WILSDEN ROAD SAFETY TRUST PROJECT

Harecroft: an evaluation of how to apply psychological speed reductions through a rural hamlet through incremental changes in visual deterrents over a fixed period of time

Wilsden Parish Council

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Cover: Harecroft, which lies within the parish boundary of Wilsden, as seen from Hewenden Viaduct

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Appendices to accompany this document:

1. Original project proposal
2. Pre-project Resident questionnaire
3. Leeds University speed data analysis and conclusions
4. Post-project resident Questionnaire
5. Photographs of site and installations

Executive Summary:

1. This project was commissioned to reduce the speed of traffic travelling through the hamlet of Harecroft, which has approximately 60 homes located on one road.
2. The road (which had a 30 mph speed limit) carries commuter traffic to and from Bradford in excess of 7000 vehicles using the road daily.
3. By reducing traffic speed, we were anticipating reduced accidental vehicle collisions and property damage, which was rife, thus leading to an improvement in the perception of safety for local residents.
4. The road was changed to a 20 mph zone through a phased series of visual installations which it was hoped would lead to a marked psychological impact upon drivers, helping to reinforce the need to reduce speeds through the hamlet.
5. Unfortunately, although the project was eventually completed, it was not carried out to the original 6 month timetable, in fact the installations took twice as long as planned.
6. Additional incidents (vehicle damage) and machinery problems (storage capacity and downloading of speed data) led to problems in gaining continuous speed data for analysing.
7. The speed data obtained from this project has been analysed by Dr Samantha Jamson, Professor of Transport Psychology, Institute for Transport Studies, University of Leeds, and a survey of residents has been performed.
8. The results are mixed, as follows:

Positive Findings

9. Vehicle speeds reduced after each new visual speed element was installed in both directions.
10. Data also indicates that average speeds slowly reduced after each installation Westbound and for 5 of the 6 phases Eastbound.
11. These reductions are also evident in each of the six time periods that data was segregated into – covering super-peak to overnight.
12. Compared to average speeds before the project commenced, overall average speeds show a reduction of 6.20 mph Eastbound and 5.37 mph Westbound.
13. Post implementation resident questionnaire feedback reports that there has been no vehicle collisions or property damage since the 20 mph zone project commenced.
14. Based on the above, the psychological effect on drivers through the phased installation of multiple visual deterrents has been considered successful.

Remaining Concerns

15. Despite the overall speed reduction, vehicles significantly exceed the new 20 speed limit:
    a. Westbound - 89% exceed 20 mph, 41% exceed 30 mph, 5% exceed 40 mph
    b. Eastbound – 74% exceed 20 mph, 11% exceed 30 mph, .5% exceed 40 mph
16. The average speed of traffic is now:
    a. Westbound – 25 mph
    b. Eastbound - 24 mph
17. Post implementation resident questionnaire feedback reports no improvement in perceived safety.
18. Residents would like to see additional deterrents (cameras by preference and/or physical restraints) being considered.

Introduction:

Why is speed reduction needed:

1. Harecroft is a rural hamlet located on the B6144.
2. There are approximately 60 homes, mostly terraced, located alongside a 400 metre length of the road which have limited or no parking facilities on the properties.
3. The 400 metre section is winding and on a slight hill – uphill Eastbound, downhill Westbound.
4. The road width is narrow and whilst 2-way, is often restricted in width by resident parked vehicles, delivery vehicles and works vehicles.
5. The B6144 is a major commuter route to and from Bradford, carrying over 7000 vehicles per day.
6. The existing speed limit is 30 mph, but residents are convinced average speeds exceed this and late evening traffic significantly exceed this. Results from a 1-week ACT project in 2019 support this.
7. Residents have reported a high level of vehicle collisions: 26 in last 5 years, including 1 major and 2 minor casualties.
8. A large number of vehicle collisions have been linked to parked vehicles late at night. These have in the main been minor and have resulted in a high incidence of “hit and run”: 16 drivers failed to stop after causing damage.
9. Residents report significant noise and vehicle discharge pollution which they hope will be reduced if speeds fall.
10. Residents are also concerned to improve the perception of danger, enabling safer movement for pedestrians with improved liveability.

