	-	-	-
7:30 AM	-	-	-
7:45 AM	-	-	-
8:00 AM	-	-	-
8:15 AM	-	-	-
8:30 AM	-	-	-
8:45 AM	-	-	-
9:00 AM	-	1	1
9:15 AM	-	-	-
9:30 AM	-	-	-
9:45 AM	-	1	1
10:00 AM	-	2	2
10:15 AM	-	3	3
10:30 AM	-	1	1
10:45 AM	-	-	-
<b>AM TOTALS</b>	<b>1</b>	<b>8</b>	<b>9</b>
2:00 PM	1	-	1
2:15 PM	1	-	1
2:30 PM	-	-	-
2:45 PM	-	-	-
3:00 PM	-	-	-
3:15 PM	-	-	-
3:30 PM	-	-	-
3:45 PM	-	-	-
4:00 PM	-	1	1
4:15 PM	-	-	-
4:30 PM	1	3	4
4:45 PM	-	2	2
5:00 PM	-	-	-
5:15 PM	-	-	-
5:30 PM	1	-	1
5:45 PM	-	-	-
<b>PM TOTALS</b>	<b>4</b>	<b>6</b>	<b>10</b>

# Conclusions

- The HAWK signal treatment was effective in getting drivers to stop for pedestrians. This favorable result could be due to the strong regulatory message that the solid red signal sends to motorists.
- The HAWK signal did not appear to cause any adverse effects on pedestrian crossing behaviors at the intersection during the field observations.
- There were minimal traffic operational issues at the intersection and, in general, most drivers (97.1%) stopped for pedestrians in the crosswalk.

# Conclusions

- A low pedestrian compliance (activation) rate (51% overall) was found, which could be attributed to the lack of understanding of the operation of the HAWK signal or the perception of delay. The existence of a sufficient number of gaps in vehicular traffic for pedestrian crossing without activating the HAWK signal could explain poor utilization.
- Implementation of a public awareness campaign on the HAWK signal could help improve pedestrian understanding and thereby improve the compliance rate (brochures were distributed in the area and were available on the poles)
- **Based on the motorist compliance rate, the use of HAWK signal as a device for improving pedestrian crossing safety at selected unsignalized intersections is recommended. This device would be especially useful at intersections on high-volume major arterials with moderate-to-high pedestrian crossing volumes, which do not satisfy any of the warrants for standard signalization.**



# Rectangular Rapid Flashing Beacons Summary



- DDOT staff monitored the development of the RRFB since 2005 and decided to test an installation at an uncontrolled crossing on a four lane arterial street. (Photos from Florida)

# Rectangular Rapid Flashing Beacons

## Summary

- DDOT installed a RRFB at an uncontrolled marked crosswalk on an 4 lane arterial street with 30,000 VPD ADT and a posted speed of 30 mph (85<sup>th</sup>ile= 44 mph). This is the largest road on which a beacon of this type has been installed.
- Because of the slope and horizontal curvature of the street, an advance beacon was used on the southbound approach, 150' before the crosswalk.

# DC's Rectangular Rapid Flashing Beacon

- The beacons were paired with a unique “Stop for Pedestrians” sign in an effort to provide drivers with a stronger regulatory message.







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# RRFB Evaluation Results- Baseline

## BASELINE

Location: Brentwood Rd. & 13th St. NE

Treatment: HiViz CW (w/ ped pylon) Day\_X\_ Night \_\_\_\_

Date: 4/23/08 Time: 9:30-10:30 am

Observers: Branyan/Goodno/Hefferan

4/25/08 Time: 4:30-5:20 pm

Date/Crossings	Cars Yielding	Cars Not Yielding	Distance Cars yielded from crosswalk							Driver Passed Stopped Veh or Attempt	Car Behind Yielding Car Jams Brakes
			< 10 ft	Red 10ft-20ft	Orange 20ft-30ft	Yellow 30ft-50ft	Green 50ft-70ft	Blue 70ft-100ft	Red >100ft		
4/23:20	34	66	0	4	5	13	12	0	0	1	0
4/23:20	39	60	0	11	12	7	6	3	0	2	1
4/25:20	38	158	0	10	13	8	6	0	1	7	0
4/25:20	35	128	10	14	7	4	0	0	0	11	0
Totals	146	412	7%	27%	25%	22%	16%	2%	1%	21	1

Total vehicles: 558

41% of vehicles yielding 30' or farther from crosswalk

Overall Compliance rate: 26%

Best 20 crossings: 39%

Worst 20 crossings: 19%

# RRFB Evaluation Results- 7 Days

## 7-DAY FOLLOW UP

Location: Brentwood Rd. & 13th St. NE

Treatment: 2RFB + 1 Advance RFB Day\_X\_ Night \_\_\_\_

W/ advance stop lines & ped pylon

Date: 5/5/08 Time: 12:30-1:15 pm

Observers: Branyan/Goodno/Hefferan

5/7/08 Time: 4:55-5:30 pm

Date/Crossings	Cars Yielding	Cars Not Yielding	Distance Cars yielded from crosswalk							Driver Passed Stopped Veh or Attempt	Car Behind Yielding Car Jams Brakes
			< 10 ft	Red 10ft-20ft	Orange 20ft-30ft	Yellow 30ft-50ft	Green 50ft-70ft	Blue 70ft-100ft	Red >100ft		
5/5:20	39	29	1	8	6	16	8	0	0	1	1
5/5:20	40	20	0	4	2	16	14	2	2	3	1
5/7:20	43	34	1	10	16	9	7	0	0	0	0
5/7:20	53	24	2	10	7	18	14	2	0	1	0
Totals	175	107	2%	18%	18%	34%	25%	2%	1%	5	2

