# REPORT OF THE ROAD SAFETY CAMERA COMMISSIONER TO THE MINISTER FOR POLICE AND EMERGENCY SERVICES

# INVESTIGATION INTO THE OPERATION OF THE RED LIGHT CAMERA AND YELLOW TRAFFIC LIGHT PHASES AT THE INTERSECTION OF TERMINAL DRIVE AND CENTRE ROAD, MELBOURNE AIRPORT AND SEVEN OTHER INTERSECTIONS.

Date of release: 9 November 2012

## PURPOSE

1. The purpose of this brief is to provide you with recommendations in relation to the red light camera and the yellow traffic light phase at the intersection of Terminal Drive and Centre Road, Melbourne Airport and seven other intersections.

## BACKGROUND

2. On 21 September 2012, Mr Gordon Bishop, a member of the general public, spoke on the 3AW breakfast show about a traffic infringement notice he received for travelling through a red light at the intersection of Terminal Drive and Centre Road, Melbourne Airport, which was dismissed in the Magistrates' Court of Victoria. Mr Bishop argued that the length of the yellow light phase did not comply with the VicRoads guidelines for a 50 km/h speed zone.
3. On 16 November 2010, VicRoads increased the speed limit on Terminal Drive, Melbourne Airport at the intersection of Centre Road from 40 km/h to 50 km/h, but it did not increase the corresponding length of the yellow light phase at that intersection from 3 seconds to 3.5 seconds.
4. The length of the yellow cycle remained at 3 seconds until 24 January 2012 when it was increased to 3.5 seconds, following an audit conducted by VicRoads.
5. On 21 September 2012, VicRoads stated in a media release that the error had occurred due to an internal communication failure.
6. On 21 September 2012, I received a letter from the Minister for Police and Emergency Services, requesting that I investigate the red light camera at the intersection of Terminal Drive and Centre Road, Melbourne Airport.
7. Upon further investigation, VicRoads discovered that there were an additional seven intersections where a road safety camera was installed and where the length of the yellow light phases was incorrect.
8. On 4 October 2012, I received a further letter from the Minister for Police and Emergency Services, requesting that I investigate these seven additional intersections, located at

   (a) Doncaster Road and Williamsons Road, Doncaster

   (b) Fyans Street and Moorabool Street, Geelong

   (c) High Street and Mahoneys Road, Thomastown

   (d) Centre Road and Warrigal Road, Bentleigh

   (e) Heatherton Road and Gladstone Road, Dandenong North

   (f) Foster Street and McCrae Street, Dandenong, and

   (g) Stud Road and High Street, Wantirna South.

9. In accordance with my powers under section 10 of the *Road Safety Camera Commissioner Act 2011*, I have investigated these matters and I now provide my recommendations accordingly.

## ISSUES/COMMENTS

### *Scope of the investigation*

10. The investigation and my recommendations relate only to the eight intersections during the period of the incorrect yellow phase set out in the table below:

| | Location of Intersection | Period of Incorrect Yellow Phase | |
|---|---|---|---|
| | | Start | End |
| 1. | Terminal Drive and Centre Road, Melbourne Airport | 16/11/2010 | 24/01/2012 |
| 2. | Doncaster Road and Williamsons Road, Doncaster | 5/10/2011 | 7/08/2012 |
| 3. | Fyans Street and Moorabool Street, Geelong | 11/05/2010 | 24/08/2012 |
| 4. | High Street and Mahoneys Road, Thomastown | 20/10/2011 | 26/09/2012 |
| 5. | Centre Road and Warrigal Road, Bentleigh | 1/08/2010 | 16/08/2012 |
| 6. | Heatherton Road and Gladstone Road, Dandenong North | 29/12/2004 | 16/08/2012 |
| 7. | Foster Street and McCrae Street, Dandenong | 18/10/2010 | 16/08/2012 |
| 8. | Stud Road and High Street, Wantirna South | 28/12/2006 | 23/08/2012 |

11. In relation to each intersection, I investigated the operation of the red light camera and the yellow phase of the traffic light signal to determine:
    (a) Whether the camera in question was functioning correctly
    (b) The cause of the error in relation to the length of the yellow light phase, and
    (c) The number of infringements affected by the error at each intersection.
12. The investigation is limited to traffic travelling straight through each of the intersections and does not include vehicles turning left or right at any of the intersections. The VicRoads manual states that the standard length of the yellow phase for left and right hand turning lanes is three seconds. As the actual yellow phase at each of the intersections was not less than three seconds, left and right hand turning vehicles were not affected by the erroneous length of the yellow light cycle and they do not fall within the scope of this investigation.

