TABLE 6.3 - REGRESSION ANALYSIS OF THE RUT DEPTH (IN mm) AFTER BLADING

Parameter	Estimate	Standard Deviation	t-value
Intercept	5.46	0.29	19.09
T1	3.80	0.38	10.10
T2	4.74	0.39	12.03
NT	0.0158	0.0014	11.54
S2 x G	0.178	0.069	2.57
S2/R	-587.4	88.7	-6.62
S2 x PI	-0.118	0.033	-3.56
S2 x T1	3.00	0.56	5.35
S2 x NC	0.0226	0.0023	9.79
S2 x NT	-0.0134	0.0018	-7.41

ferent maintenance standards, rather than a surfacing type influence. A consistent influence over all three surfacing types is that of the number of trucks. The larger the average daily truck traffic, the greater the rut depth after blading, probably because of compaction of the surfacing which makes blading more difficult. In the wet season several other factors become important, while the truck influence is virtually eliminated. For increasing grade and average number of cars the rut depth after blading is increased, as is the rut depth on quartzite surfaced roads. On curves, the rut depth is less than on tangents, probably because a wider dispersion of lateral positions occur on curves. An increase in the plasticity index results in a decrease in rut depth. This is attributed to the increased cohesion at relatively low moisture contents where the road was passable for the Mays Meter vehicles, but in those cases at high moisture contents where the road became impassable, no measurements were taken.

A further analysis was run to determine whether the average daily traffic could adequately substitute the two traffic classifications of Model (6.2). The resultant model had an R-squared of 0.21, which is significantly lower, at the 0.01 level, than that of Model (6.2). Therefore, the hypothesis that the coefficients of the two traffic classifications are the same is rejected.

6.5 *DISCUSSION OF THE MODELS*

The rut depth at any time is determined using two models. One model predicts the change of rut depth over time, and the second predicts the rut depth after blading. Intuitively, one might expect that immediately after blading, rut depth should be zero. This was not found to be the case, and thus supports the findings of the Kenya study (Hodges, Rolt and Jones, 1975) which showed that the rut depth after blading was, for example, 11 mm on laterite roads. This phenomenon may be attributed to blading techniques. Blading on the study sections in Brazil consisted of pulling loose material from the shoulder and spreading it over the roadway. The riding surface was normally not cut, particularly if the surface was firmly compacted.

Table 6.4 shows the change in rut depth over a 100 day period generated from Model (6.1). The values are for the external

SEASON	ADT CARS AND PICKUPS	ADT TRUCKS AND BUSES \ GRADE (%)	0								8							
		RADIUS OF CURVE (m)	TANGENT				180				TANGENT				180			
		PLASTICITY INDEX (%)	0		30		0		30		0		30		0		30	
		UPHILL OR DOWNHILL LANE	U	D	U	D	U	D	U	D	U	D	U	D	U	D	U	D
DRY	0	15	10.2	10.6	4.5	4.8	10.2	8.8	4.5	3.0	2.0	2.3	-3.8	-3.4	2.0	0.5	-3.8	-5.2
		400	21.9	22.2	16.1	16.5	21.9	20.4	16.1	14.7	13.6	14.0	7.8	8.2	13.6	12.1	7.8	6.4
	400	15	18.1	18.5	12.4	12.7	11.4	9.9	5.6	4.2	9.9	10.2	4.1	4.5	3.1	1.7	-2.7	-4.1
		400	29.8	30.1	24.0	24.4	23.0	21.5	17.2	15.8	21.5	21.9	15.7	16.1	14.7	13.3	9.0	7.5
WET (S_2=1)	0	15	9.6	10.0	3.9	4.2	9.6	8.2	3.9	2.4	1.3	1.7	-4.4	-4.0	1.3	-0.1	-4.4	-5.8
		400	5.4	5.8	-0.3	0.0	5.4	4.0	-0.3	-1.8	-2.8	-2.5	-8.6	-8.2	-2.8	-4.3	-8.6	-10.0
	400	15	17.5	17.9	11.8	12.1	10.7	9.3	5.0	3.6	9.3	9.6	3.5	3.9	2.5	1.0	-3.3	-4.7
		400	13.3	13.7	7.6	7.9	6.6	5.1	0.8	0.6	5.1	5.4	-0.7	-0.3	-1.7	-3.2	-7.5	-8.9

FOR PERCENTAGE PASSING 0,074 mm SIEVE = 10 %

TABLE 6.4 - GENERATED VALUES OF CHANGE IN RUT DEPTH OVER A 100 DAY PERIOD AFTER BLADING FROM MODEL (6.1).

wheelpath and for a surfacing material which has 10 percent passing the 0.074 mm sieve. Substantial ruts develop under heavy traffic, as evidenced by the predicted 30 mm change in rut depth. However, in general, the change in rut depth over a 100 day period is relatively small, suggesting that rutting may not trigger maintenance for the strong pavements studied.

