International Performance Benchmarks (IPBs) – revision August 2015

1.0 Objectives of IPB review:

The intent of updating the IPBs was to:

1. Validate that IPBs continue to correspond to current international rankings in order to provide world class benchmarks by using statistical methods that can quantify the accuracy of the any relationships identified.

2. Ensure that IPBs reflect an accurate summary of performance progression required for an athlete to be on CCC's podium pathway which is the underpinning structure that demonstrates the progression of athletes based on yearly progression targets. These targets need to be expressed in a normal or desirable progression curve that leads to international excellence and therefore extrapolate who is "on the podium pathway" or not. This required moving away from the previous IPB benchmarks which were expressed in terms of targeted rankings at WJC, U23Ch, WC, etc.

3. Address the issue that the IPBs used up until this revision favoured sprinters over distance skiers.


2.0 IPB Update Process

Method and Rationale of Data Analysis

In the spring of 2015, the following approach was taken to data collection and interpretation:

1. Collect data relative to all athletes who had achieved World Cup podiums, including sprint and distance athletes of each gender over a defined period, then backward map the trajectory of their careers using CPL points. This data was collected as follows:

   - It was decided that enough data could be captured using the last 3 seasons to be statistically accurate.
   - The final CPL points (average CPL points over the season of 7 distance and 4 sprints) of each of these athletes was compiled for every year since they first appeared on the CPL. This was used to establish individual progression curves
   - Using the average yearly points of all these athletes at each year of age a progression curve was established, the average of many different pathways. This established the core of the athlete pathway.
   - Knowing that each athlete's career path is different, and that athletes have bad years, good years and injuries, standard deviations were established and applied to the athlete progression curves. The curves were adjusted to provide a range of results using standard deviations (i.e.: +1, -1, -2 deviations) and the minimal average points met by different proportions of the sample (70-80-90%). After analyzing different standard deviations it was decided to use -1SD as a baseline for IPBs as it seems reasonable in terms of probabilities of achieving a podium one day since 85% of WC podium athletes have met that standard or more, hence an athlete's chances are pretty slim of attaining WC podiums if they are below that curve, at least for seniors.
   - These progression curves were not linear; the trend lines on the curves were then smoothed without distorting the results with the realization that there will always be a level of subjective decisions affecting the numbers we end up with, so no method is 100% perfect.

The chart below illustrates this process:

Men distance IPB
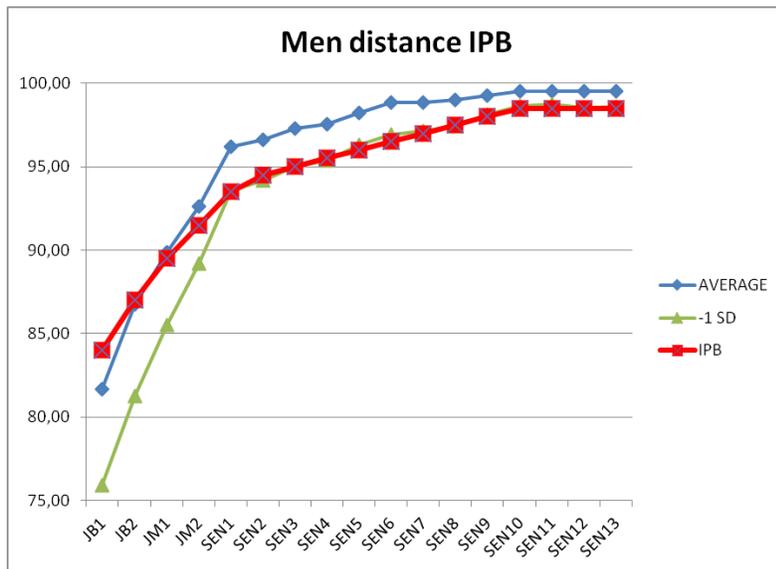
Junior vs Senior IPBs

The senior values are more reliable and representative than the junior values given that the sample was thin in the juniors. For example, going from 92.62 average points for JM2 to 96.22 average points for SEN1 in men distance is a huge jump in 1 year. It's hard to believe that this is a normal progression at this level. It is also known that international junior points can be underestimated because even the best juniors don't race that many FIS races and they often race against themselves on different distances than top seniors so they rarely can achieve very high points. This has been demonstrated many times at WJC where some juniors come in with fairly low points and end up on the podium. That is why their points can take a big jump when they start racing as seniors.

Looking at average points of the top 10 juniors in the World in distance over the last 3 seasons over the last 3 seasons for each YOB, the average progression is about 2 pts. per year.

