# A REVIEW OF AGE ADJUSTMENT FOR MASTERS SWIMMERS

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**INTRODUCTION**

In late 2011 and early 2012, in conjunction with Anthony Gimson, I investigated the possibility of finding an improved formula to replace what is known as the Finnish Formula for age adjustment of times within Masters Competitions.

Initially, Anthony and I concluded that only a marginal improvement could be made to a single formula and recommended continued usage of the Finnish Formula.

Whilst undertaking the investigation of an improved formula, it became apparent that the age adjusted times achieved by masters across all the events and gender meant that in some events a number of age groups *gained* by using the Finnish Formula, whilst in other events they *lost.*

It was decided to undertake an examination of whether the age adjustment mechanism could be improved. An investigation was undertaken as a background task throughout 2012.

This document explains the rationale for an improved formula for the calculation of the age adjustment factor.

**TABLE OF CONTENTS**

Summary ..... 3
Conclusion ..... 3
Assumption of how age adjustment should work ..... 3
Why a single formula is in adequate ..... 3
Approach to determining new formulae ..... 4
Testing the validity of the new formulae ..... 4
Maintenance of formulae ..... 5
Frequency of updating formulae ..... 5
Formulae for Long Course competitions ..... 6
Senior Swimmers ..... 6
Acknowledgements ..... 6
Appendix 1 Finnish formula adjustment for 50 Free and 200 Fly ..... 7
Appendix 2 Comparison of Finnish Formula and Alan Rowson Formulae ..... 8
Appendix 3 Comparison of adjusted times for Finnish Formula and Alan Rowson Formulae ..... 10

**Summary**

Masters swimmers speed tends to slow down with age and thus the time to swim an event increases. If a graph is produced of the time for a swim is plotted against age, the points of the graph follow an upward sloping curve.

Inspection of the curve on each of the graphs for the 18 events in short course masters swimming, reveals that the curve is slightly different for each event. This divergence of performance by age over the 18 events is partly why the Finnish Formula does not give an ideal outcome. To complicate matters further the divergence of performance is different for men and women.

Also the age adjusted times produced by the Finnish Formula tend to become increasingly inaccurate for older swimmers, particularly after 70 years.

Therefore, the divergence of performances for different events and older age inaccuracies indicate that it is not possible to create a single formula that is ideal for all the 18 events.

However, it is possible to create a formula per event and gender that provides a much better age adjusted time for each event and also to address the inaccuracies produced for older swimmers.

Consequently, 36 formulae for short course (18 for ladies and 18 for men) have been created. These formulae yield better and more realistic age adjustment times for each of the events.

No separate formulae have been derived for long course events.

This document has been kept deliberately brief because of the potential wide range of readers; but if after reading you want more information please feel free to contact me.

**Conclusion**

That Alan Rowson's formula per event are better and more realistic than the Finnish Formula and can be used to give better age adjusted times.

**Assumption of how age adjustment should work**

The approach adopted for the creation of an improved formula was that a realistic age adjustment formula when applied to each event would give a dead heat of all the masters who set the world record times if they had their world record times adjusted by the formula.

This is a major assumption and underpins the resultant formulae.

**Why a single formula is in adequate**

If a single formula is used, it does not take into account the divergence of performance by age over the 18 events in short course masters swimming (17 in long course)

This was established by producing a graph per event and gender. 36 graphs were produced, one for each of the 18 events per gender showing age adjusted time for the world masters record times using the Finnish Formula for each event. The base assumption is if there is to be a dead heat for world record adjusted times then all adjusted times would be the same. In the case of the Finnish Formula this did not occur.

The graphs show that in some events older swimmers gain an advantage, in other events they are disadvantaged.

For quick reference there are two example graphs in Appendix 1 Finnish Formula adjustment for 50 Free and 200 Fly. This shows how older swimmers *gain* in 50m Freestyle and *lose* in 200m Fly

Based on the contents of the 36 graphs, it was concluded that the Finish Formula did not produce results at event level as good as would be expected.

Furthermore, feedback indicates that most masters still believe the Finnish Formula favours older swimmers throughout. And as such it is biased.

**Approach to determining new formulae**

The approach adopted for the creation of an improved formula was that a realistic age adjustment formula when applied to each event would give a dead heat of all the masters who set the world record times if they had their world record times adjusted by the formula. World Record times were selected rather than any other records as there is a larger and more reliable data sample.