Figures 6.1, 6.2 and 6.3 show the data points and the rut depths predicted from Equations 6.1 and 6.2 for several different sections. The lack of close agreement between data points and predicted values is due in part to using equations that fit the data for all study sections. Also, the vertical scale of the plots is exaggerated for a very small unit of measurement (mm) on an extremely variable property. The figures show that the rut depth is self-restoring during the transition of the dry to wet season, *i.e.*, the rut depth after the transition season is relatively low. This is attributed to drivers who, in avoiding the water in the ruts, generate new wheeltracks which were then measured. According to all acounts, section 205 was never bladed during the observation period and the predicted rut depth represents this situation. There are no data points from November to April because the road was extremely muddy, and at times completely impassable to the Mays Meter vehicles. In addition, the transverse road profile was extremely uneven from material that was squeezed aside making realistic measurements extremely difficult.

The use of Equation 6.1 in the transition season can possibly result in negative rut depths. Inspection of the data showed that during this period the minimum rut depth was about 5 mm, and this value is used as a minimum in those cases where the prediction results in a lower value. Both the prediction equations for rut depth after blading and the change in rut depth over time contain horizontal radius of curvature terms. For very small radius curves, say 20 m, completely unrealistic predictions result. To overcome this problem a minimum radius of curvature of 100 m is proposed, until a more rational limiting value is obtained from future data sources.