For that reason, in establishing junior IPBs, senior points were used as a starting point for the benchmarks and the curves for juniors considered the average progression throughout the junior years for Canadian athletes. So for example, if the progression of the top 10 JM2 to SEN1 is 2.5 points and JM1 to JM2 is 2.0 points for men distance, then these values were subtracted from the podium pathway value for SEN 1 (96.22) to determine benchmarks for JM2 and JM1, etc.

In this example:

JM2 = 96.22 – 2.5 = **93.72**
JM1 = 93.72 – 2.0 = **91.72**

Refer to 5.0 (page 5) for the complete revised IPBs

3.0 Use of IPBs

The benchmarks reflected in the different IPBs per age represent a performance assessment tool that is used to direct planning of HP athlete development and guide selection decisions by:

1. Establishing minimal levels of performance to be achieved that generally indicate that an athlete is on the path to reach CCC's podium pathway goals. This data can be used to analyze athletes when making team selection decisions; i.e.: be able to overlay their actual progression on this chart to figure out the chances of them getting and staying on the "podium pathway".

2. Providing an assessment of athletes' performance level relative to age and measuring athlete development progression over a multiple year progression; this will assist in longer term athlete development planning decisions that relate to an athlete's overall career. The progression factor is very important: if an athlete is above a given benchmark but not progressing much over 2-3 years, his/her chances of reaching podium one day are very slim as opposed to an athlete with a steady or strong progression. There are exceptions where the stats show that these top WC athletes often have a breakthrough year or two where they make huge gains, usually in their early 20s', when they can gain 6-7% in a couple years.

3. Providing a rationale for investment and team sizes for the various development levels of NST trips, talent retention and development programs.
   - To improve the conversion rate of athletes with possible podium potential by providing the right support at the right time.
   - Is CCC funding the correct number of athletes?
   - Are athletes who have a viable chance of making the podium being excluded? Conversely, are athletes who have little chance of making the podium being supported?
   - How long can an athlete underperform relative to the pathway and still come back?
   - At what point(s) should the number of athletes at each level be narrowed to provide the best overall results with a given level of resources?

4. Providing a usable tool that can be generally understood and used by lots of people who may be interested in analyzing their athlete's results and understanding selection decisions.

5. Assisting in establishing how many athletes needed to achieve IPBs for their age in order to set and reach CCC's podium goals and ensure the right level of resources to the right athletes at the right time.

6. Assisting in establishing whether Canadian athletes follow a different pathway than those from other nations? If so, then why?

4.0 Additional Data Analysis/Conclusions

IPBs will be more useful for senior development team selections where it makes sense to use single best result for trips (which would also align with FIS WC eligibility standard) and mostly average points for team selection with some consideration for single best result.

IPBs need to be considered in combination with an athlete's history and progression.

Even at -1SD, these are very high standards though since they are relative to the WC Podium Pathway. We know that very few developing athletes will ever make it. We may not select a lot of athletes at all if we use those standards for junior and U23 trips and teams…

In total, only 35 athletes in the World, of all ages, met Podium Pathway benchmarks (average points) for men distance. 131 met -1SD benchmark but 45 of them are JM1-. This illustrates how selective those standards are. Even at -1 SD, there are not a lot of athletes considering all ages in the entire World (only

77 meeting senior age standards.) Needless to say, very few Canadians met those standards last year but there were some.

Gender analysis

– Women sprinters achieve more points than male sprinters in junior years, but are passed once they get to senior
– Women sprinters continue to improve in placement longer than men (men's senior curve is very flat)
– Men distance is the longest curve - starts lowest with the latest peak, continued improvement over a long period

Sprint vs Distance analysis

– Sprinters (especially female sprinters) achieve higher points earlier. Gap disappears at SEN1 for both genders.
– Distance racers continue to improve over a longer period and peak later
– There is more variation in the results of women distance podium athletes than in women podium sprinters. The exception is in JW2 sprinters - approximately half got very fast that year, while others improved a few years later.
– The opposite is true for men (i.e. there is less variation in men distance podium athletes than in male sprinters), especially in later years. Male distance athletes are either on the podium pathway and improving steadily, or not.

Sprint vs Distance points

This issue is not completely resolved. One issue is that domestic female athletes are worth a lot more points in sprint than distance which results in a lot more opportunities for females to score high points in sprint. Unfortunately this is a fairly big problem with our current CPL system. Even if athletes score much lower points in Europe, as long as they race enough races between themselves in Canada, their points will remain high infinitely.

