PHASE I OF THE NEAR TERM
HYBRID PASSENGER VEHICLE DEVELOPMENT
PROGRAM

*
* FINAL REPORT *
*

MASTER

APPENDIX C: PRELIMINARY DESIGN DATA PACKAGE

Volume II: Appendices

Prepared for
JET PROPULSION LABORATORY
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The research described in this publication represents the third of the several Tasks of the "Phase I of the Near Term Hybrid Passenger Vehicle Development Program" being carried-on by Centro Ricerche FIAT (CRF) on Contract No. 955187 from the Jet Propulsion Laboratory, California Institute of Technology.

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APPENDIX A.1-1

HYBRID VEHICLE SODIUM-SULPHUR-BATTERY

Contribution of BBC for JPL Hybrid Vehicle
Contract No. 955187

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1. INTRODUCTION

Na-S/batteries, when fully developed, are believed to be suitable for the propulsion of electric vehicles because of

- High energy density (Wh/kg and Wh/l)
- High power density (W/kg and W/l)
- Low price
- High cycle life
- High availability of the reactants.

A Na-S/battery consists of many series-parallel connected cells, a heat insulation and a temperature control system. A single cell contains the two molten reactants Sodium and Sulphur (or Na_2S_x if discharged), the beta-alumina solid electrolyte tube separating the reactants and the cell case. The operating temperature amounts to 285 °C to 350 °C. The design and the problems of Na-S/cells and Na-S/batteries are described in more detail in (1) (*).

2. STATE OF DEVELOPMENT

Our present cells show the following characteristics:

Length of ceramic tube:	200 mm
Ceramic outer diameter:	25 mm
Length of the cell:	235 mm
outer diameter of the cell:	37 mm
Cell weight:	460 g
Capacity:	40 Ah
Open circuit voltage:	2 V
Internal resistance:	$\leq 25 \text{ m}$
Maximum current:	40 A

(*) Numbers in parentheses designate Reference at end of section.

Maximum power:	40 W
Energy at maximum power:	40 Wh
Current at 5 hours discharge:	8 A
Power at 5 hours discharge:	14.4 W
Energy at 5 hours discharge:	72 Wh
Efficiency ($E_{out} : E_{in}$) at 10 hours charge:	0.88

A battery with 96 of an earlier type of cells has been built (Fig. A.1-1.1) (2).

The performance of the battery was as expected from single cell experiments. Batteries with the new type of cells will be built and tested in 1979/80. Further efforts will be directed towards improving the following properties:

- Life cycle of single cells
- Electrolyte tube and cell dimensions
- Safety
- Energy and power density
- Efficiency of heat insulation
- Advanced technology for mass production.

3. Na-S BATTERY FOR A HYBRID VEHICLE

The dimensions for a battery to be installed between the back wheels of a hybrid vehicle should not exceed the following dimensions:

Length:	900 mm
Width:	1200 mm
Height:	400 mm

The following electrical data should be achieved:

Peak power:	≥ 32 kW for 1 minute
Power:	15 kW for 10 minutes
Open circuit voltage:	≤ 84 V

FIG. A.1 - 1.1 — EXPERIMENTAL BATTERY WITH 96 CELLS

The weight should not exceed 300 kg.

If possible the battery should contain 12 separate strings. The connections for the different strings should be leaded separately to the outside of the battery and it should be possible to switch them off after charging or discharging.

The battery has to resist the normal stress which occurs during operation of the vehicle.

The normal accelerations during operation at the car do not exceed 1 g as can be seen from Fig. A.1-1.2 (3).

4. BATTERY DESIGN FOR THE HYBRID VEHICLE

4.1 Cell

The cell design for the hybrid vehicle battery is based on the cell described in chapter 2.

The dimensions of the cell were chosen in a way that high power density results at low discharge times of less than one hour (curve Δ of Fig. A.1-1.3).

By extrapolation of the cell data mentioned above, which have been already achieved and by assuming that a slight improvement with respect to internal resistance can be attained ($2 \Omega \text{ cm}^2$) the following data for a hybrid vehicle cell will be obtained:

Length of ceramic tube:	250 mm
Outer diameter of ceramic tube:	25 mm
Length of the cell:	285 mm
Outer diameter of the cell:	37 mm
Cell weight:	560 g
Capacity:	52.5 Ah
Open circuit voltage:	2 V
Internal resistance:	13.3 m Ω
Maximum current:	75 A
Maximum power:	75 W

FIG.A.1-1.2 – VERTICAL ACCELERATION IN RELATION TO FREQUENCY.
CAR SPEED: 60 km/h ON MACADAM ROAD

FIG.A.1-1.3— SPECIFIC POWER IN RELATION TO DISCHARGE TIME OF A CELL

Discharge time at max. power:	0.7 h
Energy at max. power:	52.5 Wh
Efficiency ($E_{out} : E_{in}$) at charging times of about 10 hours:	0.45
Current at 5 hours discharge:	10.5 A
Power at 5 hours discharge:	19.5 W
Operating voltage at 5 hours discharge:	1.86 V
Energy at 5 hours discharge:	97.7 Wh

4.2 Battery

The battery consists of 24 modules. Each module contains 18 series connected cells. Two series connected modules form a string. The battery consists of 12 strings. By parallel connection of these strings a battery with the following data will be obtained:

