STATICS REVISION

There are 4 types of bridges: girder, arch, suspension, truss
https://www.youtube.com/watch?v=52ECMAIWOxA&t=535s ➔ makes life easier

Girder ➔ one deck with cross girders (and that's about it) ➔ mostly for railways
Arch ➔ there's a circular shape (stable), mostly stone
Suspension ➔ has cables and poles, can stretch to further distance with only a few poles
Truss ➔ with triangular elements to support the deck.

Load paths:
Traffic loads (wheels) ➔ deck ➔ stringers ➔ cross girders ➔ truss joints

FOR INTERIOR NODES ONLY

- **To calculate dead load of deck (load of the concrete slab) at each node:**

Step 1: Find **unit weight** of concrete (in kN/m^3) by changing the density (kg/m^3) to (kN/m^3)
Step 2: times **unit weight** of concrete (in kN/m^3) with the thickness of the concrete slab to get an answer in (kN/m^2) ➔ which is unit weight of concrete per square meter of area
Step 3: times unit weight of concrete per area with the **distance between two nodes** to get an answer in (kN/m) ➔ which is the line load along the cross girder
Step 4: times this line load to the **length of the girder** (the width of the concrete slab) and **divided by 2** to get the point load at EACH NODE

- **To calculate the traffic load at each node:**

Step 1: According to L44 Code (section 2.3.3) each lane has traffic load = 12.5 (kN/m) AND an additional 150 kN load in the middle (max. effect)
Step 2: times this lane load (kN/m) to the distance between two nodes (m) to get answer in (kN) to get the traffic load at each node. The middle node has an additional 150kN load

FOR STARTING NODES ONLY:

- **To calculate dead load of deck (load of the concrete slab) at each node:**

Step 1: Find **unit weight** of concrete (in kN/m^3) by changing the density (kg/m^3) to (kN/m^3)
Step 2: times **unit weight** of concrete (in kN/m^3) with the thickness of the concrete slab to get an answer in (kN/m^2) ➔ which is unit weight of concrete per square meter of area
Step 3: times unit weight of concrete per area with the **distance between NODE 1 & NODE 2 (which is half the normal distance)** to get an answer in (kN/m) ➔ which is the line load along the cross girder
Step 4: times this line load to the **length of the girder** (the width of the concrete slab) and **divided by 2** to get the point load at EACH STARTING NODE

- **To calculate the traffic load at each node:**

Step 1: According to L44 Code (section 2.3.3) each lane has traffic load = 12.5 (kN/m) AND an additional 150 kN load in the middle (max. effect)

Step 2: times this lane load (kN/m) to the **distance between NODE 1 & NODE 2 (m) (which is half the normal distance)** to get answer in (kN) to get the traffic load at each starting node.

There are three types of supports: fixed, hinge/pin, and roller

With fixed support, there are three reaction forces (X, Y, M)
With pin support, there are two reaction forces (X, Y)
With roller, there is only one reaction force at a time (either X or Y)

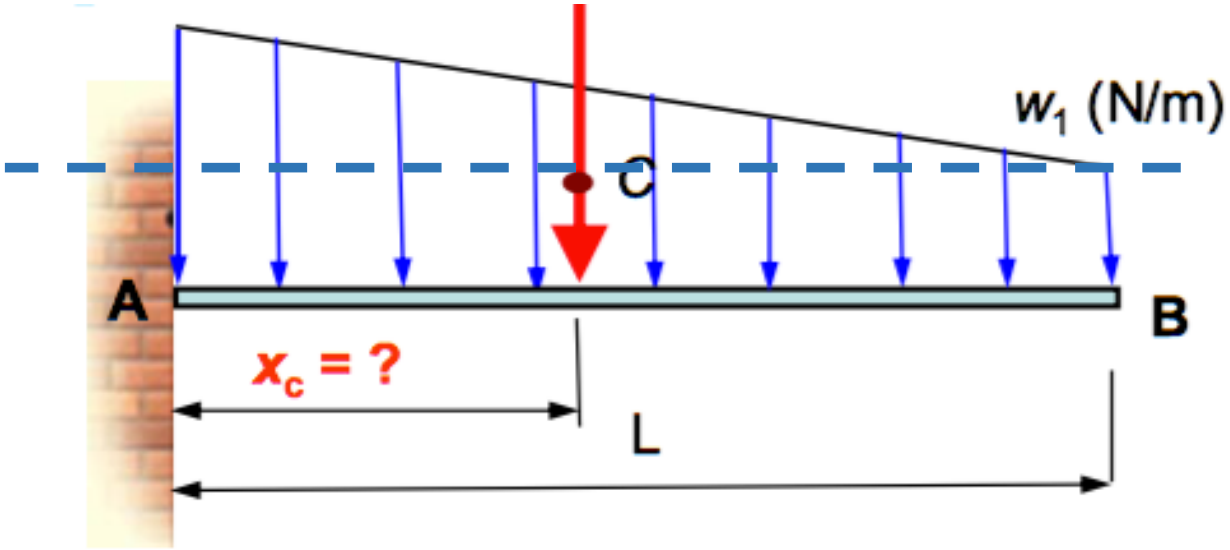
How to calculate resultant force:

Find F_{Rx} (the x-component of F_R) by adding ALL x-components of the forces present in the system
Find F_{Ry} (the y-component of F_R) by adding ALL y-components of the forces present in the system
Use Pythagoras theorem to find F_R (which should be the hypotenuse)
➔ to find direction angle, take Tan (θ)

How to find moment at ANY point at all:

Just draw a pair of axies at that point
➔ Then SEE which forces (**other than** forces at THAT point) are perpendicular to those axies.
➔ M = Force x distance

How to find the moment at point A in this system:



Step 1: divide the system into 2 simple shapes ➔ a triangle and a rectangle
Step 2: Find the location of centroid (the x-coordinate only) of both the triangle and the rectangle.

- For the rectangle, x_C = 1/2 x length.
- For the triangle, x_C = 1/3 x base

Step 3: Calculate M_A ➔ point loads at **both centroids** time with the distances from point A