A new approach to sustained speed reduction

11. Rural communities are conscious that speeding is a major issue which is hard to effectively police.
12. Villages and hamlets are unusual. To maintain rural and historical ambience and vistas that give them country character, there is a desire to avoid lots of brightly coloured-signage or physical measures which detract from this.
13. Harecroft is unable to support normal urban methods of speed-reduction:
    a. police enforcement cameras – the road does not qualify due to a lack of fatalities/serious accidents
    b. chicanes - insufficient space
    c. speeds-humps - the B6144 is a bus, emergency vehicle and major HGV route, resulting in local authority sustainable objections.
14. It is believed that wholesale visual speed deterrents, installed simultaneously, lead to immediate speed reductions, but then a gradual rise in speed occurs as drivers become apathetic with the road and its conditions, which has led to an alternate approach to addressing driver familiarity.

Aims and objectives of the project

1. The plan is to install six visual deterrents, one per month for six months.
2. It is hoped that this approach will continually stimulate drivers about the speed limit on this particular road and prevent the usual familiarity and rise in speeds after time which appear to occur when all deterrents are installed simultaneously.
3. Base line speeds will be recorded before the first installation and throughout the project to measure the effectiveness of the phased implementation.
4. The following details the sequence of installations:
    a. Place Speed-Indicator-Devices [SIDs] in stealth-mode inside intended 20mph-zone (both directions) which will provide a pre-installation base-speed and measure each aspect of the phased installation. Add pneumatic-cable across carriageway or laser-monitor to record vehicle speeds at mid- point of 20mph-zone, running in stealth-mode throughout installation process.
    b. Reduce the speed-limit on approaching roads from 40 mph to 30 mph for a 400 metre distance ("Buffer zones")
    c. Introduce a speed zone on the B6144 to 20mph (Old Allen Road to Bents Lane) and a 100-metre approach from the side road that joins it (Old Allen Road) via the installation of prominent pole signage on both sides of each road.
    d. Convert two local public adopted 'cul-de-sac' roads, Station Road and Brown Lee Lane to 20mph
    e. Install coloured road-markings (Burgundy-resin) at entrances to 20mph-zone (3-positions)
    f. At start of each 20mph-zone, add a set of 12 x rumble-strips to both sides of carriageway
    g. Within 20mph-zone, erect 20mph repeater pole signs
    h. Within 20mph-zone, paint white roadway with 20mph-roundels at set intervals
    i. Activate SIDs (showing actual speed and smile-frown) just inside 20mph- zone in both directions
5. The pneumatic cables will be removed at the end of the project.
6. The SIDs will remain in situ as these have been purchased. Their operation will be solar panel powered in order that they operate continuously without the need for battery changes.
7. Periodic speed downloads will continue after the project has ended to verify whether speeds are maintained, fall or rise after a period of time.

Activities

1. All of the actions in the Aims and Objectives section of this project were performed in sequential order, however, they were not carried out monthly due to coronavirus limitations on resources, equipment and contractor staffing availability.
2. The project took 55 weeks to conclude as opposed to an intended 26 weeks.
3. Additionally, each installation did not have a consistent period between them, instead the time differences varied in accordance with the following table:

	Intervention	**Speed Limit**	**Data period**	**Weeks**
Baseline	None	40/30/40	23 June – 12 July 21	Week 1–3
Phase 1	20mph signs installed	30/20/30	17 July – 26 Sept 21	Week 4–18
Phase 2	Addition of Repeater Poles	30/20/30	28 Sept – 5 Dec 21	Week 19–24
Phase 3	Addition of Burgundy Tarmac	30/20/30	7 Dec 2021 – 30 Jan 22	Week 25–27
Phase 4	Addition of Repeater Roundels	30/20/30	1 Feb – 18 April 22	Week 28–43
Phase 5	Addition of Rumble Strips	30/20/30	19 April – 30 May 22	Week 44–49
Phase 6	SID Activation	30/20/30	1 June – 30 June 22	Week 50–55

