Roland refers to the works of Whipple [1899], Bower [1915], Pearsall [1922], Manning [1951], Döhring [1955], Collins [1963], Singh [1964], and also Singh and Goel [1971]. However, he makes no comparisons to their equations of motion.

Weir, 1972

In an appendix to his 1972 UCLA Ph.D. dissertation focusing mainly on the control and handling characteristics of motorcycles, Weir derived the equations of motion for the Basic bicycle model with a general Newtonian approach, linearizing as the derivation proceeded. Weir's final 4 equations, eq. [A-85], [A-92], [A-99], [A-108] in his analysis, represent the lateral motion, yaw, lean and steer equations of motion.

Weir was the only author to state explicitly that he compared his equations to another past work.[6] He compared his equations to Sharp's [1971] four equations (before Sharp's simplification to only two nontrivial degrees of freedom). In comparing Weir's 4 equations to Sharp's four equations, we find Weir and Sharp in agreement with one another. Weir, however, is more general than Sharp, in that he did not make the simplifying assumption regarding the principal axes of the front inertia. When Weir's four equation are simplified by adding the zero sideslip constraints we find his equations agree exactly with ours, as long as our nonstandard sign convention for wheel angular momentum (positive for forward rolling) is recognised.

[6] See page 130 of Weir's dissertation.

Besides stating that comparing his equations agree with to Sharp's, Weir refers to Whipple [1899], Pearsall [1922], Döhring [1955], Singh [1964], Singh and Goel [1971], but does not compare his equations to these **works.**

Singh and Goel, 1975

In 1975 Singh and Goel presented (but did not derive) a 12th order mathematical model, for the continued analysis of the Rajdoot scooter. Instead of using Singh's [1964] equations, or Dohring [1955] equations **as** they did in 1971, they employ a Lagrangian formulation which appears similar to Sharp's [1971] format. The authors claim that the model used is a fully general Basic bicycle model, having in addition unsymmetric lateral mass distribution, lateral slip, aerodynamic forces, viscous damping of the steering, and transient tire forces and moments (which account for the high order of the system).

The four equations of motion presented are said to represent the lateral motion, yaw, lean, and steer equations of motion. We have not yet checked these equations for correctness, but they do appear similar to Sharp's [1971] four equations. Singh and Goel refer to their 1971 paper on the Rajdoot scooter, and to Sharp's [1971] paper, but do not compare their equations.

***Sharp** and Jones, 1975*

In 1975 Sharp and Jones use the equations derived by Sharp [1971] and modify it to incorporate a different tire model. **As** in the 1971 paper the principal axes of