Number of cells:	432
Length:	900 mm
Width:	1100 mm
Height:	400 mm
Weight overall:	320 kg
Capacity:	630 Ah
Open circuit voltage:	72 V
Internal resistance:	39.9 m Ω
Maximum current:	900 A
Maximum power:	32.4 kW
Operating voltage:	36 V
Energy at max. power:	22.7 kWh
Discharge time at max. power:	0.7 h
Efficiency ($E_{out} : E_{in}$) at charge time $\geq$ 10 hours:	0.45
Maximal charging voltage:	105 V
Two hours current:	315 A

Two hours power:	18.7 kW
Operating voltage	59.4 V
Two hours energy:	37.4 kWh
Efficiency ($E_{out} : E_{in}$) at charge time $\geq$ 10 hours:	0.75
Five hours current:	126 A
Five hours power:	8.4 kW
Operating voltage:	67.0 V
Five hours energy:	42.2 kWh
Efficiency ($E_{out} : E_{in}$) at charge time $\geq$ 10 hours:	0.9

4.3 Insulation

The double walled casing of the battery containing the heat insulation between the walls consists of two parts. Both parts are fixed at the rack of the vehicle. The battery is designed such that the upper part has a super insulation and is welded to the rack of the vehicle. The lower part bears the modules.

Conventional insulation is used for the lower case. This part can be disconnected from the rack for maintenance purposes.

The replacement of module can be performed in a few minutes. The casing with the insulation is necessary to keep the battery at operating temperature for a period of time of approximately 24 hours during which the battery might not be charged or discharged.

If the battery is not operated for several days it must be heated up before utilization.

5. SAFETY

The most severe hazard for a cell is cracking of the electrolyte tube. Cells have been in operation the outer casing of

which remained undestroyed when such a case occurred. However further safety tests are necessary to get statistical evidence for a high probability to have save cells.

Shock tests with single cells have shown that no damage occurs up to accelerations of 150 g.

Safety tests with complete batteries will be performed in the next years. This tests include experiments concerning failure propagation in the battery and severe accidents where the battery casing and cell casings are mechanically destroyed.

6. LIFE CYCLE

Our present cells have been operated up to 400 cycles. The average life cycle amounts to 250 cycles. It is expected that the average life cycle can be increased to 600 cycles in 1986 and more than 1000 cycles in the nineties.

7. BATTERY PRICES

Mass production is scheduled to start in 1986. According to our present estimations a battery price of approximately 10000 to 15000 DM may be achieved at this time.

It is expected that this price will decrease in the nineties to a value between 5000 and 8000 DM.

8. MANUFACTURABILITY

We expect, that the pilot plant production can be started in 1984 and that the mass production can be started in 1986.

The following Table A.1-1.1 shows the time schedule for the Na-S battery production.

TABLE A.1-1.1— TIME SCHEDULE FOR THE Na/S BATTERY PRODUCTION

	1979	1980	1981	1982	1983	1984	1985	1986	
Pre pilot plant				10 batt. per year		20 batt. per year			
Pilot plant				contr.		operation			
					operat. start up		1000 batteries per year		
Mass prduction							constr.	operation start up	

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- (1) W. Fischer u. B. Hartmann:

Die Natrium/Schwefel-Batterie. Ein Speicher für die Elektrotraktion und den Spitzenlastausgleich. ASR-Digest für angewandte Antriebstechnik, Heft Sept. 1978, 6. Jahrgang.

- (2) W. Fischer und H. Meinhold:

Neue Ergebnisse mit Natrium/Schwefel-Batterie und Aspekte für ihren praktischen Einsatz. Elektrische Energie-Technik; 24. Jahrgang, 1979, Nr. 1.

- (3) Information of FIAT, Febr. 1979.

APPENDIX A.1-2

A.1-2a Final Report No. 0566 July 13, 1979

A.1-2b Final Report No. 103 July 21, 1979

SUBCONTRACT MAGNETI MARELLI - CRF

UNDER JPL CONTRACT No. 955187

"NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM"

PHASE I

1. INTRODUCTION

For the purposes of the "JPL" Hybrid Vehicle project, Magneti Marelli has made available to FIAT, the leader of the group, its direct experience in the field of electrochemical accumulators.

This report summarizes the position in June 1979 concerning the choice made from the range of batteries suitable to the requirements, and discusses some of their electrical characteristics which can now be achieved on a large scale production basis.

In the light of results obtained in the laboratory on technical cells, the report forecasts the results obtainable using the same battery types, by 1985.

2. CHOICE OF THE BATTERY

The first type of battery to be considered was the Lead-Acid one, partly because we are familiar with this type but mainly because today it is one of the very few road traction battery systems produced industrially and therefore available at a competitive price and a known degree of produced reliability. Its design characteristics are by now so "firm" that the Lead-Acid battery is virtually the point of reference for all other types in more or less advanced stages of development.

Magneti Marelli has also started to develop the Nickel-Zinc type, after carefully investigating the possibilities of achieving performance levels clearly superior to those of the Lead-Acid type, in the near term and within a reasonable investment of resources.

3. LEAD-ACID BATTERY

Among the various types available for the "JPL" project, the one considered was a polypropylene monobloc battery specially designed for electrically-propelled road vehicles weighing less than 2 t approximately.

3.1. Physical characteristics

The space occupied (see Fig. A.1-2.1) is much the same as that of the Golf Cart type of battery and the present weight, 29 kg approximately, enables the battery to readily moved by one person using the special handgrips provided in the cover.