4. There were also a number of incidents that have resulted in a proportion of the SID data being lost. The following data days were lost (From 386 project days = Westbound – 119 days; Eastbound – 94 days), due to the following reasons:

    a. Vehicle damage – Eastbound a short data loss from being knocked from the pole (re-hung after a week as still operational).
    b. Vehicle damage – Eastbound a long data loss from being knocked down a second time resulting in the machinery breaking. A replacement battery-operated SID was loaned to the project by CMBDC, but this took several weeks to erect.
    c. Battery running flat – Temporary Eastbound SID needed battery replacement every 2 weeks (due to traffic volume), which was not always possible.
    d. Data storage issues – The SIDS were originally set to record bi-directional speeds (2 per vehicle), which used up memory quicker than expected. New data replaced older data before machine data was downloaded. We amended the readings to approaching speed recording mid-way through the project.
    e. Downloading issues – The App for downloading recorded data is only compatible with Android equipment/phones but, the Parish Council use Apple equipment. This meant relying on CMBDC to download the data and send it to us. Resources issues meant they were not always able to do this before new data replaced older data before machines were downloaded.

5. The ACT pneumatic cables were more resilient and only 3 days of speed data was lost throughout the project.
6. Despite the SID data losses, the combination of the two x SIDs and the ACT has produced adequate data for analysis.
7. During the project period, there were also a number of other factors that lead to lower vehicle volumes and slower speeds, most notably:
    a. Coronavirus – a period of working from home, reducing commuter traffic.
    b. Road relaying – the road was reduced to Single Alternate Lane Traffic (SALT) for 3 weeks while the road was re-laid during a spell of snow. Raised ironworks slowed vehicles considerably during this process. However, a newly laid road resulted in higher speeds thereafter.
    c. Facilities – A number of cables and pipes were laid along and across the road, reducing the traffic to SALT for 2 weeks in total.
8. Subsequent data analysis indicates that these events have not skewed the results.

The method/methodology used to evaluate your project

1. A SID was erected approximately 100 metres inside the 20 mph zone in each direction.
2. The recording component of the SIDs were switched on immediately, but the visual displays were switched off (to operate in stealth mode) and red and white screen surrounding tape was covered over so that the device did not appear to be a traffic device – see picture 1

Picture 1

3. A pneumatic cable (ACT) was laid across the road at the approximate mid-point of the 20 mph zone to capture speeds well after initial signage and devices.
4. The visual deterrents were then installed as per the following table:

	Intervention	**Speed Limit**	**Data period**	**Weeks**
Baseline	None	40/30/40	23 June – 12 July 21	Week 1–3
Phase 1	20mph signs installed	30/20/30	17 July – 26 Sept 21	Week 4–18
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5. Throughout the process of installations, Traffic count data was regularly downloaded from all three devices in order that analysis could be carried out post project to determine if speeds were reducing as each installation was performed.

6. Post project completion, the traffic flow data was analysed and used to identify peaks in flow throughout the 24-hour period, for weekdays and weekends separately and in each direction.
7. Results have been generated for all traffic count which provides the mean as well as 85th%ile data derived for the Project Phases, along with the % reductions observed.
8. Subsequent data analysis indicates that the events described in 4 above have not skewed the overall results although the SID results for Phase 2 appear to produce some anomalous data. For the Phase 2 westbound results the sample size was typically only 5% to 15% of the other phases. Although the sample size for the eastbound Phase 2 results was larger it was also significantly smaller than for the other phases. For these reason care should be taken in interpreting much from the Phase 2 SID mean speeds.

EASTBOUND: WEEKDAYS AND WEEKENDS

Weekdays Eastbound	
00:00-05:00	overnight
05:00-06:00	early risers
06:00-07:00	steady peak
07:00-09:00	super peak
09:00-19:00	steady peak
19:00-24:00	evening

Weekends Eastbound	
02:00-07:00	overnight
07:00-09:00	early risers
09:00-21:00	steady peak
21:00-02:00	evening

WESTBOUND: WEEKDAYS AND WEEKENDS

Weekdays Westbound	
00:00-05:00	overnight
05:00-07:00	early risers
07:00-16:00	steady peak
16:00-18:00	super peak
18:00-20:00	steady peak
20:00-24:00	evening

Weekends Westbound	
02:00-07:00	overnight
07:00-09:00	early risers
09:00-20:00	steady peak
20:00-02:00	evening

9. Oncoming speed data was used for SID analysis, which it is acknowledged can then change as soon as the 20-mph zone has been entered.
10. By contrast, the ACT records the actual speed in the mid-point of the zone as the vehicle travels across the cables.
11. Results are available in two places – point of entry to the 20-mph zone and mid-point.
12. The final installation was the switching on the of SIDs and removal of the masking tape – revealing the red and white surrounding imagery.

