TO: PROF. OLIVIER DE WECK, DR.IL YOUNG KIM

FROM: ALF KOHLER, NAMIKO YAMAMOTO

SUBJECT: 16.810 MOTOR BIKE FRAME DESIGN AND ITS FEA RESULTS

DATE: 2/5/2004

We modified out original design of the bike frame which we submitted on January 12th in order to satisfy the requirements. Several lines in our design consist of arches, which we believed distribute the stresses and reduce displacement accordingly. In the process of modifying the design, we noticed the fact that an end of an arch should be placed at the fixed point and that the direction of the force should point against the arch's curve in order to make the most of the nature of arches. For example, the two loadings at the measurement point 2 are supported by two arches. The loading of 75 lbs in the – y direction is counteracted by the arch horizontally places, and the other loading of 50 lbs in the – x direction is supported by the other arch to reduce the displacement and change the directions of the forces towards the left fixed point. Two curves right below the measurement point 2 have two main functions. The first one is to minimize the y direction displacement by placing masses just below the loading point. The second one is again to transfer the forces towards the two fixed points.

The properties of the bike frame loaded were estimated with the Solidwork, a 3-D modeling software, and the COSMOWorks, an FEM analysis software.   The following table shows the results.   As shown, further modification are required to meet the requirements for the displacement at the measurement point 2, the 1st mode, and the mass.

Displacement (mm)	
1 X	0.029619
Y	0.028768
at 45 degrees	0.041286
2 Y	0.012577
Mass (lb)	0.496
Cost	
Perimeter (in)	
Cut rate at Q=3 (in/s)	12
Cost per time ($/hour)	75
Cost per part ($)	4.71025
1st mode (Hz)	244.53