Also in the cover is a system of channels which, when the modules of the complete vehicle battery are connected together, enable the gases released to be suitably vented. This avoids the heavy corrosion which normally occurs in the battery container due to the out flow of sulphur and caused by the escaping gas, and to release safely the explosive H_2/O_2 mixture through a unique exit equipped with a flame interruption device.

The same channels can be used to top up the cells with distilled water. The construction of the cover is such that the ingress of water into a given cell is stopped once the desired level is reached; in this way all cells have the same electric level when the topping-up operation is complete.

3.2. Electrical characteristics

The 12V (nominal) battery module has a nominal capacity of 90 Ah when discharged in 5 hours; its nominal specific discharge energy at this rate is therefore 37 Wh/kg approximately.

Maximum specific power is 140 W/kg approximately and the duration is therefore about 400 effective cycles.

A.1-14

VOLTAGE	V 12
CAPACITY (20h)	Ah 90
WEIGHT W/ELECTROLYTE	kg 29.0

FIG. A.1-2.1— BATTERY SIZES

Results obtained in the laboratory on technical cells show that the performance of these battery modules can be improved, bringing about an increase in the specific energy and the deviation without affecting the specific power. The specific energy is noticeably increased (4.3 Wh/kg approximately in 5 hours) by decreasing the overall weight of the battery module has been kept to 25 kg.

The duration is increased to approximately 600-700 effective cycles. On Fig. A.1-2.2 the relationships between specific energy obtainable and peak power availability, for various mean discharge power levels are shown.

4. NICKEL-ZINC BATTERY

Magneti Marelli has started a research and development program on Nickel-Zinc batteries, which are considered as the most promising for near term traction applications.

At present our efforts are concentrated on producing single Zinc and Nickel electrodes; encouraging results have already been obtained, especially concerning duration in terms of cycles. We believe that future batteries shall have energy densities above 65 Wh/kg and peak power levels of 140 W/kg with a service life equating to that of present Lead-Acid types.

Research at Marelli is not yet sufficiently advanced to permit the supply of technical cells for Phase II of the project, nor to permit us to foresee large-scale production by 1985. For information only, we can state that our intention is to build a prototype Nickel-Zinc battery in a container similar to that used for the present Lead-Acid type (see para. 3), in order to achieve complete physical interchangeability between the two. The Nickel-Zinc battery will have a capacity of 340 Ah approximately and will weigh 23.7 kg; with a specific energy of about 70 Wh/kg approximately.

FIG. A.1-2.2 — MAXIMUM POWER VS USEABLE SPECIFIC ENERGY AS A FUNCTION OF AVERAGE POWER.

5. CONCLUSIONS

For the "JPL" Hybrid Vehicle project, Magneti Marelli have examined two types of battery, i.e. the Lead-Acid type and the Nickel-Zinc type.

The first type is already produced industrially and is known to be reliable. A new version of the modular battery has been designed, which can be manufactured in the near future, based on the results of laboratory tests on technical cells.

These results indicate that the battery may well be suitable for use on the specified type of vehicle.

For the Nickel-Zinc type, on the other hand, the present state of the art does not allow us to provide useable batteries within the time scale of the project. Nevertheless, the results obtained with single electrodes enable us to foresee batteries being produced in the future having the following characteristics:

- energy density over 65 Wh/kg
- peak power of approximately 140 W/kg
- duration comparable with that of present Lead-Acid types which would fulfil better the requirements of the JPL Hybrid Vehicle.

1. OBJECT OF PHASE I

Magneti Marelli have been given the task of identifying the possible types of power control that can be used on a hybrid vehicle.

After a preliminary study, Magneti Marelli have decided to adopt a type of power control and corresponding auxiliary equipment that are suitable for a separately excited DC motor.

This characterization has led to a preliminary design for the power circuits and for the battery charger together with an evaluation of weights, dimensions and efficiency.

As far as the power circuitry is concerned, a preliminary design has been made as well as the definition of weight and dimensions of each unit constituting it.

2. POWER CONTROL CHARACTERISTICS

After an evaluation of the various electric system alternatives, the Ni-Zn battery -DC motor combination has been selected by C.R. FIAT.

This choice implies a battery voltage of 96 V and a maximum available power of 38 kW.

Since the maximum power must be supplied even at low battery voltage, the maximum current is about 500 A.

During braking, the current can be about of the same value since the DC motor has commutating poles.

The field current reaches a maximum of 16.5 A at a voltage of 48 V and it must be possible to invert its direction in the shortest time for the braking phase. Braking must be regenerative down to zero speed, thus requiring a voltage boosting for speeds that are less than the basic one.

There must be a braking torque control, similar to that relative to the drive torque so as to modulate braking when the motor operates as a generator.

Ripple must be within 20% of the maximum current (i.e. 100 A peak-to-peak).

During field control operation a mechanical contact shall be able to short circuit the main chopper in order to reduce losses.

It is also necessary to guarantee operation in case of on board computer failure, by deriving a signal directly from the pedal unit.

3. CHOICE OF CONTROL DEVICE TYPE

Based upon previous experiences and evaluations carried out by Magneti Marelli in the design of control devices for electric vehicles, a control device has been chosen consisting of an armature chopper and of a field chopper-inverter. This choice, supported by many practical realizations, has proved to be the most valid and feasible.

The evolution and availability of high power transistors has made it possible to select these for the realization of both choppers, thus allowing an increase in the maximum working frequency and therefore the elimination of the smoothing inductance.

For regenerative braking, provision has been made so that additional choppers are not needed.