5.0 Revised IPBs – August 2015

WOMEN SPRINT

Name	JG1	JG2	JW1	JW2	SEN1	SEN2	SEN3	SEN4	SEN5	SEN6	SEN7	SEN8	SEN9	SEN10
average	85,65	90,86	93,73	94,45	95,18	95,85	96,58	97,67	98,50	98,50	98,50	98,50	98,50	98,50
-1 SD	81,98	87,92	90,77	90,78	91,67	92,67	93,79	95,56	96,83	97,06	97,30	97,30	97,30	97,30
IPB	83,50	86,50	89,00	91,00	93,00	94,00	95,00	96,00	96,50	97,00	97,50	97,50	97,50	97,50
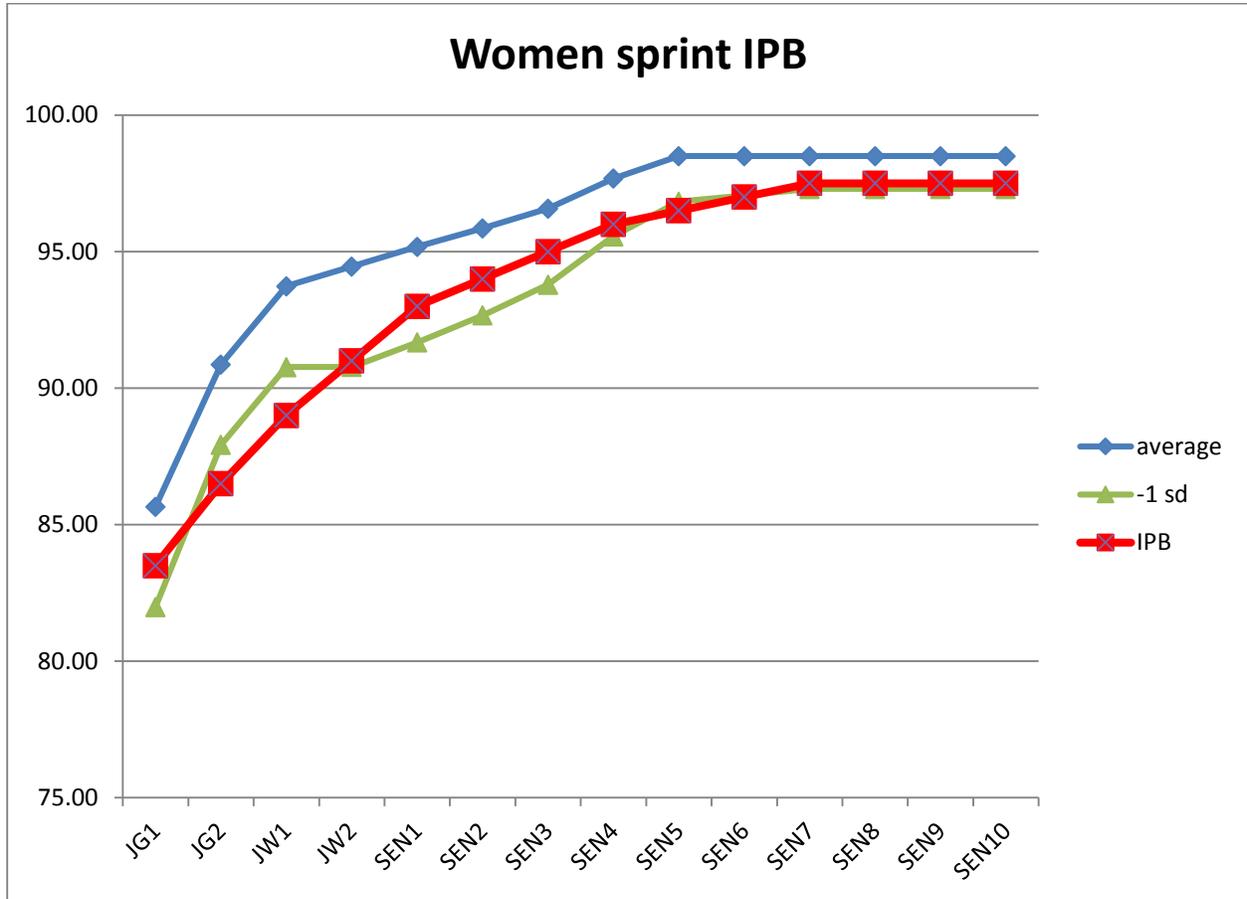
WOMEN DISTANCE