### *Red light offence*

13. The purpose of a red light camera is to enforce the offence of entering an intersection when the traffic lights or arrows at the intersection are showing a red traffic light or arrow as set out in road rules 59 and 60 of the Road Safety Road Rules 2009.
14. In its function of enforcing red traffic lights and arrows, a red light camera is only armed when the traffic light turns red. The camera system is only triggered if a vehicle drives over the in-road sensors after the light has turned red.
15. The red light camera takes two images of the vehicle: the first image shows the vehicle entering the intersection after the light or arrow has turned red and the second image shows the vehicle proceeding through the intersection. The two images are reviewed by two qualified verifications officers and are sent to Victoria Police for authorisation.
16. An infringement notice will only be issued when a vehicle enters an intersection 0.5 seconds or more after the traffic light or arrow has turned red and the vehicle proceeds through the intersection.
17. If the vehicle enters the intersection when the light or arrow is yellow, a traffic infringement notice will not be issued.

***Yellow light cycles***

18. VicRoads bases the standard of yellow times in all traffic light phases on the Austroads *Guide to Traffic Management Part 9: Traffic Operations* (the Austroads guidelines), a set of engineering and design standards agreed by all state and territory road authorities in Australia and New Zealand.
19. Standard yellow times for all traffic light phases in Victoria are contained in the VicRoads *Traffic Engineering Manual* (the VicRoads manual) as follows:

| **Speed (km/h)** | 45 or less | 50 | 60 | 70 | 80 | 90 |
|---|---|---|---|---|---|---|
| **Yellow Time (seconds)** | 3.0 | 3.5 | 4.0 | 4.5 | 4.5 | 5.0 |

20. The yellow times are based upon the legal speed limit of the intersection and the expected 85th percentile approach speed of traffic. The 85th percentile refers to the proportion of traffic that travels at or below the legal speed limit at the intersection. The yellow times are based on a formula set out in **Attachment A**.
21. The VicRoads manual states that

> "…the design of the yellow time is related to the speed of an approaching vehicle, the acceptable deceleration rate for the vehicle and its distance from the stop line. There is a critical distance from the intersection that a driver will be faced with the option of stopping at the stop line or legally continuing and entering the intersection prior to the introduction of the red signal. The appropriate yellow time should ensure that the continuing vehicle can cross the stop line before the yellow signal disappears."

***Road safety camera functionality***

22. Each of the eight cameras in question have been found to be operating correctly in accordance with the requirements of the Road Safety (General) Regulations 2009 during the periods when the yellow light phases were inconsistent with the VicRoads manual. Certificates under section 83 of the *Road Safety Act 1986* have been issued to that effect.
23. It is important to distinguish between a malfunction on the part of a road safety camera and an issue with the phasing of the traffic lights themselves.
24. Upon investigation, no red light infringements were issued as a result of the red light camera malfunctioning during the periods when the yellow light phases were inconsistent with the VicRoads manual.

***The cause of the yellow light phase errors***

*(a) Melbourne Airport*

25. On the 13 November 2009, VicRoads received a request from Australia Pacific Airports (Melbourne) (APAM) – the entity that owns and operates Tullamarine Airport, to raise the speed limit at Terminal Drive from 40km/h to 50km/h as part of a change in the sequence of speed limits on approach to the airport.
26. Upon reviewing the request, VicRoads approved the change and sent written confirmation of the approval to APAM on 31 March 2010.
27. VicRoads received written confirmation that the requested speed limit change had occurred on 16 November 2010. This meant the installation of new signage showing the increased speed limit on the approach to the intersection.
28. In normal circumstances, the VicRoads traffic signalling team and other stakeholders such as the Department of Justice would also be notified of the change to the speed limit. This did not occur in this case due to the standard internal forms not providing adequate guidance.
29. VicRoads and APAM were in communication during the period between the request to change the speed limit and the work being carried out. However, VicRoads incorrectly assumed that APAM had communicated the change to the traffic signalling group as well as the Department of Justice.
30. When VicRoads received written confirmation that the speed limit had been altered, the confirmation was reviewed and subsequently filed away without any further communication to other relevant parts of the organisation or stakeholders.
31. Because of this communication breakdown, the yellow signal length at the intersection of Terminal Drive and Centre Road at Tullamarine Airport was set incorrectly from 16 November 2010 to 24 January 2012 when an audit was conducted.