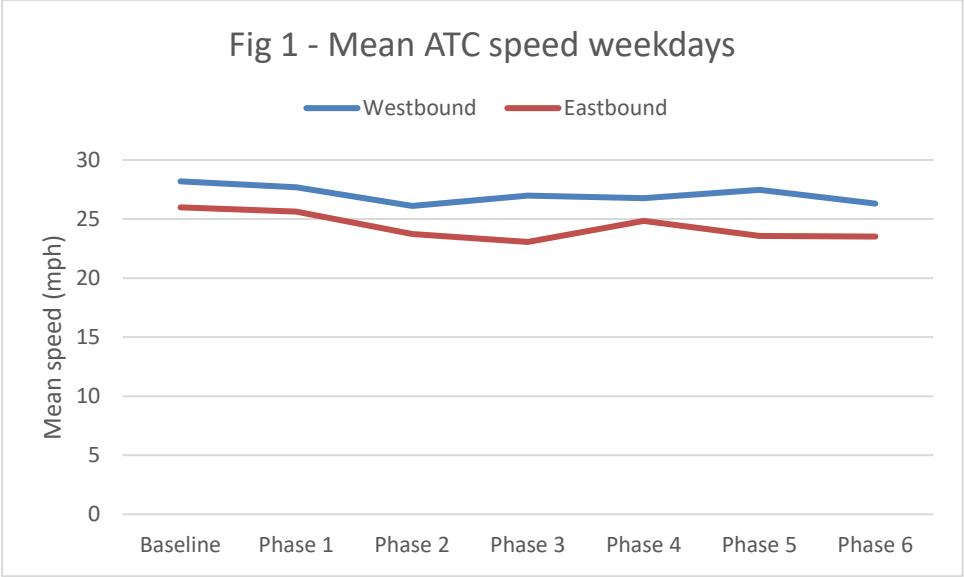
The results of the evaluation

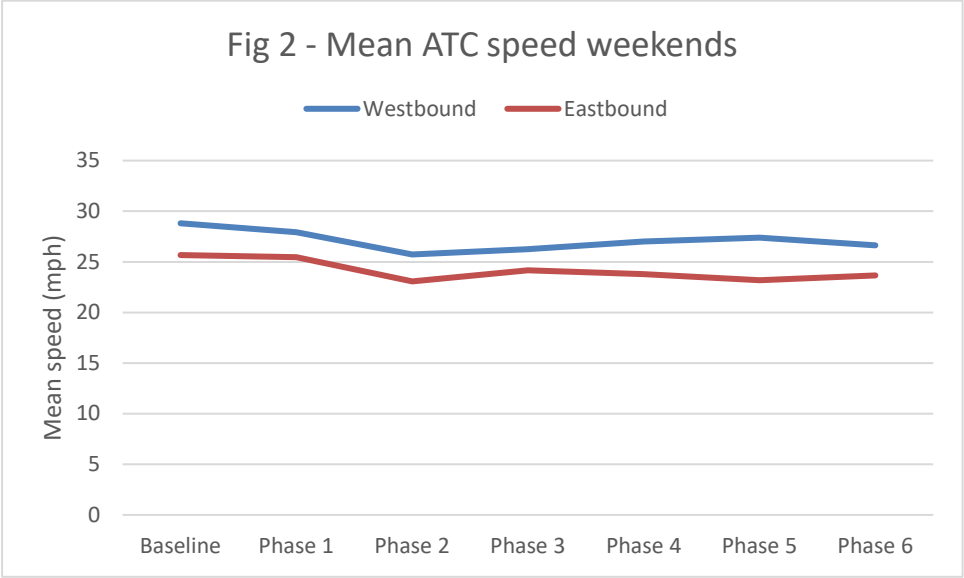
1. The overall results are mixed, with some notable successful outcomes and some remaining concerns.
2. There are two external factors that have an impact upon the results. The topography of Harecroft and traffic volumes are both significant factors to the results.
   a. Westbound the road is long, straight, and only slightly uphill to Harecroft, where it then descends slightly through the hamlet.
   b. Eastbound the road is winding and an acute narrow bridge over a small stream precedes a significant hill (14%) up to Harecroft, where the road is then slightly uphill through the hamlet.
   c. On weekdays traffic flows Westbound show a major peak between 1800 and 1900 and a minor peak at 0900. Eastbound these peaks in traffic flow are reversed indicating the pattern of commuter traffic
3. Approaching traffic Westbound has always been faster due to this topography. This can be illustrated by the calculation of the speed at or below which 85 percent of all vehicles are observed to travel from the baseline data in the centre of Harecroft. Westbound this baseline speed was 33.09 mph on weekdays and 33.99 at weekends. The corresponding baseline figures for Eastbound traffic was 30.84 on weekdays and 30.60 at weekends.
4. The following table shows the overall average SID data in each direction for each of the installation phases.

