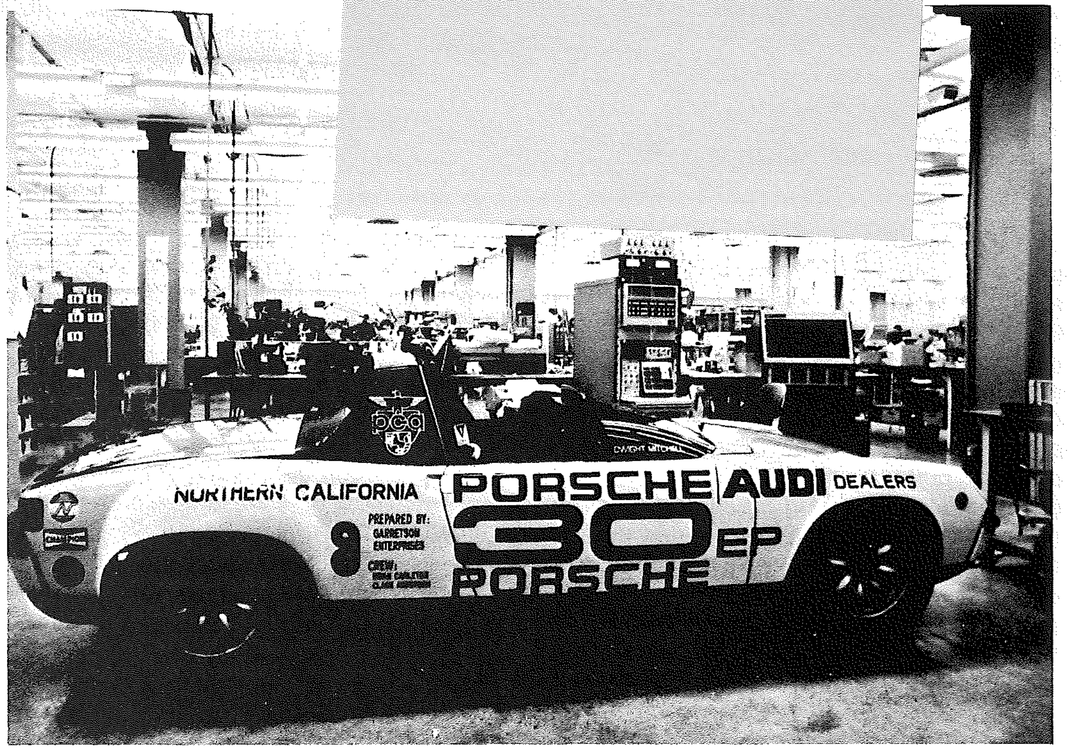

Figure 1

914 CHASSIS DYNAMIC ANALYSIS

by Bruce Anderson, Golden Gate Region

In 1973, we had an opportunity to perform a dynamic analysis on the 914 chassis at Hewlett Packard's Santa Clara Division. This was a fortunate opportunity afforded us by fellow PCA member, Hank Fallek, who was, at that time, the Fourier Analyzer Product Manager at Hewlett Packard.

The purpose for these tests was to determine where to mount a roll cage to best reduce the chassis flexure under dynamic conditions. The method employed was to generate vibrations in the car using Zonic Technical Laboratories' hydraulic exciter system and measure the resulting vibrations with a Hewlett Packard Fourier Analyzer. Figure 1 shows the car in the labora-

Figure 2 shows the method used to couple the force from the hydraulic exciter to the car. The car was allowed to rest on three tires with the left rear jack point resting on the hydraulic exciter. A static force level of approximately 750 pounds was required to maintain the exciter at mid-stroke. A dynamic force of approximately 175 pounds was then used to excite the car at various frequencies between 10 and 500 cycles per second. At that time, we felt that the most interesting and most important modes of vibration fell between 10 and 70 cycles per second.

Figure 3 shows the left rear fender of the car with four markers on the fender to indicate where the accelerometer was used to measure

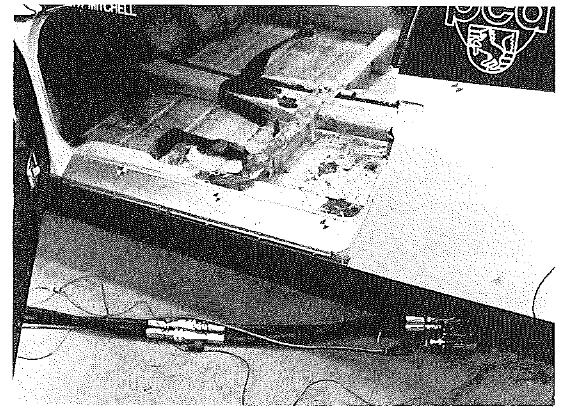
Figure 2

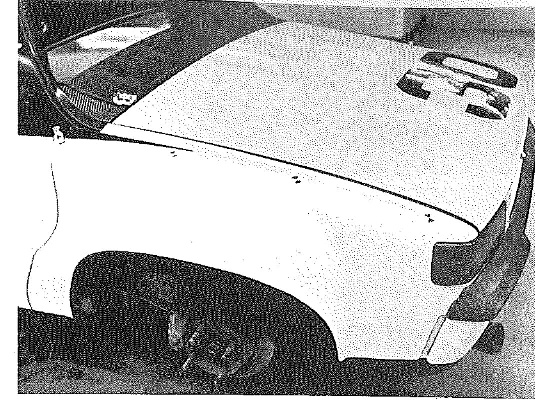
Figure 3

Close examination of the vibrations between 10 and 70 cycles per second disclosed several important modes of vibration. It was decided to investigate 7 of these modes of vibration because they had the largest amplitudes of all the various modes. By using the accelerometer to probe the vibrations at various points on the car during excitation, the shapes of each mode could be plotted. Each point in the plot involved a comparison of the input force at the exciter to the accelerometer output using Fourier Analysis techniques. The modes plotted were 11, 12, 15, 18, 31, 38 and 56 cycles per second. The 11 cycle mode was simply a rolling mode of the rigid body on the tires as a mounting. The 12 cycle mode depicts a large torsional mode with nodes at the front of the car. The 15 cycle mode appears to be a combination pitching and bending mode. The 18 cycle mode is a classical, first order bending of the car. The 31 cycle mode is also a first order bending mode with less flexure at the front end of the car. The 38 and 56 cycle modes were first order bending and torsional modes combined. It was noted that nodal points (i.e. points free from vibrations) for all the modes were relatively close to each other and centered around the shock mount bulkheads at each end of the car.

It was suggested that a 6-point roll cage attached to two node points and one anti-node point on each side of the car would improve the car's resistance against flexing—improving its handling characteristics on the race track. We installed the roll cage as recommended and the tests were repeated. The tests showed a great reduction in vibrations at the various modes and in some cases changes in frequencies of the modes to a higher frequency. The driver, Dwight Mitchell, felt that it had made a great improvement in the handling of the car.

During this past autocross season, we have had the opportunity to install the same type of roll cage in our Garreston Enterprises 914 autocross car. We found the change in the car's handling to be almost unbelievable. The car is much more responsive to steering changes and more predictable. Figure 4 shows the roll cage mounted in the autocross car. 3/76