Regenerative braking is in fact obtained by modifying the circuit configuration so as to cut off the power supply to the motor (Fig. A.1-2.3). Adoption of a relay has advantageous since it is deenergized when zero current flows through the contacts so that there is no limitation to the number of opening/closing operations it can perform. This choice also allows to use the same armature chopper during normal running and braking conditions.

FIG. A.1-2.3—ARMATURE CHOPPER ELECTRIC DIAGRAM

The control operates mainly by maintaining the armature current I_A within a range that includes a preset value of I_{SET} . The width of this range decreases non-linearly when I_A decreases.

This type of control, which is performed by means of a current feed-back, makes it possible to avoid the use of internal oscillators and frequency controls, by letting the system itself perform the function of oscillator, limited in this by appropriate non-linearities.

The same type of control is also applied to the field current I_F - as from Fig. A.1-2.4. Ripple, though, is maintained at much lower percentage values.

This control has been possible by using a type of electric motor with a field value calculated for a voltage of 48 V. From this it follows that, by supplying a voltage of 96 V, currents are produced which tend to values higher than I_{Fmax} and therefore allowing chopper operation also in the neighborhood of I_{Fmax} . Another advantage is that field inversion times are reduced by half.

4. OPERATIONAL DESCRIPTION

With reference to the block diagram of Fig. A.1-2.4, the on board computer sets a value of armature current I_{SET} .

The armature current oscillates between two threshold values: when the upper threshold is exceeded the chopper transistors are inhibited, whilst a value of current smaller than the lower threshold value makes the chopper conduct. The control thus establishes a ripple equal to 90 A peak-to-peak at a maximum frequency of 2 kHz and a current of 500 A.

For a 100 A current, a ripple value of 30 A peak-to-peak is set, resulting also in a maximum frequency of 2 kHz, because of the increased armature inductance.

This type of operation is valid until the basic motor speed

FIG. A.1-2.4 — POWER CONTROL LOGIC BLOCK DIAGRAM

is reached; over this speed the control of the motor is performed by varying the field current.

The field control is obtained in similar way to the armature control; however field control implies a much lower ripple percentage value (0.1 A over 16.5 A maximum field current) resulting also in a much lower frequency value (300 Hz).

The electric diagram of the armature chopper is given in Fig A.1-2.3.

When the relay T_1 opens the polarity across the motor collector terminals reverses but the armature current maintaining its direction. Fig. A.1-2.5 shows the configuration corresponding to regenerative braking for speeds greater than the basic one ω_b .

The field must also be reversed and shall be controlled so as to limit the I_A and modulate the braking torque.

For values below the basic speed, the armature voltage is no longer capable of supplying current to the battery so that a voltage boosting must be produced in the motor coil, as given in Fig. A.1-2.6.

This circuit arrangement has been designed by Magneti Marelli that have also filed an Italian Patent.

The on-off pulses for the chopper are generated by the same logic which operates a comparison, with hysteresis, between the preset value of current and the actual current in the motor.

A more detailed operational description of the regenerative braking with reference to the block diagram of Fig. A.1-2.4 is given below.

The values of current preset by the on board computer become negative. The absolute values of these are compared with the armature current I_a . The sign detected by an ad hoc comparator, modifies the field reference current bringing it to its maximum negative value. The braking current goes to zero in a time interval shorter than that required for field inversion; thus, there is a very short elapse of time in which the armature current I_a is zero.

FIG. A.1-2.5—ARMATURE CHOPPER ELECTRIC DIAGRAM REGENERATIVE BRAKING
CONFIGURATION FOR SPEEDS GREATER THAN THE BASIC ONE

FIG. A.1-2.6 — ARMATURE CHOPPER ELECTRIC DIAGRAM. REGENERATIVE BRAKING CONFIGURATION FOR SPEEDS LOWER THAN THE BASIC ONE

It is during this time corresponding to $I_a = 0$ that the relay opens.

The on board computer, during inversion, shall maintain the value of I_{set} at zero until the field current has reversed and reached a prefixed threshold. Once this transient has extinguished and for speeds greater than ω_b , the armature current I_a settles at an absolute value greater than I_{set} and the $K (I_a - I_{set}) > 0$ error modulates the field weakening.

Therefore, during regenerative braking, for speeds greater than ω_b , the armature current I_a is controlled by varying the field current.

For values of speed below ω_b , the $(I_{set} - I_a)$ positive values short-circuit the motor armature by means of the main chopper; negative values of $(I_{set} - I_a)$ inhibit the chopper and the overvoltage which is produced allows transfer of the energy stored in the armature coil to the battery. This type of operation has proved successful for the more recent types of choppers produced by Magneti Marelli.

5. ARMATURE CHOPPER AND FIELD CHOPPER-INVERTER

For the realization of the main chopper, the Toshiba Giant Transistor 2SD648 have been considered which have the following characteristics:

Monolithic Darlington

400 A maximum continuous collector current

300 V V_{CEO} (SUS)

$T_{on} = 1 \mu s$ typical

$T_{off} = 2 \mu s$ typical.

Two transistors in parallel have been used, thus involving a considerable chopper oversizing with respect to the specifications. This oversizing might be reduced by the availability on the market of analogous components or by the

production of a specific component manufactured, on request, by a specialized American Company. The maximum frequency has been set to 2 kHz so as to satisfy the TR constraints.

With reference to Fig. A.1-2.7, the use of two transistors in parallel implies the need for a current coupling that guarantees equal power dissipations in each transistor.