	JG1	JG2	JW1	JW2	SEN1	SEN2	SEN3	SEN4	SEN5	SEN6	SEN7	SEN8	SEN9	SEN10
AVERAGE		84,11	90,66	92,54	95,16	95,85	95,93	96,50	97,12	97,45	98,33	98,20	97,67	97,36
-1 SD		78,42	85,63	87,83	90,65	92,20	92,28	93,25	94,16	94,48	95,83	95,99	95,61	94,92
IPB	81,00	84,00	86,50	88,50	90,50	92,00	93,00	94,00	94,50	95,00	95,50	96,00	96,00	96,00

Women distance IPB
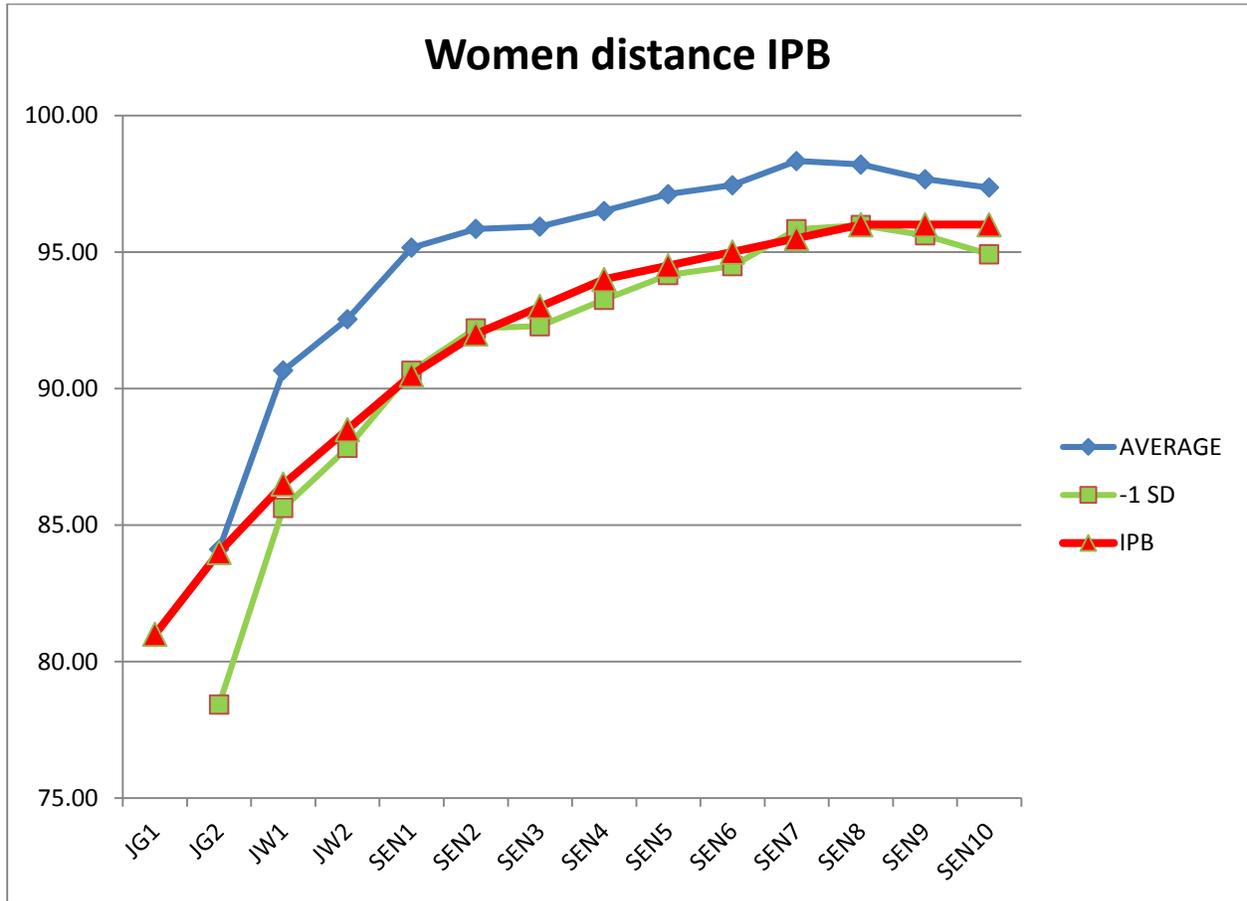
MEN SPRINT

Name	JB1	JB2	JM1	JM2	SEN1	SEN2	SEN3	SEN4	SEN5	SEN6	SEN7	SEN8	SEN9	SEN10
AVERAGE	83,06	89,22	92,39	93,83	96,68	97,50	98,00	98,18	98,15	98,29	98,59	98,27	98,56	98,64
-1 SD	77,47	84,41	88,30	90,05	93,77	95,20	96,00	96,58	96,57	96,72	97,02	96,76	97,28	97,69
IPB	84,50	87,50	90,00	92,00	94,00	95,00	96,00	96,50	96,50	96,50	97,00	97,00	97,00	97,00