World Record records are recorded in 5 year age bands. It was assumed that each record was set by a swimmer at the lower boundary of the age band rather than their actual age when setting the world best time. So, for a 25-29 age band record, it was assumed an age of 25 years when setting the world best. Empirical evidence suggests many masters make extra effort to break records as they age up to the next age group.

The World record times were obtained from the FINA website.

If a graph is produced for an event of the world record times plotted against age, the plotted points of the graph follow an upward sloping curve. Similarly, a graph containing the age adjustment factors required for each of these times to produce the same adjusted time will produce an downward sloping curve of plotted points.

There are various mathematically types of curves, such as exponential, polynomial, logarithmic, etc. to define a curve on a graph. A polynomial expression was used to describe the plotted curves for swimming performance.

Based on this approach, 36 graphs were produced for each of the 18 events per gender. A formula for each of the 36 events was created to achieve the goal of producing a dead heat as described earlier).

Microsoft Excel was used to plot graphs and create formulae from these graphs.

Each of the 36 formulae is of the following format

**Y** = 0.000000000055826* (age to the power 6) - 0.000000019980038* (age to the power 5) + 0.000002807675499* (age to the power 4) - 0.000197478468079* (age to the power 3) + 0.007186097374188* (age to the power 2) - 0.128590589172152* (age) + 1.893216340550950

**Y** is the adjustment factor calculated.

(These are known as the Alan Rowson Formulae)

Thus **age adjusted time** equals **actual time** multiplied by **Y**

**Testing the validity of the new formulae**

The first test was to compare the adjustment factor for the Alan Rowson Formulae against the Finnish Formula. See Appendix 2 Comparison of Finnish Formula and Alan Rowson Formulae.

The next step was to compare Alan Rowson's Formulae against the Finnish Formula on the 2011 Masters Decathlon results. David Chaney ran the entire 2011 results database through this test.

Checks were undertaken on a number of swims.

The decathlon points obtained using Alan Rowson's formulae appear to be realistic.

No swims now score more than 1000 points. Using the Finnish Formula, some swims were scoring significantly more than 1000 points. Given 1000 points is the score for a world record, only someone breaking an existing record should get more than 1000 points.

A comparison of the overall ranking of the top 40 swimmers using both sets of formulae was created. As would be expected the top ranked swimmers still come out as top ranked swimmers. Although there is some movement of these swimmers up or down the overall rankings.

Finally a comparison of age adjusted times for each event was produced to compare the Finnish Formula with Alan Rowson's Formulae. All these graphs can be viewed in document ***age adjusted graphs per stroke men and ladies.pdf*** . A sample graph is given in Appendix 3 Comparison of adjusted times for Finnish Formula and Alan Rowson Formulae.

The nearer the plotted line of the adjusted times is to the horizontal position indicates the *best* formulae. In all cases The Alan Rowson Formulae give results that are closer to horizontal than those created by Finnish Formula.

One of the reasons that the age adjusted times do not follow a perfect horizontal line is that the World Records Times do not alter with age in an exact mathematical manner. However within reasonable tolerance swimmers times within an event do increase in an almost mathematical trendline.

An extreme example of an anomaly is the Men's 1500 free; the World Record Time for a 75 year old is faster than the record for a 70 year old, with times of 20:39.50 and 20:54.56 respectively. Thus when you plot the adjusted times you get a spike on the graph. This is the only example of a 75 year old record being faster than a 70 year old's record. There are only 4 cases of faster older swimmers than younger swimmers for 50 and above. There are a few more in the younger age groups, 30-34, 35-39, this is not unexpected as the record times are in the same order of magnitude.

N.B. The advantage of using a formula of the trendline is it smoothes out any anomalies.

The results of the aforementioned research indicate that the formulae per event (Alan Rowson Formulae) are realistic and valid.

**Maintenance of formulae**

The creation of the formulae took a long time, due to

- determining the goal
- how to create formulae
- how to test the formulae
- Creation of test data.
- Testing

However maintenance is a relatively modest task.

The updating of the formulae can be undertaken by anyone who is moderately competent with Microsoft Excel.

Thus the maintenance of formulae when required should not be an issue.

**Frequency of updating formulae**

The trigger to investigate the change of formulae was the British Swimming Decathlon points scoring.

It is agreed that the formulae will be updated in parallel with when the Decathlon is updated to use the latest FINA points. This is currently annually.