This is obtained by means of a mutual inductance so that transistor thermal run-away is avoided.

During operation at values above ω_b , i.e. when the duty-cycle is equal to 1, a by-pass relay short-circuits the chopper thus increasing efficiency and avoiding differences in currents that might occur during steady state functioning.

The two transistor bases are independently supplied by two drivers one of which can be inhibited by an OFF signal during battery charging operation (see Fig. A.1-2.7).

The two bases are protected by voltage limiters (claspers) that prevent the base voltage from going below -0.5 V.

The collectors of the two transistors will be fitted with antispikes devices.

Four transistors have been used for the field-chopper, with the following characteristics:

- 18 A maximum continuous current
- 200 V V_{CEO} (sus).

In this way mechanical contacts are avoided for field inversion, thus increasing the overall reliability. Also, it allows to control chopper and field inversion operation. By alternatively switching on and off the two diagonals, chopper and current inversion operations are obtained in the shortest time possible.

Energy transfer to the battery is still performed via the two diodes down to zero current, whilst the transistors are inhibited although their bases would enable them to conduct.

At the end of energy transfer to the battery, the reverse voltage on the transistors reduces to zero and the transistors begin to conduct up to the preset value of reverse current; at this point, chopper operation begins again.

FIG. A.1-2.7 — ARMATURE AND FIELD CHOPPER CIRCUIT

6. AUXILIARY EQUIPMENT

Main battery charger - Fig. A.1-2.8.

With reference to the battery charger circuit of Fig. A.1-2.8, the line voltage is rectified and chopped so as to obtain an average voltage value which is less than the minimum battery voltage.

After filtering, this voltage is applied to the main chopper via coil L_2 . Only one power transistor is forced to conduct whilst the other is kept inhibited by the driver. At this point, via the chopper, coil L_2 begins to store energy; the armature current I_a starts increasing and when it reaches the upper threshold value the chopper opens and the energy stored in L_2 is transferred to the battery. When I_a reaches the lower threshold value the transistor is forced to conduct again. This type of operation is the same as for regenerative braking operation for values below ω_b . A negative I_{set} information is sent from the on board computer based upon the actual I_{batt} .

7. EVALUATION OF WEIGHTS, DIMENSIONS AND EFFICIENCY

The most relevant elements as far as weights and dimensions are concerned are:

- No. 2	heat dissipators for the power transistors,
designed for a forced air speed of 4 m/sec	
	Dimensions (mm)	Weight (kg)
	177 x 127 x 128	5.6
- No. 3	500 A relays:	
	170 x 130 x 90	1.9
- No. 4	1000 μ F, 200 V capacitors	
	120 x 52 $\emptyset$	
- No. 2	600 A trasfoshunts	
	150 x 130 x 80	2.5

FIG. A.1-2.8— BATTERY CHARGER CIRCUIT

Overall dimensions (mm)

200 x 300 x 400

Total weight (kg)

22

The addition of container, control cards and connections bring to final overall dimensions of:

400 x 350 x 250 mm

and to a final total weight of

27 kg

The battery charger dimensions are:

150 x 100 x 200 mm

and the weight, including coils, capacitors and relay is:

4 kg

The field chopper expected efficiency is 0.96 under control worst condition i.e. with a duty cycle equal to 50% and an armature current of 500 A.

Battery charger efficiency is expected to be around 0.94.

APPENDIX A.1-3

Final Report No. CS 167/79 May 24, 1979

SUBCONTRACT PININFARINA - CRF

UNDER JPL CONTRACT No. 955187

"NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM"

PHASE I

PRELIMINARY DEFINITION OF THE VEHICLE ARCHITECTURE

General philosophy of body design

As far as the present state of the art is concerned relative to aerodynamics, a two-volume body design has proved more efficient than the three-volume type, geometric conditions being equal.

The general architecture of the vehicle body is as shown on drawing X, where account has been taken of mechanical parts and battery dimensions, number of passengers, capacity of the trunk and law regulations.

Drawing X (Fig. A.1-3.1)

It shows by means of three view, 1:5 scale, a first approach to the design that takes a previous research on aerodynamics by Pininfarina as a starting point and relative to a high-performance 4-passenger car, called "STUDIO CR 25".

Such a choice has been made because, for what concerns dimensions the body shape was capable of being adapted to the JPL design without deterioration in aerodynamic parameters.

Drawing J - 1:5 scale (Fig. A.1-3.2)

Definition by means of 4 views of the body shape considered as best (among the various ones presented as an alternative to this one) from functional aerodynamic, esthetic and legal points of view.

FIG. A.1-3.1 — BODY SHAPE — THE FIRST SOLUTION

A.1-34

FIG. A.1-3.2 — BODY SHAPE — THE SELECTED SOLUTION

Drawing J with profile views (front, rear and three quarter front and rear) (Fig. A.1-3.3/4/5)

Drawing J - 1:5 scale - Four views showing the position of the "typical sections" (Fig. A.1-3.6).

Figures A.1-3.7 to A.1-3.17 - 1:1 scale showing the "typical sections".