	Westbound	**Baseline**	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Total**
Weekday	overnight	2653	12381	810	7867	2057	1718	1704	**29190**
	early risers	1014	5032	527	833	4418	5096	5714	**22634**
	steady peak 1	47007	212360	9482	76622	64123	52873	51846	**514313**
	super peak	14150	67841	2420	29672	20283	14122	15783	**164271**
	steady peak 2	13110	64516	2361	31159	13266	8166	8871	**141449**
	evening	13131	65949	2577	30529	10683	6394	6779	**136042**
Weekend	overnight	887	4680	9	2889	1142	1241	1445	**12293**
	early risers	930	4525	3	806	2261	2719	3292	**14536**
	steady peak	20437	110654	139	45016	24378	21763	3292	**225679**
	evening	5583	29797	20	14399	4128	3013	3449	**60389**
	Total	**118902**	**577735**	**18348**	**239792**	**146739**	**117105**	**102175**	**1320796**

	Eastbound	**Baseline**	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Total**
Weekday	overnight	2537	10400	1962	7517	16958	7543	6971	**53888**
	early risers	531	2095	436	609	2086	1329	1456	**8542**
	steady peak 1	1776	6645	1489	1043	4553	5029	4690	**25225**
	super peak	15841	55675	12491	14887	48334	40357	35471	**223056**
	steady peak 2	64562	238059	50589	156959	297446	156754	139783	**1104152**
	evening	16847	70627	13012	41297	84524	41888	41285	**309480**
Weekend	overnight	1080	5170	480	4869	5852	3232	2834	**23517**
	early risers	1733	7697	809	2716	5753	4689	3528	**26925**
	steady peak	23571	110726	11762	87169	110993	64706	51640	**460567**
	evening	4488	20478	1827	16975	20973	11767	10255	**86763**
	Total	**132966**	**527572**	**94857**	**334041**	**597472**	**337294**	**297913**	**2322115**