*(b) Doncaster*

32. In April 2009, a new signalling program was introduced to the intersection of Doncaster Road and Williamsons Road, Doncaster to

accommodate the addition of bus priority lanes on the north and south approaches to the intersection.

33. The red light camera was activated at this intersection on 5 October 2011.

34. Because of the new signal programming, the yellow time for the northern approach was set to three seconds. This is appropriate for any vehicles completing a right hand turn but 1.5 seconds too short for vehicles travelling straight, as the speed limit is 70km/h.

35. The yellow light timing for this intersection was corrected on 7 August 2012 following an enquiry from the RACV on behalf of a member of the public.

*(c) South Geelong*

36. The intersection of Fyans Street and Moorabool Street, South Geelong received an upgrade which affected the way vehicles completing a right hand turn from Moorabool Street are controlled. When this occurred, the yellow phase timing was mistakenly changed for vehicles travelling straight from four to 3.5 seconds on 11 May 2010.

37. Both roads have a speed limit of 60km/h for which a four second yellow time for straight through traffic is appropriate. This error was found and the yellow time lengthened to four seconds on 24 August 2012.

*(d) Thomastown*

38. The intersection of High Street and Mahoneys Road, Thomastown is directly adjacent to Keon Park railway station. The western approach to the intersection has a road safety camera installation. Due to the high amount of railway traffic, VicRoads has designed the phasing of the intersection to clear traffic around the level crossing when a train is approaching.

39. When a train is arriving at the station, the traffic light control system receives a signal from a special sensor in the railway tracks and has a set amount of time to ensure there is no traffic at the level crossing. If this occurred when it was green for straight and right turning vehicles at the western approach, the intersection would then directly enter the traffic clearing mode of the program and skips some programming, leading to an incorrect yellow time.

40. This error was introduced on 20 October 2011 and rectified 26 September 2012. It is important to note that this error is encountered very rarely due to the requirements for a train to be arriving during certain part of the traffic light cycle. At all other times, the yellow light timing was correct.

*(e) Bentleigh East*

41. The intersection of Centre Road and Warrigal Road, Bentleigh East has a speed limit of 60km/h. VicRoads upgraded the programming of the intersection to include flexible traffic light phasing for light traffic

conditions. This provides for fast switching of programmed phases while still allowing for traffic flow for the busier road.

42. Within the flexible traffic light programming, there are instructions for the lights to stop straight through movements in one direction to allow right hand turn vehicles to make a turn safely if the sensors detect them. This programming is only activated late at night and into the early morning.

43. At the end of such a cycle, the programming then skips to another portion of the cycle, which causes a yellow time of three seconds to be shown for vehicles travelling straight and completing a turn. While a yellow time of three seconds is appropriate for vehicles turning, it is not for vehicles travelling straight. This error was introduced during the upgrade to the new programming on 1 August 2010 and rectified on 16 August 2012. It is important to note that this error is encountered very rarely due to the requirements for very light traffic and for a vehicle turning right. At all other times, the yellow light timing was correct.

*(f) Dandenong North*

44. The intersection of Heatherton Road and Gladstone Road, Dandenong North has a speed limit of 60km/h. VicRoads upgraded the programming of the intersection to include flexible traffic light phasing for light traffic conditions. This provides for fast switching of programmed phases while still allowing for traffic flow for the busier road.

45. Within the flexible traffic light programming, there are instructions for the lights to stop straight through movements in one direction to allow right hand turn vehicles to make a turn safely if the sensors detect them. This programming is only activated late at night and into the early morning.

46. At the end of such a cycle, the programming then skips to another portion of the cycle, which causes a yellow time of three seconds to be shown for vehicles travelling straight and completing a turn. While a yellow time of three seconds is appropriate for vehicles turning, it is not for vehicles travelling straight. This error was introduced during the upgrade to the new programming on 29 December 2004 and rectified on 16 August 2012. It is important to note that this error is encountered very rarely due to the requirements for very light traffic and for a vehicle turning right. At all other times, the yellow light timing was correct.

*(g) Dandenong*

47. The intersection of Foster Street and McCrae Street, Dandenong has a speed limit of 60km/h. VicRoads upgraded the programming of the intersection to include flexible traffic light phasing for light traffic conditions. This provides for fast switching of programmed phases while still allowing for traffic flow for the busier road.