FIG. A.1-3.3 — BODY SHAPE —LATERAL VIEW

FIG. A.1-3.4 — BODY SHAPE — FRONT AND REAR VIEWS

FIG. A.1-3.5 - BODY SHAPE - THREE QUARTER FRONT AND REAR VIEWS

FIG. A.1-3.6 — BODY SHAPE — TYPICAL SECTIONS

A.1-40

FIG. A.1-3.7 - HOOD/WING SECTION ON FRONT WHEEL CENTER LINE (DISREGARDING SHOCK-ABSORBER)

BLACK SILK PRINTED FASCIA

A.1-41

FIG. A.1-3.8 - HOOD TRAILING EDGE/LOWER WINDSHIELD SECTION (AT SIDE OF AIR INTAKE)

A.1-42

FIG. A.1-3.9 — UPPER WINDSHIELD CENTER SECTION

FIG. A.1-3.10 - "A" FILLAR SECTION

A.1-44

FIG. A.1-3.11 — FRONT DOOR LOWER PILLAR SECTION

FIG. A.1-3.12 — LOWER CENTER PILLAR SECTION

FIG. A.1-3.13 - SILL/ROCKER PANEL & LOWER DOOR EDGE SECTION

FIG. A.1-3.14 - ROOF/UPPER DOOR EDGE SECTION

BLACK SILK PRINTED FASCIA

A.1-48

FIG. A.1-3.15 - FIFTH DOOR SIDE SECTION

FIG. A.1-3.16 - REAR WING SECTION ON REAR WHEEL CENTER LINE

BLACK SILK PRINTED FASCIA

FIG. A.1-3.17 - FIFTH DOOR CENTER SECTION

APPENDIX A.1-4

Final Report No. RT 143 May 24, 1979

SUBCONTRACT PIRELLI - CRF

UNDER JPL CONTRACT No. 955187

"NEAR TERM HYBRID PASSENGER VEHICLE DEVELOPMENT PROGRAM"

PHASE I

Projected characteristics of tires to be produced according to the state of the art technology of the '80 s and particularly suitable for Internal Combustion Engine vehicles and for the "Hybrid Vehicle"

1. INTRODUCTION

A preliminary evaluation of the characteristics of the tires that will be produced in accordance with the state of the art technology of the '80s can be made taking account of the tire evolution trend in these last decades and also of:

- 1) the technological innovation that takes advantage of the new developments in terms of materials and techniques
- 2) the vehicle evolution
- 3) the market trend evolution.

This trend can be extrapolated for the next 5-10 years, bearing in mind that points 2) and 3) will play a greater role than in the past in relation to the problems of energy cost increase.

As far as vehicles are concerned, i.e. the internal combustion engine type and the hybrid type, reference is made to vehicles capable of reaching a maximum speed of 130 km/h and the design of which aims at a drastic reduction in consumptions; it is assumed, also, that in both cases all the other performance characteristics are comparable (accelerations, comfort etc.).

In particular the hybrid vehicle proposed by FIAT will have the following characteristics:

Curb weight	1600 kg
Capacity (5 persons + baggage)	420 kg
Total weight	2020 kg

The following have been assumed as reference characteristics for the tires used on such vehicles:

Vertical stiffness
Cornering stiffness
Road holding on wet surface
Rolling resistance

The above characteristics do not include parameters which are directly connected to tire safety, although this must be perfectly adequate for all the vehicle working conditions.

2. TIRES FOR INTERNAL COMBUSTION ENGINE VEHICLE

2.1 Vertical Stiffness

This is a very important parameter because, together with suspension stiffness, it contributes considerably to the ride smoothness and comfort.

What is actually of interest under this point of view is the dynamic vertical stiffness measured while the tire is rolling, in the area of deflection corresponding to load conditions.

The only important improvement, as far as this parameter is concerned (in the elapse of time that has been considered) has been in passing from bias-ply tires to radial-ply tires (see Fig. A.1-4.1)).

For radial-ply tires, further considerable changes in this parameter are not expected in the future. Anyway an increase in tire pressure results in an energy absorption reduction (Fig. A.1-4.2)) and, therefore, the increase in vertical stiffness which follows will be relevant for obtaining a saving in energy, especially if it is accompanied by appropriate modifications to the vehicle suspension system.

2.2 Cornering Stiffness

The cornering stiffness is a parameter that has kept growing as a function of the tire structure (bias-ply tire, radial-ply tire, etc.). The present trend towards low profile radial-ply tires would have the potential capability of providing a higher value of cornering stiffness; on the other hand, while it is rather doubtful that a further increase of this parameter would result in an appreciable driveability advantage, the structures necessary to achieve this might result in a higher rolling resistance coefficient.

FIG. A.1-4.1- DYNAMIC VERTICAL STIFFNESS VS SPEED FOR TWO DIFFERENT TIRES

FIG. A.1-4.2 — INFLATION PRESSURE EFFECT ON ROLLING RESISTANCE COEFFICIENT

Based upon these considerations, a value of tire height/width ratio has been taken as reference which is between 0.70 and 0.60, so that a cornering stiffness can be assumed which maintains the present values (Fig. A.1-4.3).

2.3 Roadholding on wet surface

Although it is rather hard to evaluate this parameter quantitatively, it can be stated that the use of radial-ply tires has improved the vehicle roadholding on wet surface for the fact that for this type of tire it is possible to adopt highly grooved treads.

Another relevant improvement has been in passing from quasi longitudinal grooved treads to transverse treads.

This is particularly important at high speeds, when the loss of traction due to aquaplaning effects becomes relevant.

It is expected that roadholding on wet surfaces at low speeds (in which the tread compound becomes important) will be maintained at its present values, that can be considered acceptable, also in order not to compromise the rolling resistance values which would become higher in case higher traction coefficient compounds are adopted.

