**LATIN SQUARE DESIGN (LSD)**

A relevant question on the problem on tyre brands is whether there is a possible position effect. Experience shows that rear tyres get worn out faster than front tyres and even different sides of the same car show different amounts of tread wear. In the RBD, the 4 brands were randomized to the 4 wheels of each car with no regard for position.

The effect of position on tread wear can be balanced out by rotating the tyres every 6666.7 km giving each brand 6666.7 km on each wheel. However the easiest randomization is to have the positions imposing another restriction on the randomization in such a way that each brand is not only used once on each car but only once on each of the 4 possible positions.

A design in which each treatment appears once and only once in each row and once and only once in each column is called a Latin Square Design.

Our interest is still centered on one factor which are our treatments (tyre types) but 2 restrictions are placed on the randomization.

**Car**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Positions** | **I** | **II** | **III** | **IV** |
| LF 1 | C | D | A | B |
| RF 2 | B | C | D | A |
| LR 3 | A | B | C | D |
| RR 4 | D | A | B | C |

Note that in the above table, each row and each column of the 4x4 square represents a complete replication of the 4 treatment levels. The model is now   
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4x4   
**Advantages**   
1.The major advantage of LSD is that it has greater power compared to CRD and RBD since this design permits the investigator to isolate the variation attributable to three (3) variables; the rows, columns and treatments.

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**LSD for the tyre-type example**   
  **Car**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Position** | **I** | **II** | **III** | **IV** | 𝒚𝒊𝒐𝒐 |
| 1  2  3  4 | C(12) B(14) A(17) D(13) | D(11) C(12) B(14) A(14) | A(13) D(11) C(10) B(13) | B(8)  A(13) D(9)   C(9) | 44  50  50  49 |
| 𝒚 |  |  |  |  |  |

sums of squares and obtain a more precise estimate of the common variance σ2 namely 1.3 as in the RBD.