Unless there are significant improvements in the world record times, it is unlikely that the formulae would become drastically inaccurate against the aim of producing a dead heat of world record adjusted times.

The update of the formulae to take account of improvement of world records between July 2012 and December 2012 indicate that the changes over this period made marginal difference to the outcome.

The hypothesis is that each generation is faster than the previous generation and over a number of years the formulae would become less accurate in creating a dead heat of age adjusted record times.

Empirical evidence indicates that world records for older swimmers are broken with a bigger percentage than the percentage by which the records are broken by younger swimmers. Consequently it is at the older age groups that the formulae would be come more inaccurate more quickly.

Annual updating of formulae will overcome any improvement in records causing an issue.

**Formulae for Long Course competitions**

The British Swimming Decathlon converts long course times to short course times and then calculates age adjusted times and decathlon points. There are a limited number of short course competitions that use age adjusted times and decathlon points. Currently there are no long course competitions that use adjusted times. Therefore, the demand for long course formulae appears unnecessary.

It is anticipated that the change in performance in long course events to be similar to short course and thus short course formulae could be used for long course competitions to give age adjusted times.

Formulae based on actual Long Course world records could be created if there was a demand

**Senior Swimmers**

In masters' terminology, Senior Swimmers are defined as swimmers age 18 to 24 inclusive. Many masters' competitions include Seniors in their competition. FINA does not maintain any records for Seniors. Thus seniors' times could not be taken into account when creating the formulae. If age adjustment is required for seniors the age adjustment formulae can be used but treat seniors as being 25 year old within the formulae.

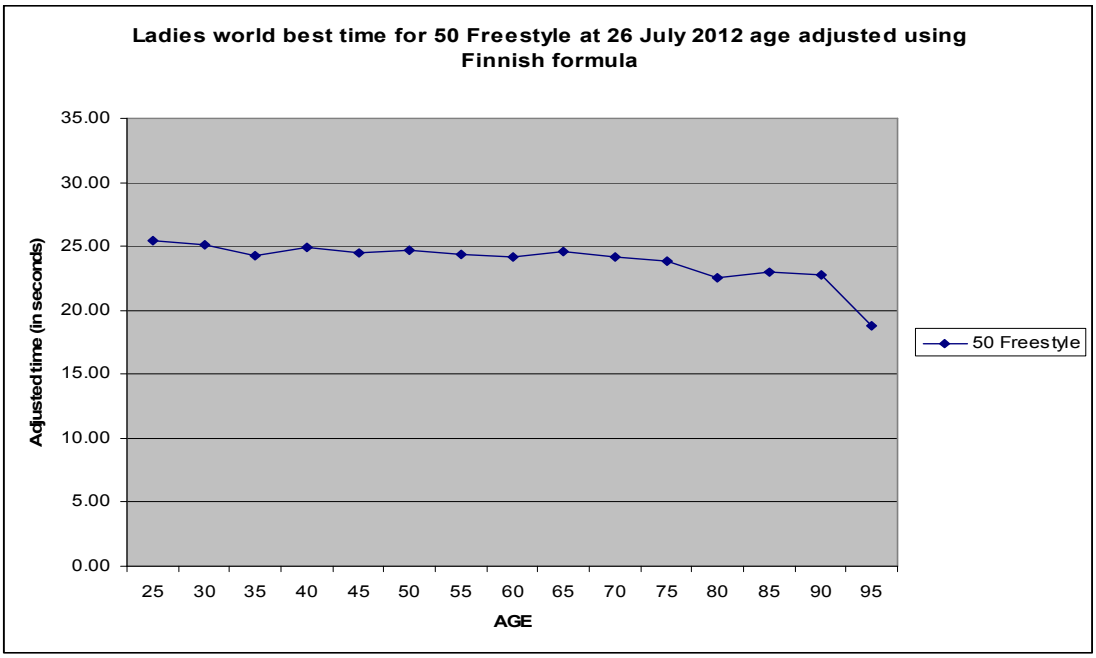
The British records for Seniors and Masters age group 25-29 show that the records are within the same area. Some are faster and some are slower.