48. Within the flexible traffic light programming, there are instructions for the lights to stop straight through movements in one direction to allow right hand turn vehicles to make a turn safely if the sensors detect them. This programming is only activated late at night and into the early morning.

49. At the end of such a cycle, the programming then skips to another portion of the cycle, which causes a yellow time of three seconds to be shown for vehicles travelling straight and completing a turn. While a yellow time of three seconds is appropriate for vehicles turning, it is not for vehicles travelling straight. This error was introduced during the upgrade to the new programming on 18 October 2010 and rectified on 16 August 2012. It is important to note that this error is encountered very rarely due to the requirements for very light traffic and for a vehicle turning right. At all other times, the yellow light timing was correct.

*(h) Wantirna South*

50. The intersection of Stud Road and High Street, Wantirna South has a speed limit of 80km/h. VicRoads upgraded the programming of the intersection to include flexible traffic light phasing for light traffic conditions. This allows fast switching of programmed phases but still allowing for traffic flow for the busier road.

51. Within the flexible traffic light programming, there are instructions for the lights to stop straight through movements in one direction to allow right hand turn vehicles to make a turn safely if the sensors detect them. This programming is only activated late at night and into the early morning.

52. At the end of such a cycle, the programming then skips to another portion of the cycle, which causes a yellow time of three seconds to be shown for vehicles travelling straight and completing a turn. While a yellow time of three seconds is appropriate for vehicles turning, it is not for vehicles travelling straight. This error was introduced during the upgrade to the new programming on 28 December 2006 and rectified on 23 August 2012. It is important to note that this error is encountered very rarely due to the requirements for very light traffic and for a vehicle turning right. At all other times, the yellow light timing was correct.

53. The table below shows the VicRoads standard time for the yellow phase that applies to each intersection and the actual length of the yellow phase at the time the infringement notice was issued. It also includes the correction time (including the Victoria Police tolerance) required to restore infringing motorists to the position they would otherwise have been in, had the traffic light phasing been operating in accordance with the VicRoads guidelines.

| | Location of Intersection | Speed Limit (km/h) | VicRoads Standard Time on Yellow (seconds) | Actual Time on Yellow (seconds) | Correction time (seconds) |
|---|---|---|---|---|---|
| 1. | Terminal Drive and Centre Road, Melbourne Airport | 50 | 3.5 | 3.0 | +1.0 |
| 2. | Doncaster Road and Williamsons Road, Doncaster | 70 | 4.5 | 3.0 | +2.0 |
| 3. | Fyans Street and Moorabool | 60 | 4.0 | 3.5 | +1.0 |

| | | | | | |
|---|---|---|---|---|---|
| | Street, Geelong | | | | |
| 4. | High Street and Mahoneys Road, Thomastown | 70 | 4.5 | 3.0 | +2.0 |
| 5. | Centre Road and Warrigal Road, Bentleigh | 60 | 4.0 | 3.0 | +1.5 |
| 6. | Heatherton Road and Gladstone Road, Dandenong North | 60 | 4.0 | 3.0 | +1.5 |
| 7. | Foster Street and McCrae Street, Dandenong | 60 | 4.0 | 3.0 | +1.5 |
| 8. | Stud Road and High Street, Wantirna South | 80 | 4.5 | 3.0 | +2.0 |

***The number of infringements affected by the yellow light phase errors***

54. With the cooperation of the Department of Justice, I have now been furnished with a list of vehicles that received an infringement notice in relation to a red light offence during the period from 16 November 2010 to 24 January 2012 at the intersection of Terminal Drive and Centre Road, Melbourne Airport.

55. At my request, the offences were segmented into tenths of a second. As a matter of curiosity as much as anything else, I inquired what was the longest lapsed period between the light turning red and a vehicle entering the intersection. The answer was an astonishing fifty and a half seconds! The relevant information is in **Appendix B** of this report.