6.6 SUMMARY

Models (6.1) and (6.2) are recommended for general use for

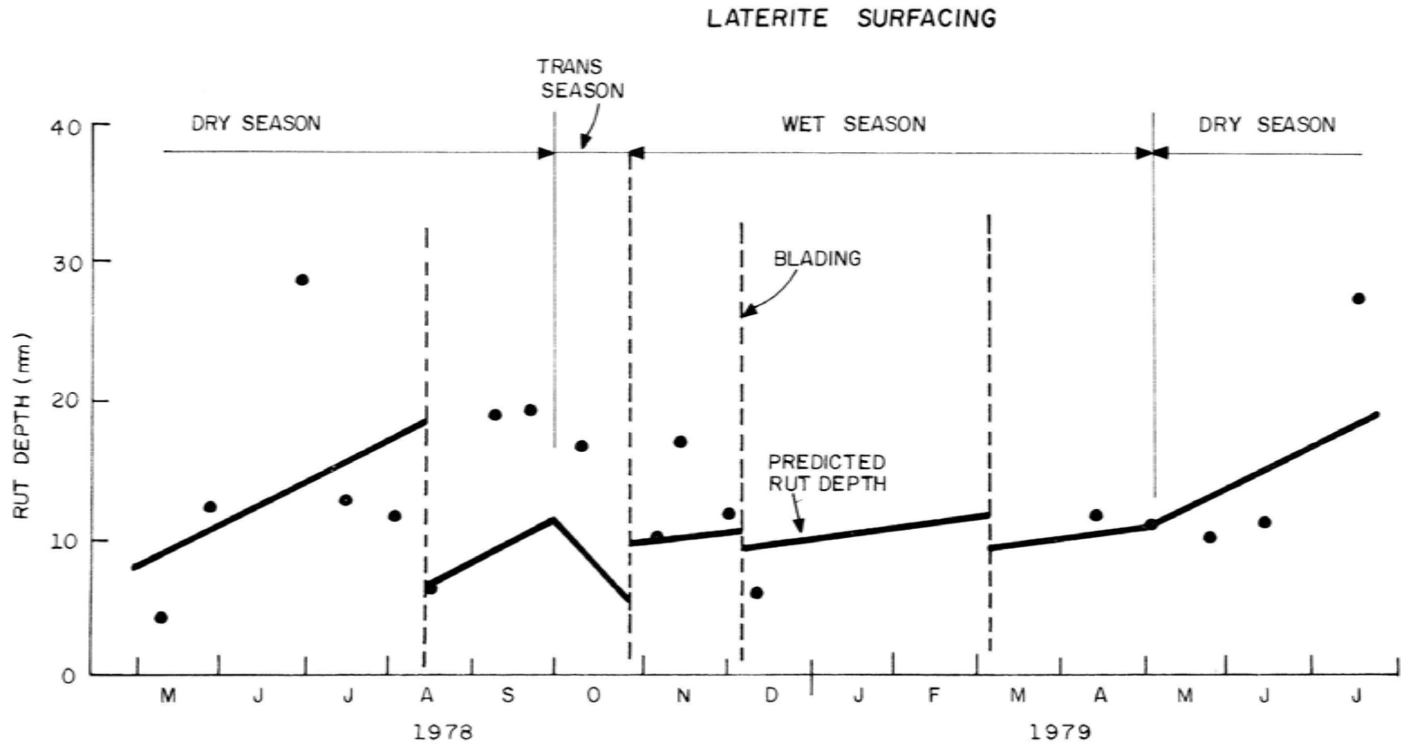

FIGURE 6.1- MEASURED AND PREDICTED RUT DEPTH ON DOWNHILL LANE OF SECTION 256.

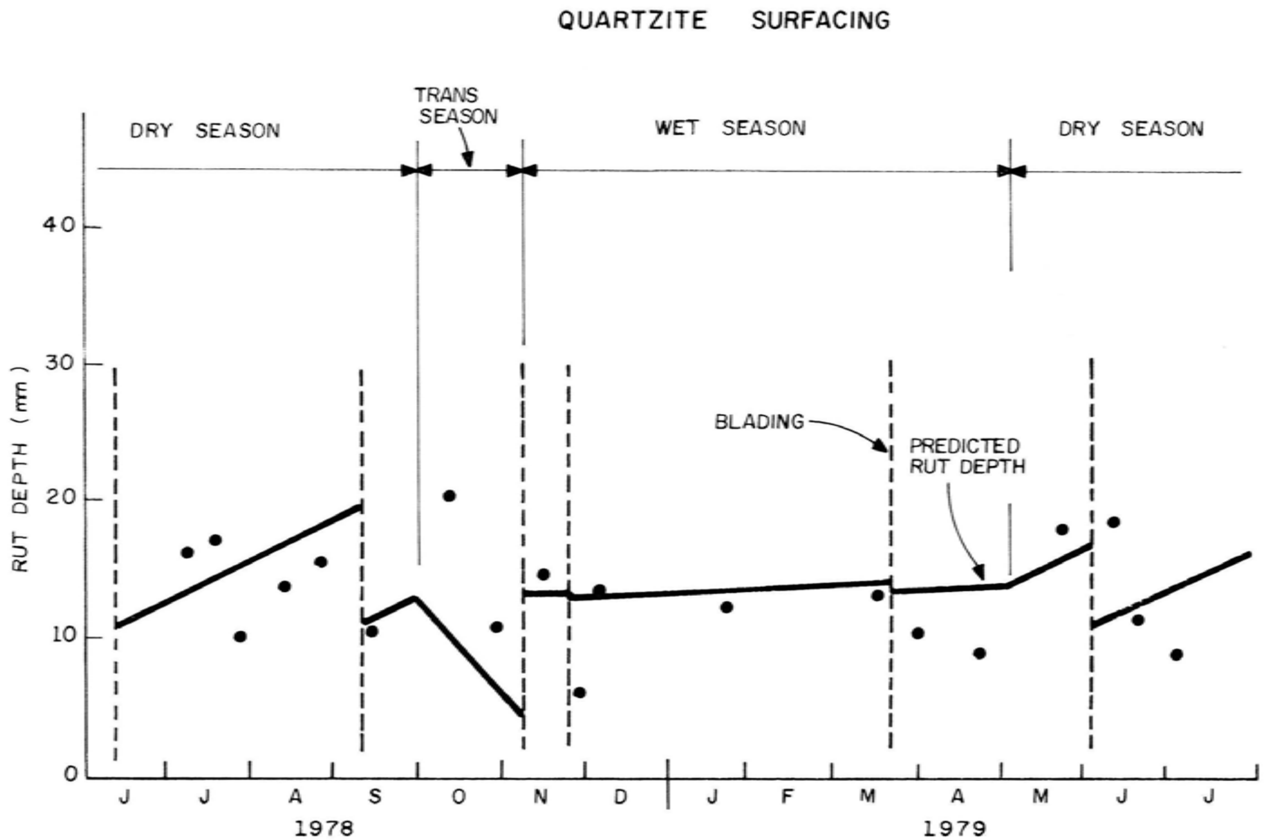

FIGURE 6.2 - MEASURED AND PREDICTED RUT DEPTH ON UPHILL LANE OF SECTION 303.