Roadholding on wet surfaces at high speeds will instead improve, independently from the rolling resistance coefficient, by properly modifying the tread design.

This forecast, which is bound to such an important factor like safety, remains valid also if the actual speed of vehicles will diminish both for power reduction reasons (due to fuel saving) and for reduction of the speed limits.

FIG. A.1-4.3— TIME EVOLUTION OF CORNERING STIFFNESS/VERTICAL LOAD RATIO FOR DIFFERENT TIRE TYPE

2.4 Tire dimensions

The tire across dimensions will slightly increase, external diameter and deflection being equal, in view of the introduction of the low profile type tires: this type of tires presents in fact low energy absorption characteristics that are obtainable without sacrificing other properties.

The use of tires of a diameter slightly greater than the present one (cross section and deflection being equal) might imply a further decrease of the rolling resistance coefficient (Fig. A.1-4.4).

It can be assumed, without involving big changes in the vehicle architecture, that appropriately designed cars capable of very low fuel consumption, will be equipped with tires with diameters 10% greater than the present ones.

2.5 Rolling resistance

Also in this case the tire technological evolution has led to an appreciable improvement in terms of rolling resistance (Fig. A.1-4.5).

It can be expected that the values presently reached will further diminish for tires of the 80's, due to improvements that can be obtained on the tire itself and to the adoption of slightly larger diameters (+10%).

3. TIRES FOR HYBRID VEHICLE

The specific characteristics of the tires for the hybrid vehicle will not be substantially different (excluding dimensions which are function of the various loads per axle) from those of the internal combustion engine vehicle (refer to paragraph 1 for reference vehicle characteristics).

FIG. A1-4.4 — TIRE RADIUS EFFECT ON ROLLING RESISTANCE COEFFICIENT

FIG. A.1-4.5— ROLLING RESISTANCE COEFFICIENT VS YEAR AS A FUNCTION OF PLY TIRE TYPE

However the greater overall weight of the hybrid vehicle and, most of all, the smaller ratio between full load weight and weight with driver only, allow, with the same level of comfort, to use a higher inflation pressure. Assuming a 20% increase in inflation pressure, the rolling resistance that can be expected for hybrid vehicle tires will further decrease (Fig. A.1-4.6).

4. COST ESTIMATES

The tires under consideration will have substantially the same weight as the present ones; the use of high-quality materials capable of reducing the rolling resistance will imply a cost increase not greater than 5%.

5. PIRELLI POSSIBLE CONTRIBUTION TO PHASE II OF THE PROGRAM

Pirelli possible contribution to Phase II of the program will consist in supplying prototype tires especially designed and manufactured for the hybrid vehicle.

6. CONCLUSIONS

The state of the art technology of the '80s will result in a large scale production of radial-ply tires and particularly in a broad use of the low profile type tires.

In general, there will be an improvement in tire characteristics due to the inevitable perfectioning of the product, but the preliminary parameters (vertical and cornering stiffness) will maintain their present values. An exception is

FIG. A.1-4.6 — ROLLING RESISTANCE COEFFICIENT VS SPEED FOR DIFFERENT VEHICLES

represented by the rolling resistance coefficient which, owing to the adoption of slightly larger diameters, will reduce down to a value of 0.8%.

For the hybrid vehicle, because of the greater masses involved and of smaller load variations, it will be possible to adopt higher inflation pressures, so as to reduce the rolling resistance coefficient down to about 0.6%-0.7%.

The overall dimensions will be according to the FIAT proposed limits

$\varnothing$ = 650 mm

Chord = 195 mm

The expected cornering stiffness characteristics are given in Fig. A.1-4.7.

A.1-63

FIG. A.1-4-7 - CORNERING STIFFNESS CHARACTERISTICS FOR HYBRID VEHICLE TIRES

APPENDIX A.3-1

HANDLING COMPUTER SIMULATION MODEL

The mathematical model is characterized by 11 d.o.f. (degrees of freedom) so distributed:

- 6 d.o.f. associated with the body, considered like a rigid body in which the overall sprung mass is included. They are the 3 body center-of-gravity translations and the 3 body rotations (roll, pitch, yaw)
- 4 d.o.f. associated with the angular velocity of each wheel since different slip ratios are possible
- 1 d.o.f. associated with the steering wheel angle. This degree of freedom exists only for those maneuvers in which the steering wheel is released.

The main input data required by the program are the following:

- vehicle geometry
- sprung and unsprung mass
- moments of inertia
- geometric, kinematic and elastic characteristics of the suspensions
- braking system characteristics
- steering system characteristics
- transmission characteristics (gear, final ratio, torque converter,...)
- tires characteristics
- propulsion system characteristics
- aerodynamic parameters
- maneuver data.

In the frame of the main characteristics, the simulation mathematical model:

- performs a simulation of a vehicle (not necessary having a symmetrical behaviour) with any of the four wheels being either driving or braking or both
- takes into account the non-linearity of the suspension and

estimates its longitudinal and lateral displacements

- can deal both with independent suspensions and rigid axles; therefore it takes into account effects due to possible anti-pitch and/or anti-roll rods
- as far as tire are concerned, considers the non-linear relationship between lateral forces and slip angles, normal load and tractive forces. Moreover it estimates camber forces and aligning torques. Vertical and lateral tire flexibilities are instead neglected
- assumes that the central moments of inertia of the vehicle remains constant during any motion: the interaction of those parts that change position during the maneuver is therefore neglected
- takes automatically into account the aerodynamic effects due to the vehicle speed
- can introduce external disturbances such as wind gusts from any direction and external forces and/or torques applied to the center of gravity
- neglects any effect connected with an irregular road-bed or the lifting of a wheel from the ground.