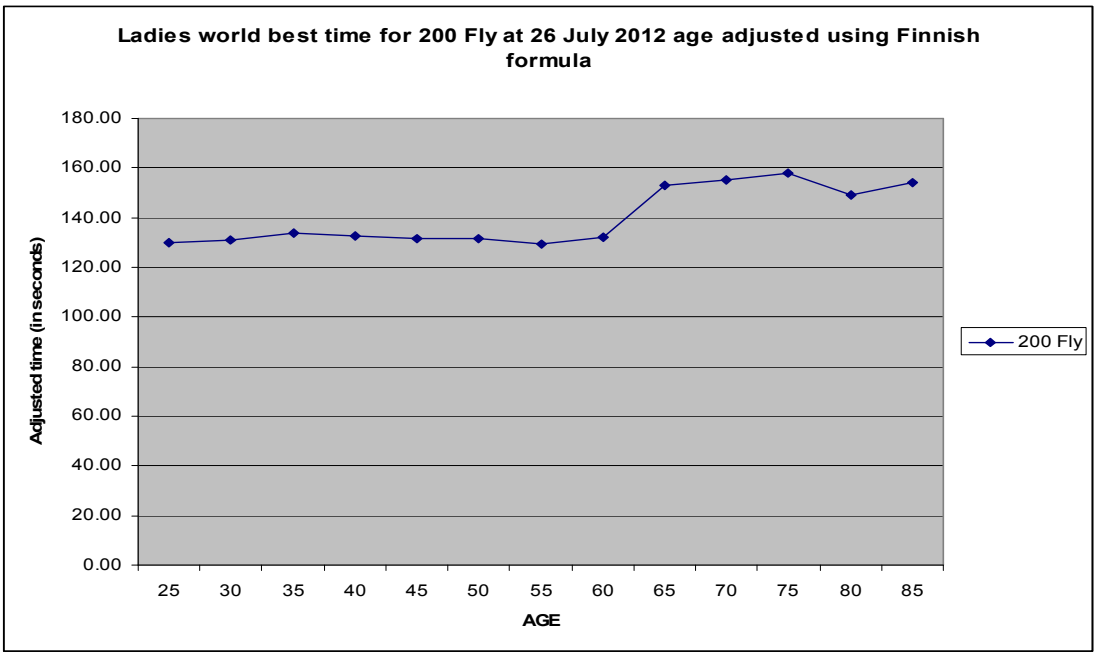
**Acknowledgements**

I would to thank Anthony Gimson, David Chaney and Rob Moore who supported me through this process in various ways. Anthony with his knowledge of age adjustment, David provided data and ran the formulae through the Decathlon results. Rob provided me with an Excel macro to test formulae and publish results.

**Appendix 1 Finnish formula adjustment for 50 Free and 200 Fly**

The two graphs in this appendix are examples of how the Finnish Formula adjusts the world best times for ladies in 50m Free and 200m Fly. Graphs for the other 34 short course events for ladies and men were produced (not included here to keep this document size smaller).