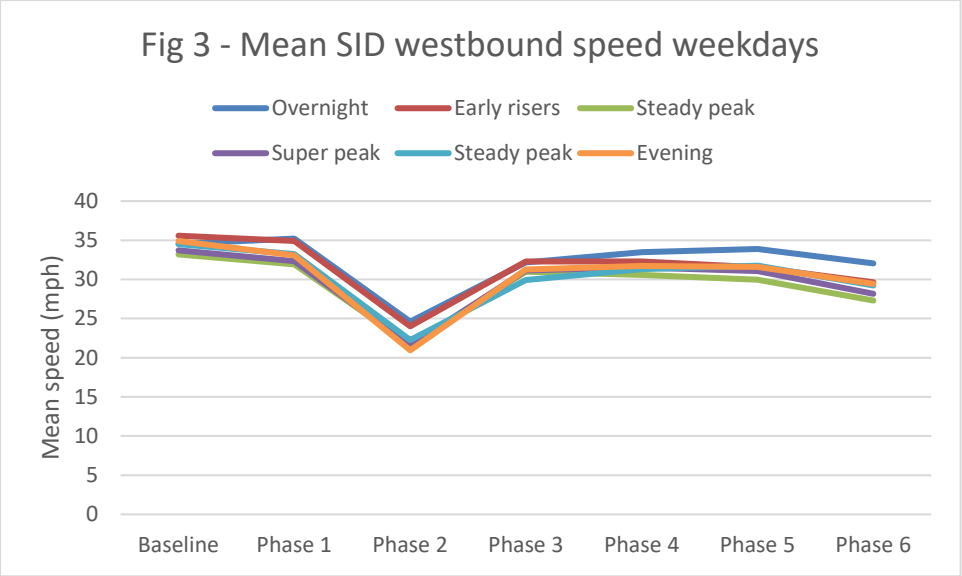
5. Figures 1 and 2 show that mean speeds measured by the ATC at the centre of Harecroft were significantly lower Eastbound than Westbound on both weekdays and weekends. There are also differences in the way that a SID and ATC processes the data that are dealt with in detail in Appendix 3 and illustrated in Fig 9 and 10 of the appendix.

