

How to Design Strength Training Programs using Prilepin's Table

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During the sixties and seventies of the 20th century, Soviet sports scientist A.S.Prilepin collected data from the training logs of more than 1000 World, Olympic, National and European weightlifting champions. Prilepin synthesized his findings in a very simple table named after himself. Prilepin's table gives time tested workout guidelines as to how did elite weightlifters train. Now, I am talking about training guidelines for pure maximal strength. Here's the table:

Intensity %1RM	Rep Range	Reps Total	Optimal Reps
<70%	3-6	18-30	24
70-79%	3-6	12-24	18
80-89%	2-4	10-20	15
>89%	1-2	4-10	7

Have in mind, that this table is based on a study of weightlifters. However, it is quite applicable to powerlifting and strength training. Prilepin's guidelines are widely used in the powerlifting circles, and that's simply because they work. If you are looking for ways to refine your strength training workouts, Prilepin's table is the answer. Let's first define intensity. Intensity is defined as the % of the maximal weight one can do for one rep (1RM). If you can lift 100 pounds one time for a given exercise, then lifting 70 pounds is defined as 70% intensity. Upon initial examination of the table, you will notice, that sets of more than 6 reps are not performed. They induce too much fatigue, and obviously are counter-productive for strength gains, especially in super technical lifts such as the Olympic lifts. To understand the table, consider designing a workout, where you will lift 75% of your 1RM. The table suggests that when training with 75% of your 1RM (Intensity Zone 70%-80%):

1. You perform sets of 3 to 6 reps
2. The total reps should be in the range of 12-24
3. The optimal total is 18 reps
4. If you do less than 12 total reps, the training stimulus would be too weak to elicit positive strength adaptation
5. If you perform more than 24 reps, you are going to slow down, and fatigue too much

There is one major problem with the table. It gives guidelines for a specific intensity zone. If you want to use 65%, 70%, 75%, and 80% of your 1RM in one workout, these weights fall into three different intensity zones. The rep ranges still rule, but what about the total number of lifts? If you add the guidelines for each intensity zone, you will end up with a grossly overestimated number of lifts (in this case, the optimal number of lifts will be $24+18+15=57$ lifts!). You will either tire yourself out, or more probably, won't be able to finish the workout at all.

In this article, I propose a way to get over this shortcoming. I'll give you a strategy to find the optimal number of lifts when designing strength training routines using weights from different intensity zones. My first idea is to introduce, what I will call the Prilepin Number of Lifts Score (PNLS). PNLS is a measure of how the performed repetitions in a given intensity zone, relate to repetitions performed in the other intensity zones. Let's assign a PNLS of 1, to the upper range of number of lifts for each intensity zone. Look at this table:

Prilepin Number of Lifts Score		
Intensity	Upper Total Limit	PNLS
<70%	30	1
70-80%	24	1
80-89%	20	1
>89%	10	1

When you perform the upper limit of reps in a given intensity zone, this yields a PNLS of 1. The PNLS for a given zone, will be calculated as $\frac{\text{Number Of Performed Lifts in Zone}}{\text{Upper Total Limit}}$. If you do

2 sets of 6 reps = 12 total reps with 60%1RM, the PNLS for these two sets is $\frac{12}{30} = 0.4$ (12 reps over 30 upper limit reps). Now if you target a PNLS of 1 for the whole workout, you can add more sets in a different intensity zone. If you add 5 sets of 3 reps = 15 total with 75% 1RM, the PNLS of these 5 sets will be $\frac{15}{24} = 0.625$ So if your workout is like this: Bench Press - 2x6x60%, 5x3x75% The total PNLS for the Bench Press will be $\frac{12}{30} + \frac{15}{24} = 1.025$. A PNLS of 1 is the upper limit according to Prilepin's table. For most intensity zones, the optimal PNLS falls between 0.7 and 0.8. Remember, that PNLS is exercise specific, so if your workout consists of 5 different exercises, each exercise will have its own PNLS. This was my first idea of measuring the relation between intensity and the number of lifts. I quickly discovered a problem in this scheme. Consider these two workouts:

6 sets x 4 reps = 24 reps at 72%1RM (ZONE 70-80%)

6 sets x 4 reps = 24 reps at 77%1RM (ZONE 70-80%)

Both workouts have a PNLS of $\frac{24}{24} = 1$, but workout #2 is harder. Now we need to devise a formula that further refines the correlation between the number of lifts and intensity. The formula should also fall within Prilepin's table guidelines.