56. The total number of infringement notices affected by these recommendations is contained in the table below.

| | Location of Intersection | Period of Incorrect Yellow Phase | | Number of affected infringements where Time Into Red is less than or equal to the Correction Time |
|---|---|---|---|---|
| | | Start | End | |
| 1. | Terminal Drive and Centre Road, Melbourne Airport | 16/11/2010 | 24/01/2012 | 2652 |
| 2. | Doncaster Road and Williamsons Road, Doncaster | 5/10/2011 | 7/08/2012 | 3844 |
| 3. | Fyans Street and Moorabool Street, Geelong | 11/05/2010 | 24/08/2012 | 15 |
| 4. | High Street and Mahoneys Road, Thomastown | 20/10/2011 | 26/09/2012 | 28 |
| 5. | Centre Road and Warrigal Road, Bentleigh | 1/08/2010 | 16/08/2012 | 34 |
| 6. | Heatherton Road and Gladstone Road, Dandenong North | 29/12/2004 | 16/08/2012 | 109 |
| 7. | Foster Street and McCrae Street, Dandenong | 18/10/2010 | 16/08/2012 | 0 |
| 8. | Stud Road and High Street, Wantirna South | 28/12/2006 | 23/08/2012 | 112 |

## CONCLUSION

57. The investigations into the eight red light cameras determined that each of the cameras was operating accurately and in accordance with the Road Safety (General) Regulations 2009 during the periods when the yellow light phases were inconsistent with the VicRoads manual.

58. In relation to the intersection of Terminal Drive and Centre Road, Melbourne Airport, the issue was caused by a lack of internal and external communications between VicRoads, its internal departments and its failure to notify relevant stakeholders of changes to an intersection in a timely manner.

59. In relation to the other seven intersections, the issue was caused by errors in the programming of traffic signal control systems by VicRoads. During upgrades to intersection design and programming, some errors were introduced into the systems and not detected by internal reviews. It was not until two general audits into the operation of the traffic signals, triggered by the Melbourne Airport incident, were conducted by VicRoads, that the errors were detected.

60. The fact that the traffic lights did not comply with the guidelines does not, however, mean that those drivers have not committed an offence. Road

rule 57 of the Road Safety Road Rules 2009 specifically provide that it is an offence for a driver to fail to stop at a yellow traffic light if "the driver can stop safely before reaching the stop line", therefore any driver entering an intersection against a yellow light is in breach of that road rule unless it was unsafe to stop.

61. The guidelines were designed to provide a "ready reckoner" as to whether or not a driver could stop safely. They were developed many years ago when the braking capacity of motor vehicles was much less than it is today. Even then, as I am informed, the guidelines made a very generous allowance for the driver's inability to stop safely.

62. The media's criticism of the timing errors discovered in relation to a number of intersections, appears to ignore these factors and to ignore the fact that all drivers entering an intersection against a yellow light are prima facie guilty of an offence, irrespective of the timing of the yellow light phase. It follows that the danger associated with entering an intersection against a red light speaks for itself. The recommendations below are not based on any assumption that the drivers were technically "not guilty", but by a fundamental concern that drivers entering an intersection against a yellow light should not be treated inconsistently, that the law should be *administered* equally. Knowledge of these matters might well serve to temper the present media criticism.

## RECOMMENDATIONS

63. In carrying out my investigation, it seemed to me in all cases that what I had to decide was:
    (a) What was an appropriate extension of time to restore infringing motorists to the position they would otherwise have been in, had the traffic light phasing been operating in accordance with the VicRoads guidelines, and
    (b) How can VicRoads avoid the reoccurrence of similar problems in relation to traffic light phasing in the future.

64. As a result of my investigation, I find that the red light cameras at each of the intersections were operating accurately and in accordance with the Road Safety (General) Regulations 2009 throughout the relevant periods. However, as a result of the erroneous length of the yellow light phases, I recommend:

    (a) Any person who received a traffic infringement notice for a red light offence at the intersection of:

        - Terminal Drive and Centre Road, Melbourne Airport, between 16/11/2010 and 24/01/2012, where the time elapsed since the traffic light turned red was 1 second or less,
        - Doncaster Road and Williamsons Road, Doncaster, between 5/10/2011 and 7/08/2012, where the time elapsed since the traffic light turned red was 2 seconds or less,