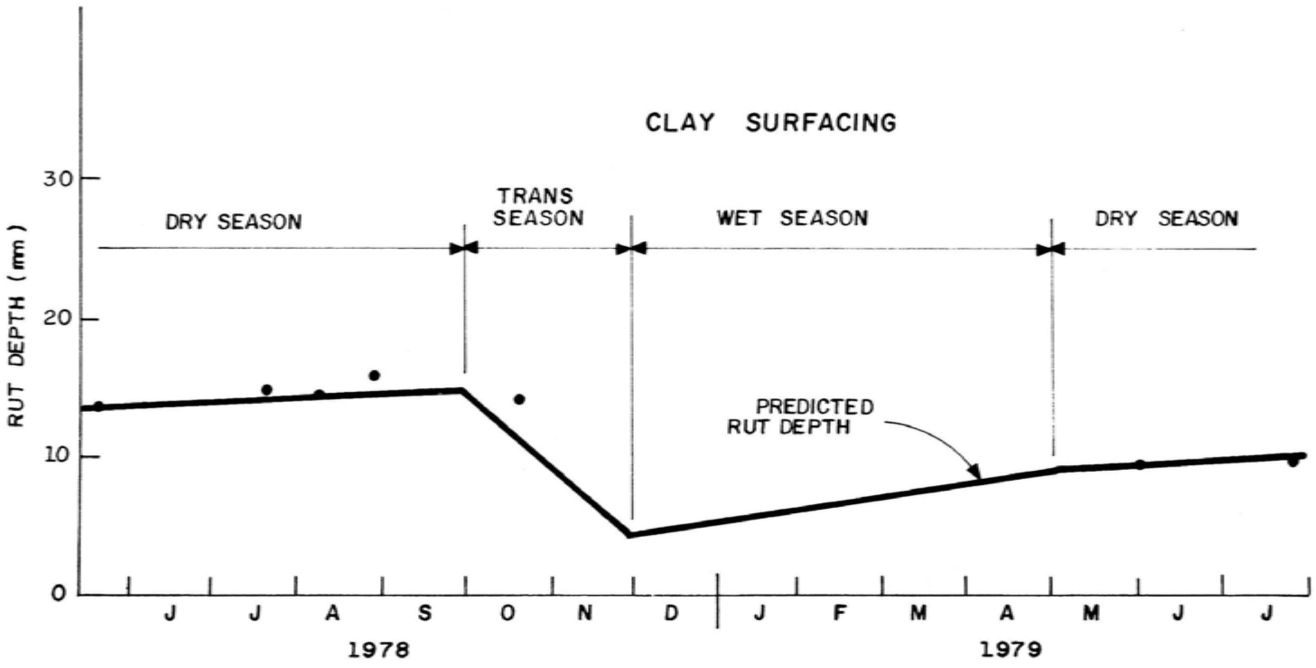

FIGURE 6.3 - MEASURED AND PREDICTED RUT DEPTH ON UPHILL LANE OF SECTION 205.

predicting the rut depth at any time. These models generate reasonable predictions during the wet and dry seasons even outside the inference space in which the models were developed. Although no substantive data are available, it is proposed that a 100 m radius curve be used as a limit even if the radius is smaller, to avoid unrealistic extrapolations. In the transition season from the dry season to wet season there is a sharp reduction in rut depth as drivers avoid ruts where water collects. In certain cases, the reduction could lead to predict negative values of rut depth. To overcome this problem, a threshold of a 5 mm rut depth, which was an average minimum value observed during this period, is recommended when this model is applied.

A comparison of the predicted timewise change in ruth depth with data collected in the Kenya study shows excellent agreement. Furthermore, this good agreement is applicable to both the high and low annual rainfall data. This leads to a tentative conclusion that the models developed are applicable to all rainfall conditions.