Men sprint IPB
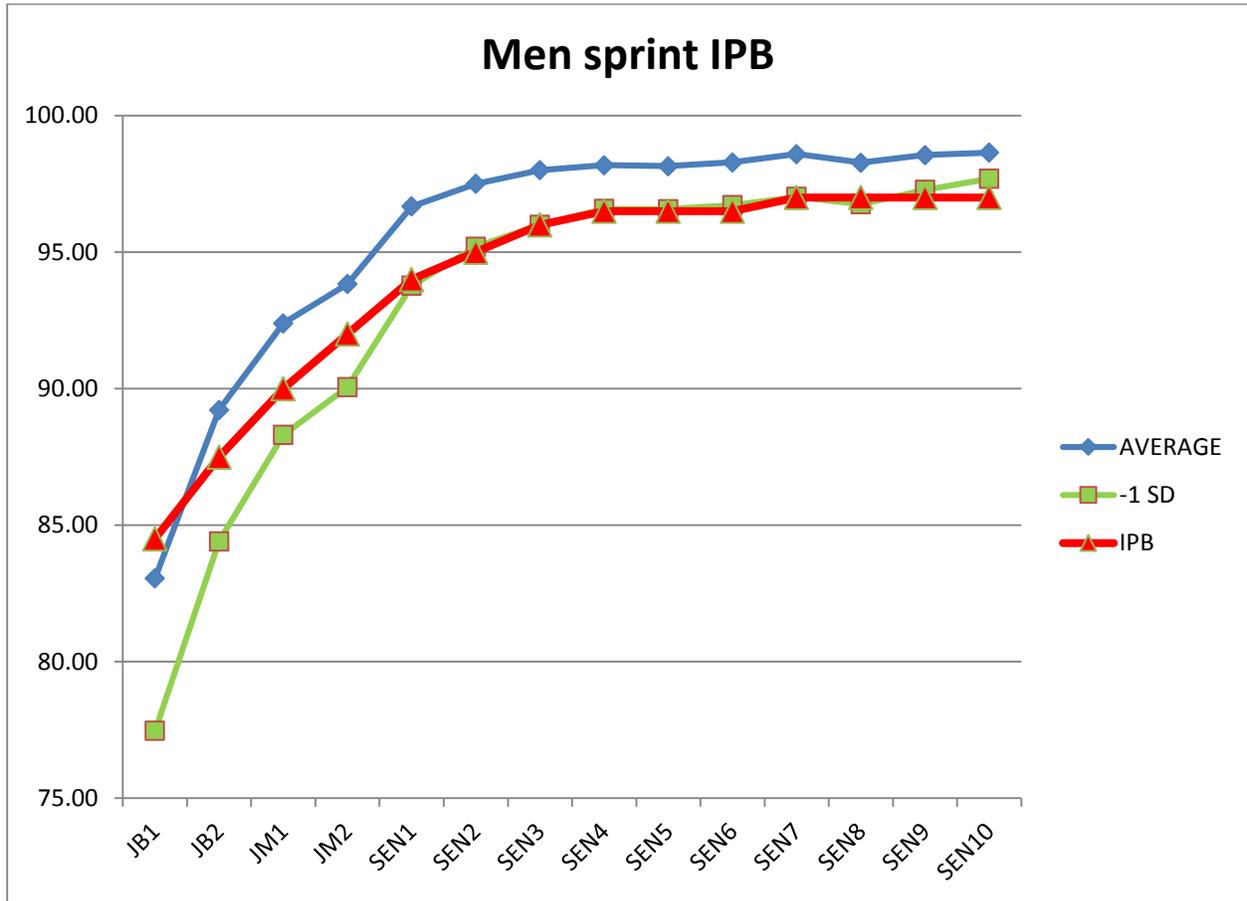
MEN DISTANCE

Name	JB1	JB2	JM1	JM2	SEN1	SEN2	SEN3	SEN4	SEN5	SEN6	SEN7	SEN8	SEN9	SEN10
AVERAGE	81,68	86,76	89,87	92,62	96,22	96,62	97,28	97,55	98,21	98,83	98,85	99,00	99,27	99,50
-1 SD	75,93	81,28	85,53	89,19	93,54	94,17	94,99	95,39	96,28	96,92	97,11	97,42	98,09	98,65
IPB	84,00	87,00	89,50	91,50	93,50	94,50	95,00	95,50	96,00	96,50	97,00	97,50	98,00	98,50

Men distance IPB