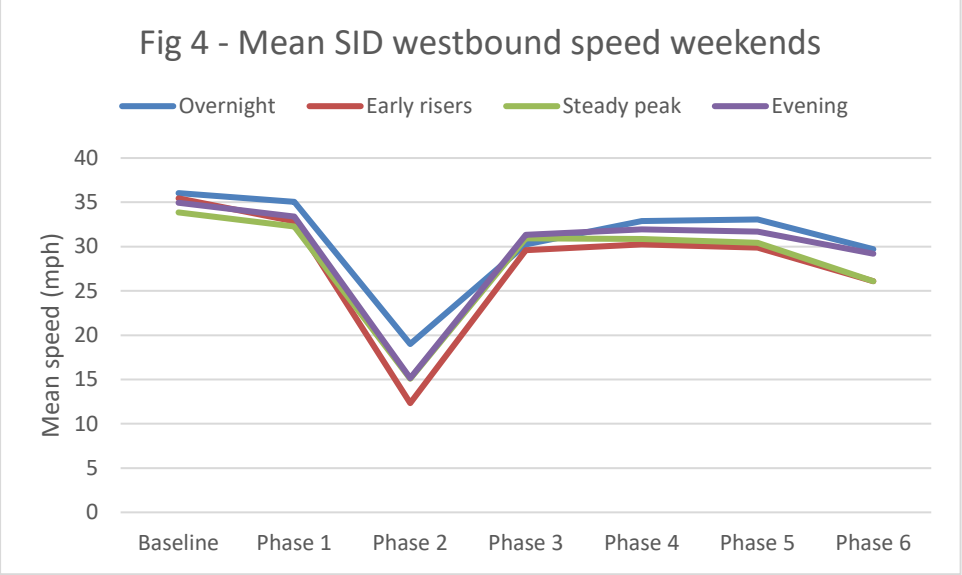




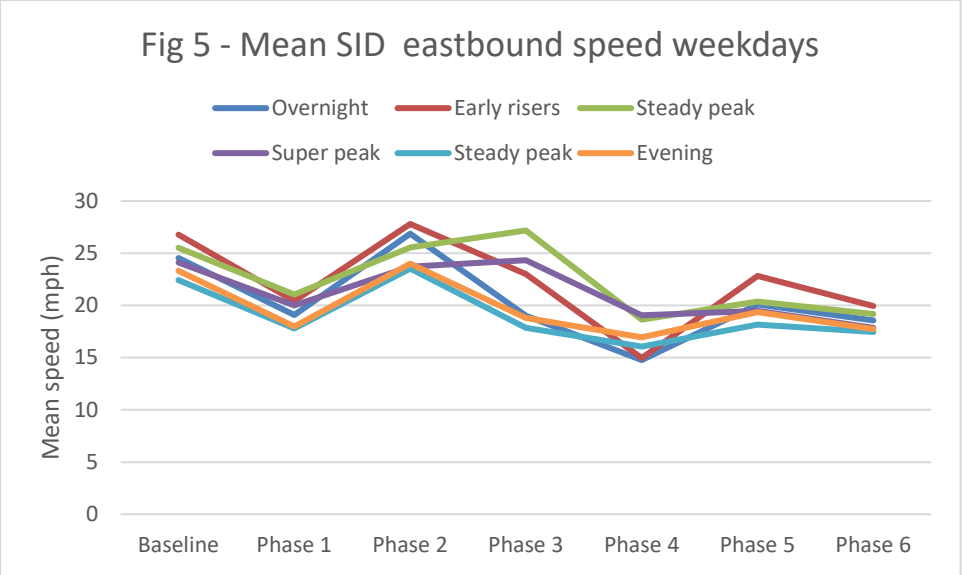
6. When ATC data in the centre of Harecroft is compared with the SID data positioned at the entry point it is observed that Westbound traffic slows down significantly between the two locations. This is illustrated in Fig 3 for weekdays with similar trends being observed for weekends. Conversely Eastbound traffic increased speed from the SID to the ATC although not to the same extent as Westbound
7. The results from the ATC, which was sited in the middle of the hamlet, show us that the current mean speeds in each direction at the end of this project were:
    a. Westbound 25 mph (3 mph lower than the SID data), indicating vehicles continued to slow after entering the 20 mph zone.
    b. Eastbound 24 mph (7 mph faster than the SID date), indicating vehicles started to speed up after entering the 20 mph zone, although some of this may be an outcome of immediate vehicle acceleration as the top of the steep hill is passed.

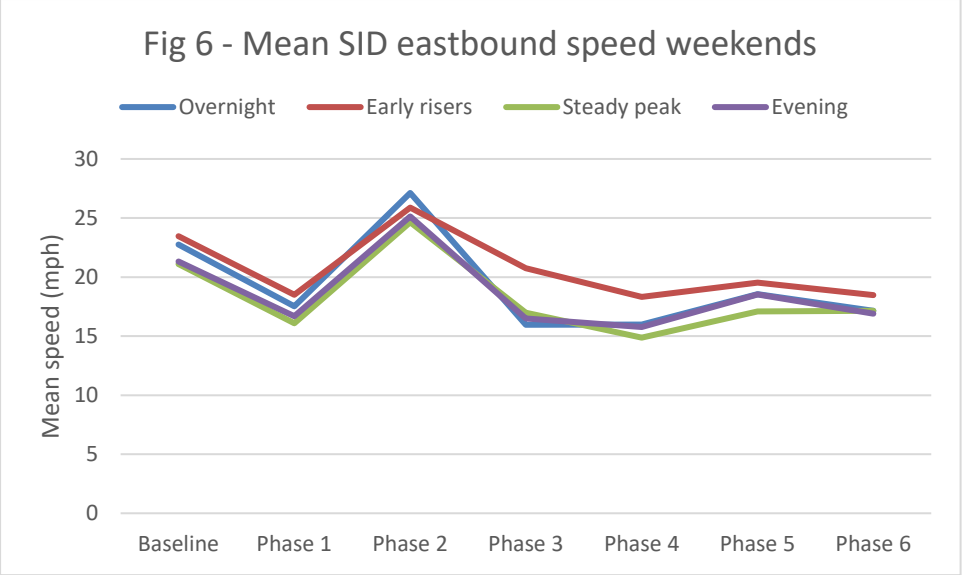
In order to establish the impact of traffic flow and the time of day the mean speed was determined for each phase and time zone. These results are shown in Fig 3 and Fig 4 for westbound traffic and Fig 5 and Fig 6 for eastbound traffic. These results are presented somewhat differently in Appendix 3 where the average speed reduction is illustrated in Fig 3 to Fig 6.





For westbound traffic the impact of time of day on the mean speed appears to be small although in all cases the highest mean speeds were observed overnight. If Phase 2 results are discounted there appears to be a steady reduction in mean speeds over the project.





For eastbound traffic the impact of the time of day and the project phase appears to be more significant, especially for weekdays, even if Phase 2 is discounted. The results for Phase 3 where the burgundy tarmac was installed appear to show this had the greatest impact on weekdays at times of lower traffic flow such as evenings and overnight. The greatest impact on mean speeds, both weekdays and weekends, was seen for Phase 4, the installation of repeater roundels.