- Fyans Street and Moorabool Street, Geelong, between 11/05/2010 and 24/08/2012, where the time elapsed since the traffic light turned red was 1 second or less,
- High Street and Mahoneys Road, Thomastown, between 20/10/2011 and 26/09/2012, where the time elapsed since the traffic light turned red was 2 seconds or less, and the length of the yellow cycle was incorrect,
- Centre Road and Warrigal Road, Bentleigh, between 1/08/2010 and 16/08/2012, where the time elapsed since the traffic light turned red was 1.5 seconds or less, and the length of the yellow cycle was incorrect,
- Heatherton Road and Gladstone Road, Dandenong North, between 29/12/2004 and 16/08/2012, where the time elapsed since the traffic light turned red was 1.5 seconds or less, and the length of the yellow cycle was incorrect,
- Foster Street and McCrae Street, Dandenong, between 18/10/2010 and 16/08/2012, where the time elapsed since the traffic light turned red was 1.5 seconds or less, and the length of the yellow cycle was incorrect, and
- Stud Road and High Street, Wantirna South, between 28/12/2006 and 23/08/2012, where the time elapsed since the traffic light turned red was 2 seconds or less, and the length of the yellow cycle was incorrect,

should have any traffic infringement notice withdrawn, any infringement penalty refunded and any demerit points reversed.

This recommendation only applies to vehicles travelling straight through the intersection and not to vehicles turning left or right at the intersection.

(b) VicRoads undertake a comprehensive audit immediately with a view to identifying any traffic light discrepancies in the past 12 months. This audit should apply to all intersections controlled by traffic lights irrespective of whether or not a road safety camera is installed and should be repeated on a six monthly basis.

(c) The present guidelines be translated into state legislation and/or regulations, rather than relying on a set of guidelines agreed upon by state road authorities, while encompassing the formula contained in Appendix E of the Austroads *Guide to Traffic Management Part 9: Traffic Operations* and allowing for VicRoads to alter traffic light sequences at any time to cope with changed conditions.

(d) VicRoads, TAC and Victoria Police undertake a campaign to promulgate traffic light sequences and to educate motorists that entering an intersection during a yellow light phase is an offence under road rule 57 of the Road Safety Road Rules 2009 unless they

cannot stop safely, similar to the “Amber Gambler” campaign in Victoria and the United Kingdom in the 1970’s.

## CONSULTATION

65. This brief was prepared in consultation with Department of Justice and VicRoads.

**<u>Attachment A</u>: Austroads formula for determining yellow light phases**

The yellow traffic light times are based on the following formula from the Austroads guidelines:

$$t_y = t_r + \frac{0.5(v_d / 3.6)}{(a_d + 9.8G)}, t_y \geq 3.0$$

Where:

| | |
|---|---|
| $t_y$ | Yellow time in seconds |
| $t_r$ | Reaction time in seconds |
| $v_d$ | Design speed in km/h |
| $a_d$ | A comfortable level of deceleration in $m/s^2$ |
| G | The gradient on approach to the traffic lights. Decimal value, negative for downhill, positive for uphill. (Eg. -0.05 for 5% downhill grade) |

**Appendix B: Time into red and corresponding number of vehicles at Terminal Drive and Centre Road, Melbourne Airport**

The table below shows the number of traffic infringements issued at Terminal Drive and Centre Road, Melbourne Airport between 16 November 2010 and 24 January 2012. The figures highlighted in grey represent the number of traffic infringement notices that will be affected by my recommendations.

