Traffic Light Controller

Consider a traffic light controller implemented as a state machine. The light controls a simple road crossing with no turn arrows. Road sensors indicate whether cars are present in the south-north (I_{SN}), and east-west (I_{EW}) directions. Light controls are encoded by a two bit signal (red = 00, yellow = 01, and green = 10). However, for this problem, we'll assume there are two outputs (O_{SN} and O_{EW}) that can assume the values R, Y, or G. Light control in the north direction (O_{SN}) is identical to light control in the south direction. Light control in the east direction (O_{EW}) is identical to light control in the west direction. The controller's behavior should meet the following requirements:

1. The controller is clocked at a period of one second.
2. When the light for one road goes red, the light for the other road simultaneously goes green.
3. A one second yellow light should preceed a red light.
4. The minimum green light is three seconds long.
5. In the absence of active road sensors, the green light should given to the road with the last active input.
6. The maximum wait for a green light (if stopped by a yellow light) is five seconds.
7. If both road sensors are constantly active, the green light should alternate between the roads while observing the minimum green and yellow light constraints.

Following these rules, design a state diagram describing the behavior of this controller. Draw your states in a circular pattern with state zero at the top. Other states should increase around the circle in a clockwise direction. Label each transition arc with active inputs (I_{SN} and/or I_{EW}) and outputs (O_{SN} and O_{EW}) using the slash notation discussed in class. However, define the outputs as R, Y, or G instead of the actual binary code.