I created a table that includes for each intensity of 60%, 70%, 80%, 90%, the upper limit number of lifts (NOL) according to the Prilepin's table and the sum of the two. Here's what I came up with:

Intensity	Upper NOL	Intensity + NOL
60%	30	90
70%	24	94
80%	20	100
90%	10	100

Now you see that if we sum the intensity and the number of lifts (the upper NOL limit from Prilepin's table), we end with a number of around 100.

Here's how I created my modified PNLS formula. Because the formula gives a relation between the Intensity(weight) and the number of lifts(NOL), I will call it INOL.

$$\text{INOL of a set} = \frac{\text{Number of Lifts(NOL) at a given intensity}}{100 - \text{intensity}}$$

If we run the formula with the previous examples we get:

1. Bench Press - 2x6x60%, 5x3x75%

$$2. \text{INOL(Bench Press)} = \frac{2 \times 6}{(100-60)} + \frac{5 \times 3}{(100-75)} = \frac{12}{40} + \frac{15}{25} = 0.3 +$$

$$0.6 = 0.9$$

1. Workout #1: 6 sets x 4 reps = 24 reps at 72%1RM

$$2. \text{INOL}(\#1) = \frac{24}{(100-72)} = 0.86$$

3. Workout #2: 6 sets x 4 reps = 24 reps at 77%1RM

$$4. \text{INOL}(\#2) = \frac{24}{(100-77)} = 1.04$$

The INOL formula favors a greater number of lifts at a lower intensity, and a smaller number of

lifts at a higher intensity. This is good, because, very heavy lifts (above 90%1RM) fry the Central Nervous System and induce a lot of fatigue. At the same time trainees are able to perform more total lifts than the Prilepin's table guidelines at lower intensities. Prilepin's guidelines for Reps per Set remain rock-solid. INOL will only influence the total number of lifts.

Now, what is the difference between 5x2x80% and 2x5x80%? They both have INOL of $\frac{10}{20} = 0.5$. But if you calculate the INOL as the sum of the INOLs for each set, you will get an idea of which is tougher:

$$5 \text{ sets} \times 2 \text{ reps} \times 80\% \text{ INOL} = 5 \times \frac{2}{20} = 0.1 + 0.1 + 0.1 + 0.1 + 0.1$$

$$2 \text{ sets} \times 5 \text{ reps} \times 80\% \text{ INOL} = 2 \times \frac{5}{20} = 0.25 + 0.25$$

In the first case, each set gave a 0.1 INOL (fatigue), while in the second case each set added a 0.25 INOL (fatigue). In the first example, the workout was easier because the total fatigue(INOL) was fragmented into smaller parts. Now you can design your workouts, by both looking at the total INOL, and the INOL distribution among the sets. INOL is a good measure of fatigue, that takes into account the weight(intensity) and the number of reps performed. When you design strength training workouts, using mixed intensity zones, you can calculate the INOL for each exercise and follow these guidelines. You can track and modify them to suit your body for best results. By spreading the INOL among more weekly sessions you will be less fatigued, compared to concentrating all work sets in less sessions. It is my view, that very frequent workouts, with workout INOLs of 0.6-1 work best for most people. The only problem is that for most people it is too impractical to lift very frequently.

Total WEEKLY INOL of a single exercise:

Weekly INOL Guidelines:

<2	easy, doable, good to do after more tiring weeks and prepeaking
2-3	tough but doable, good for loading phases between
3-4	brutal, lots of fatigue, good for a limited time and shock microcycles
>4	Are you out of your mind?

Single Workout INOL of a single exercise:

Workout INOL Guidelines

<0.4	too few reps, not enough stimulus?
0.4-1	fresh, quite doable and optimal if you are not accumulating fatigue
1-2	tough, but good for loading phases
>2	brutal