| Time Into Red (Seconds) | Lane 1 | Lane 2 | Lane 3 | Lane 4 | Grand Total |
|---|---|---|---|---|---|
| 0.6 | 0 | 2 | 1 | 1 | 4 |
| 0.7 | 6 | 1 | 3 | 4 | 14 |
| 0.8 | 52 | 115 | 78 | 7 | 252 |
| 0.9 | 253 | 386 | 336 | 41 | 1016 |
| 1.0 | 418 | 477 | 370 | 101 | 1366 |
| 1.1 | 373 | 508 | 308 | 96 | 1285 |
| 1.2 | 306 | 417 | 228 | 91 | 1042 |
| 1.3 | 239 | 351 | 208 | 83 | 881 |
| 1.4 | 197 | 244 | 135 | 85 | 661 |
| 1.5 | 129 | 220 | 114 | 60 | 523 |
| 1.6 | 111 | 181 | 100 | 50 | 442 |
| 1.7 | 71 | 120 | 77 | 40 | 308 |
| 1.8 | 57 | 97 | 58 | 28 | 240 |
| 1.9 | 53 | 81 | 46 | 16 | 196 |
| 2.0 | 25 | 61 | 23 | 14 | 123 |
| 2.1 | 24 | 57 | 25 | 12 | 118 |
| 2.2 | 25 | 40 | 18 | 6 | 89 |
| 2.3 | 10 | 22 | 17 | 4 | 53 |
| 2.4 | 9 | 28 | 11 | 1 | 49 |
| 2.5 | 5 | 19 | 9 | 3 | 36 |
| 2.6 | 3 | 12 | 9 | 4 | 28 |
| 2.7 | 3 | 14 | 6 | 1 | 24 |
| 2.8 | 1 | 11 | 2 | 0 | 14 |
| 2.9 | 2 | 5 | 3 | 0 | 10 |
| 3.0 | 3 | 15 | 2 | 0 | 20 |
| 3.1 | 2 | 8 | 3 | 1 | 14 |
| 3.2 | 2 | 4 | 3 | 0 | 9 |
| 3.3 | 4 | 4 | 2 | 1 | 11 |
| 3.4 | 1 | 8 | 3 | 1 | 13 |
| 3.5 | 2 | 4 | 0 | 0 | 6 |
| 3.6 | 0 | 6 | 2 | 1 | 9 |
| 3.7 | 1 | 1 | 1 | 1 | 4 |
| 3.8 | 1 | 7 | 0 | 1 | 9 |
| 3.9 | 0 | 4 | 2 | 0 | 6 |
| 4.0 | 1 | 4 | 2 | 0 | 7 |
| 4.1 | 2 | 6 | 1 | 0 | 9 |
| 4.2 | 2 | 5 | 2 | 1 | 10 |
| 4.3 | 0 | 4 | 2 | 0 | 6 |
| 4.4 | 2 | 3 | 2 | 0 | 7 |
| 4.5 | 0 | 2 | 0 | 0 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| 4.6 | 0 | 5 | 1 | 0 | 6 |
| 4.7 | 2 | 2 | 0 | 0 | 4 |
| 4.8 | 0 | 1 | 0 | 0 | 1 |
| 4.9 | 0 | 1 | 3 | 0 | 4 |
| 5.0 | 1 | 2 | 0 | 0 | 3 |
| 5.1 | 0 | 2 | 0 | 0 | 2 |
| 5.2 | 0 | 2 | 0 | 0 | 2 |
| 5.3 | 1 | 1 | 0 | 0 | 2 |
| 5.4 | 0 | 4 | 0 | 0 | 4 |
| 5.5 | 0 | 5 | 0 | 0 | 5 |
| 5.6 | 0 | 6 | 2 | 1 | 9 |
| 5.7 | 1 | 3 | 2 | 0 | 6 |
| 5.8 | 1 | 3 | 0 | 0 | 4 |
| 5.9 | 0 | 5 | 0 | 0 | 5 |
| 6.0 | 0 | 0 | 1 | 0 | 1 |
| 6.1 | 0 | 1 | 2 | 0 | 3 |
| 6.2 | 0 | 6 | 0 | 0 | 6 |
| 6.3 | 0 | 1 | 1 | 0 | 2 |
| 6.4 | 1 | 2 | 1 | 0 | 4 |
| 6.5 | 0 | 3 | 0 | 0 | 3 |
| 6.6 | 0 | 2 | 1 | 0 | 3 |
| 6.7 | 1 | 2 | 0 | 0 | 3 |
| 6.8 | 0 | 2 | 1 | 1 | 4 |
| 6.9 | 0 | 2 | 0 | 0 | 2 |
| 7.0 | 0 | 1 | 0 | 0 | 1 |
| 7.2 | 0 | 1 | 0 | 0 | 1 |
| 7.3 | 0 | 1 | 1 | 0 | 2 |
| 7.5 | 0 | 2 | 0 | 0 | 2 |
| 7.6 | 0 | 0 | 1 | 0 | 1 |
| 7.8 | 1 | 1 | 0 | 0 | 2 |
| 7.9 | 0 | 1 | 0 | 0 | 1 |
| 8.0 | 0 | 3 | 0 | 0 | 3 |
| 8.1 | 0 | 1 | 0 | 0 | 1 |
| 8.2 | 0 | 1 | 2 | 0 | 3 |
| 8.3 | 1 | 0 | 0 | 0 | 1 |
| 8.4 | 0 | 1 | 0 | 0 | 1 |
| 8.5 | 0 | 1 | 0 | 0 | 1 |
| 8.7 | 0 | 0 | 1 | 0 | 1 |
| 8.9 | 0 | 1 | 0 | 0 | 1 |
| 9.1 | 0 | 1 | 0 | 0 | 1 |
| 10.0 | 3 | 4 | 1 | 3 | 11 |
| Grand Total | 2408 | 3637 | 2233 | 760 | 9038 |