Total vehicles: 282

62% of yielding vehicles 30' or farther from crosswalk

Overall Compliance rate: 62%

Best 20 crossings: 69%

Worst 20 crossings: 56%

# RRFB Evaluation Results- 30 Days

## 30-DAY FOLLOW UP

Location: Brentwood Rd. & 13th St. NE

Treatment: 2RFB + 1 Advance RFB Day\_X\_ Night \_\_\_\_

W/ advance stop lines. Pylon still up

Date: 5/27/08 Time: 10:00-10:35 am

Observers: Branyan/Goodno/Hefferan

5/29/08 Time: 4:55-5:30 pm

Date/Crossings	Cars Yielding	Cars Not Yielding	Distance Cars yielded from crosswalk							Driver Passed Stopped Veh or Attempt	Car Behind Yielding Car Jams Brakes
			< 10 ft	Red 10ft-20ft	Orange 20ft-30ft	Yellow 30ft-50ft	Green 50ft-70ft	Blue 70ft-100ft	Red >100ft		
5/27:20	42	13	2	2	5	20	9	4			
5/27:20	45	19		1	11	18	14	1			
5/29:20	53	12		4	11	27	9	2			
5/29:20	46	22		6	10	19	9	2			
Totals	186	66	1%	7%	20%	45%	22%	5%	0%	0	0

Total vehicles: 252 72% of yielding vehicles 30' or farther from crosswalk

Overall Compliance rate: 74%

Best 20 crossings: 82%

Worst 20 crossings: 68%

# RRFB Evaluation Results- 100 days

## 100-DAY FOLLOW UP

Location: Brentwood Rd. & 13th St. NE

Treatment: 2RFB + 1 Advance RFB Day\_X\_ Night \_\_\_\_

W/ advance stop lines. No Pylon

Dates: 8/14/08 Time: 9:30-10:30 am

Obsrvs: Branyan/Goodno/Hefferan/Deutsch

8/21/08 Time: 4:30-5:07 pm

Date/ Crossings	Cars Yielding	Cars Not Yielding	Distance Cars yielded from crosswalk							Driver Passed Stopped Veh or	Car Behind Yielding Car Jams
			< 10 ft	Red 10ft-20ft	Orange 20ft-30ft	Yellow 30ft-50ft	Green 50ft-70ft	Blue 70ft-100ft	Red >100ft		
8/14:20	50	11		3	7	2	16	8	4		
8/14:20	48	13	3	1	8	18	17	1	4	2	
8/21:20	58	13		3	10	23	20	1	1		
8/21:20	54	21		3	11	8	27	2	3		
Totals	210	58	1%	5%	17%	24%	38%	6%	6%	2	0

Total vehicles: 268

74% of yielding vehicles 30' or farther from crosswalk

Overall Compliance rate: 78%

Best 20 crossings: 82%

Worst 20 crossings: 72%

# RRFB Evaluation Results-6 months

## 6 MONTH FOLLOW UP

Location: Brentwood Rd. & 13th St. NE

Treatment: 2RF + 1 Advance RF

Day\_\_ Night X

W/ advance stop lines. No Pylon

Dates: 11/20/08 Time: 5:05-5:50 pm  
/2008 Time:

Obsrvs: Branyan/Goodno

Date/ Crossings	Cars Yielding	Cars Not Yielding	Distance Cars yielded from crosswalk							Driver Passed Stopped Veh or	Car Behind Yielding Car Jams
			< 10 ft	Red 10ft-20ft	Orange 20ft-30ft	Yellow 30ft-50ft	Green 50ft-70ft	Blue 70ft-100ft	Red >100ft		
11/20:20	58	17	4	4	1	26	18	3	2		
11/20:20	48	10	2	1	2	23	18	2	0	1	
:20											
:20											
Totals	106	27	6%	5%	3%	46%	34%	5%	2%	1	0

Total vehicles: 133 87% of yielding vehicles 30' or farther from crosswalk

Overall Compliance rate: 80%

Best 20 crossings: 83%

Worst 20 crossings: 77%



# RRFB Experience Summary

- DDOT's experience at the pilot location (Brentwood Rd. NE) was very successful— 80% driver compliance at the 6 month evaluation.
- This intersection was replaced with a roundabout in early 2010 and complaints of crossing difficulty have resumed.
- During the summer of 2010, DDOT installed 5 more RRFBs locations. Evaluation has begun on these locations and preliminary data from site showed little improvement. More evaluation is needed to see what variables may account for the this outcome.