Things that went particularly well.

1. Feedback and speed analysis suggests that switching the SIDs on – to flash speeds and smiling/frowning faces at drivers has had the biggest impact on speeds (and therefore driver consciousness).
2. During the process, the purple tarmac and 20-mph roundels painted onto the carriageway had the next most significant change to speed.
3. The project management and engagement of the City of Bradford Municipal District Council (CMBDC) Highways Department is to be recognised, even though many project issues ensued creating delays and problems. Throughout, they engaged and strived to deliver solutions to these issues.

Things that you would do differently

1. It is evident that the psychological test was impaired by the phases not being delivered in a linear pattern – i.e., strictly monthly/4 weekly.
2. By having a fixed implementation schedule, the project could have completed to its original timeline of 6 months (not the 12+ that it took)
3. It is also clear that Westbound, where traffic is faster, adding a physical element would have assisted in the impact – particularly higher rumble strips that create steering wheel vibration. CMBDC recommended this but, after resident consultation, where vehicle noise was cited as a reason to object, it was not carried out. Road painting was used in lieu of but, with less of an effect.
4. The Westbound 20 mph zone starts well outside the start of any residential properties, see picture 2below. It is believed the siting of this so far from properties has confused drivers who could not see the need for such a reduced speed and used their own judgement to drive to road surroundings. The positioning would be to advance the zone a further 100 metres to the edge of housing for driver association.

Picture 2

Conclusion and recommendations

Conclusions

1. Graphs 1, 2 and 3 (in Results of the Evaluation) show that speeds did reduce at each stage of the phased implementation process and have not, as yet, risen through familiarity.
    a. Vehicle speeds reduced after each new visual speed element was installed in both directions.
    b. Data also indicates that average speeds slowly reduced after each installation Westbound and for 5 of the 6 phases Eastbound.
    c. These reductions are also evident in each of the six time periods that data was segregated into – covering super-peak to overnight.
2. Overall, when compared to average speeds before the project commenced, overall average speeds show a reduction of 6.20 mph Eastbound and 5.37 mph Westbound.
3. Post implementation resident questionnaire feedback reports that there has been no vehicle collisions or property damage since the 20 mph zone project commenced
4. Based on the above, the psychological effect on drivers through the phased installation of multiple visual deterrents has been considered successful.
5. However, the apparent reduction in speed recorded by the SIDs, masks the speed that vehicles travel at afterwards as recorded by the ACTs, which is through the hamlet passed residents homes.
6. In what is now a 20-mph zone, vehicles significantly exceed the speed limit:
    a. Westbound - 89% exceed 20 mph, 41% exceed 30 mph, 5% exceed 40 mph
    b. Eastbound – 74% exceed 20 mph, 11% exceed 30 mph, .5% exceed 40 mph
7. The average speed of traffic at the mid-point of the hamlet is now:
    a. Westbound – 25 mph
    b. Eastbound - 24 mph
8. Post implementation resident questionnaire feedback unfortunately reports no improvement in perceived safety as vehicles are still travelling too quickly.

Recommendations

9. Phased implementation works and should be repeated with an alternate order of installations to check the best sequencing.
10. It would seem that switching the SIDs on at the start of the project (as they had the biggest impact), could yield the best outcome.
11. Including some small physical elements (such as raised rumble strips), may have a greater impact than visual elements alone (note rumble strips are easy and cheap to install). This is supported by post implementation resident feedback would like to see additional deterrents (cameras by preference and/or physical restraints) being considered.
12. SIDs must be kept in place permanently for any speed reductions to be retained.
13. SIDs should be mains or solar powered to avoid displays being temporarily suspended by batteries running out.

Hints and tips for future projects.

1. Carefully site SIDS and ACT cables where they cannot get damaged – this may include the use of H-brackets on poles.
2. Examine how speed data can be downloaded from devices and ensure you have the necessary and compatible equipment to perform this.
3. Check the road volumes and memory capacity of the recording devices to ensure a programme of period downloads so that no data losses will occur.
4. Try and gain a fixed schedule of works to avoid the project lasting longer than planned.