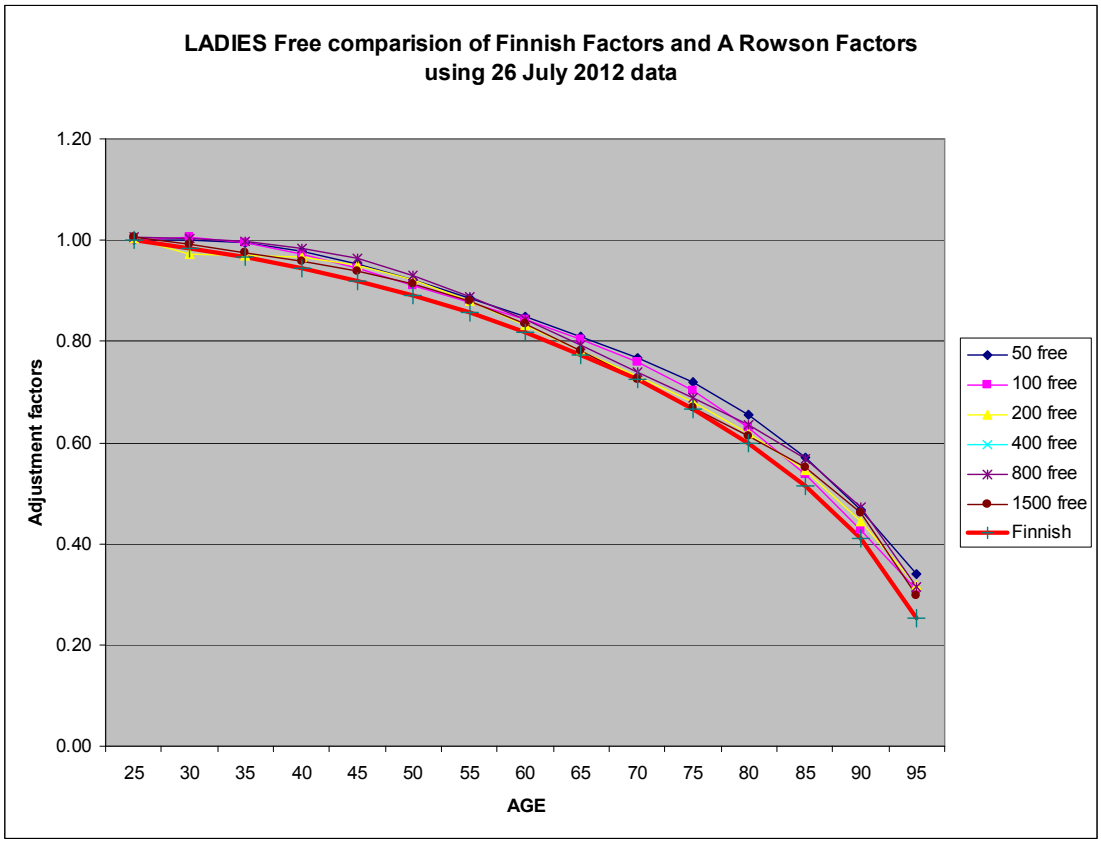


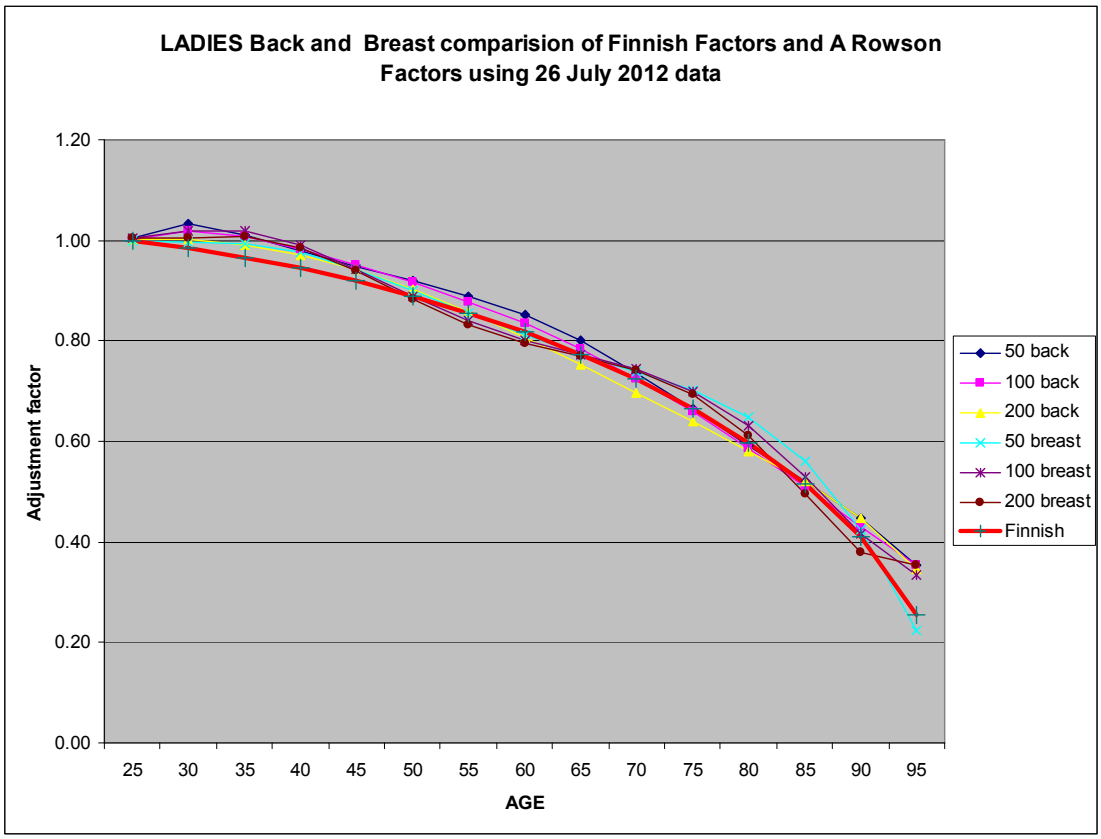



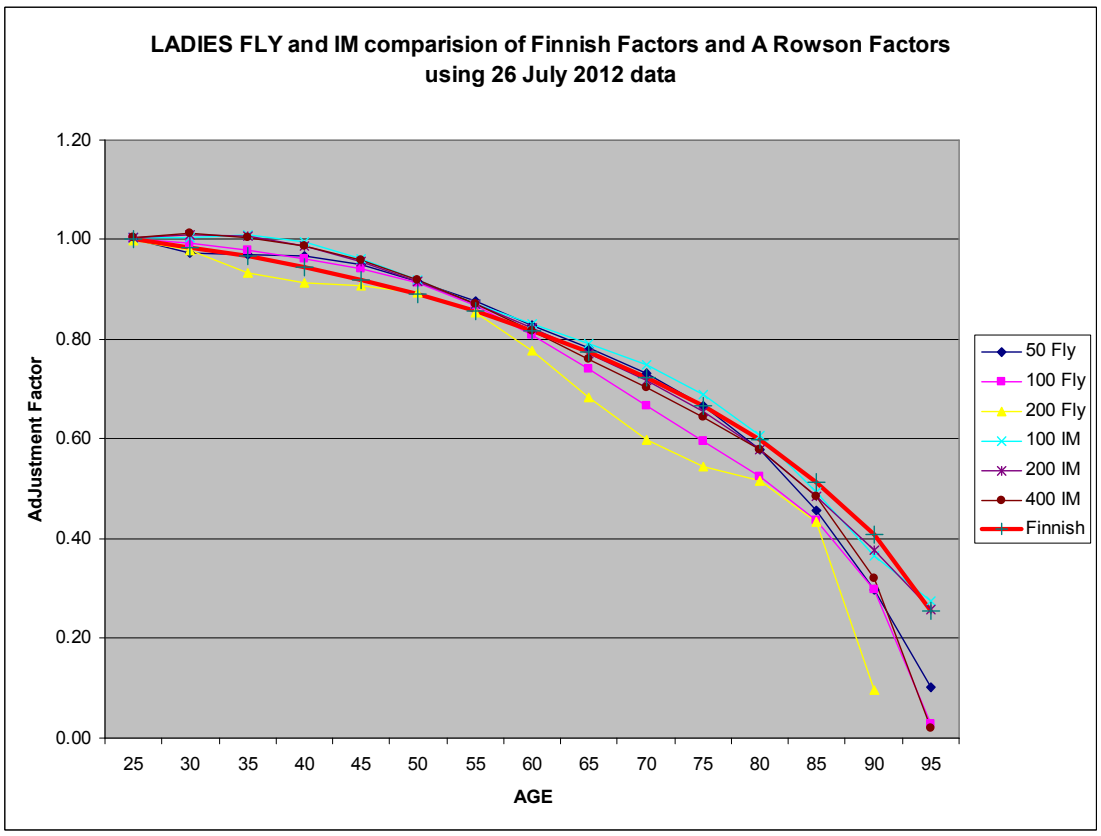
**Appendix 2 Comparison of Finnish Formula and Alan Rowson Formulae**

The following three graphs show the age adjustment factor that the Finnish Formula would generate for all events and the corresponding factor that the Alan Rowson's Formulae would generate for each event.

The graphs show that the age adjustment factors calculated by Alan Rowson's formulae are in the same range as Finnish formula, but show why a formula per event is required.




LADIES Back and Breast comparision of Finnish Factors and A Rowson Factors using 26 July 2012 data
Adjustment factor
1.20
1.00
0.80
0.60
0.40
0.20
0.00
25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
AGE
50 back
100 back
200 back
50 breast
100 breast
200 breast
Finnish


LADIES FLY and IM comparision of Finnish Factors and A Rowson Factors using 26 July 2012 data
AdJustment Factor
1.20
1.00
0.80
0.60
0.40
0.20
0.00
25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
AGE
50 Fly
100 Fly
200 Fly
100 IM
200 IM
400 IM
Finnish

**Appendix 3 Comparison of adjusted times for Finnish Formula and Alan Rowson Formulae**

The following graph show the age adjustment times that Finnish Formula and Alan Rowson's Formulae would generate for men's 50m Freestyle. This illustrates how Alan Rowson's formulae give a better result