The model can simulate all the "open-loop" tests (free path).

Among these:

- steering-pad
- steering wheel angle input
- throttle release
- balanced or unbalanced braking during straight forward or cornering motion
- external disturbances
- overtaking (only if steering wheel angle recording is available).

The characteristic outputs of the program are shown in the following pages. Graphs and Tables are relative to one of the maneuvers performed in the frame of hybrid-reference vehicle behaviour comparison.

GRAPHS

- 1 Vehicle Path
- 2 Steering Wheel Angle vs Time Input Law
- 3 Roll Angle Output vs Time Output Plot
- 4 Pitch Angle Output vs Time Output Plot
- 5 Sideslip Angle vs Time Output Plot
- 6 Yaw Angle vs Time Output Plot
- 7 Yaw Rate vs Time Output Plot
- 8 Yaw Acceleration vs Time Output Plot
- 9 Curvature vs Time Output Plot
- 10 Lateral Acceleration Output Plot
- 11 Four Wheels Normal Load vs Time
- 12 Four Wheels Slip Angle vs Time
- 13 Four Wheels Lateral Force vs Time
- 14 Four Wheels Self-Aligning Torque vs Time

TABLES

- 15 Hybrid Vehicle Output Data During Lane Change Maneuver At 55 MPH For Various Instants (Time Difference Between Two Consecutive Instants = 0.1 Sec).

** HANDLING **

THE INCONSISTANCY THAT APPEARS IN THE RADIAN AXIS VALUES IS
DUE TO THE APPROXIMATIONS PERFORMED BY THE COMPUTER.

THE INCONSISTANCY THAT APPEARS IN THE RADIAN AXIS VALUES IS
DUE TO THE APPROXIMATIONS PERFORMED BY THE COMPUTER.

A.3-18

	ANGOLI DI:	VELOCITA' DI:	*	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	306195-16	-	*	0G 0P .0S	-	
ASSETTO MIS.	000000	-	*	0G 0P .0S	-	
IMBARDATA	306195-16	245800-05	*	0G 0P .0S	2G 0P .5S	211206-04
BFCCHEGGIO	218747-01	000000	*	1G 15P 12.0S	2G 0P .0S	
ROLLIO	557185-06	000000	*	0G 0P -1.5	2G 0P .0S	
VOLANTE	176808-04	000000	*	0G 0P 3.6S	2G 0P .0S	000000

***** P I L O T A G G I O *****				
VELOCITA' DI ROTAZ.	440.805	=	4296.19	GIRI/1'
COPPIA	34.5216	=	3.51902	KGH
POTENZA	15531.1	=	21.1092	CV
PARFALLA	.310695			
COPPIA VOLANTE	.152592-03	*	RISULTANTE FORZE EXT. BARIC.	.000000
MARCIA INSERITA	3	*	RISULTANTE MOM. EXT. BASIC.	.000000
PRESS. CTRC. FRENANTE	.000000	*	RISULTANTE COMP. VELOC. VENTO	.000000

 *
 * RISULTATI ALL' Istante T = .1000
 *
 *
 * VELOCITA' KM/H = 88.5027 RAGGIO EFFETTIVO = 361.455
 * ACCELERAZIONE LATERALE = .170399 G CONTINGENZA EFFETTIVA = .170445
 *

 \$\$\$\$ VEICOLI \$\$\$\$
 X = 2.45825 VINX = 24.5839 AINX = -.244560-02
 Y = .295654-02 VINY = .867718-01 AINY = 1.67207
 Z = .341457-01 VINZ = .128245-02 AINZ = .738073-01
 CURVATURA = .276659-02 VMORX = 24.5781 AMORX = -.803345-03
 VELOCITA' = 24.5841 VMORY = .358273-01 AMORY = 1.67162
 RAGGIO = 361.455 VMORZ = .538544 AMORZ = .834020-01
 PASSO INT. = .200000-01 PSTAR = -.140777 PPUNTOS = -1.51544
 CONTINGENZA = .170445 QSTAR = -.310301-02 OPUNTOS = -.116361
 INDICE FSV = 1.60082 RSTAR = .558531-01 RPUNTOS = .988492

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: * ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .158303-02 - * OG 5P 26.58 -
 ASSETTO MIS. .000000 - * OG 0P .08 -
 IMBARDATA .194657-02 .558833-01 * OG 6P 41.58 3G 12P 6.88 .989379
 BECCHEGGIO .218471-01 -.278242-02 * 1G 15P 6.38 OG -9P 33.98
 ROLLIN -.573895-02 -.139556 * OG-19P 43.78 -7G 59P 45.68
 VOLANTE .723750 7.23733 * 41G 28P 4.18 414G 40P 5.68 .369549-03

 \$\$\$\$ RUOTE \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .387966-01 .000000 .310216-01 .000000
 DERIVA -.343393-01 -.166234-02 -.265531-01 -.145882-02
 CONVERGENZA -.475870-03 .931606-04 -.135416-05 -.115466-03
 CAMPANATURA .825440-03 .186355-01 -.233630-03 -.192392-01
 CAMP. RIF. AL SUOLO -.224246-01 .253711-01 -.226418-01 -.331844-01
 SCUOTIMENTO .107426-01 .690511-01 .241670-02 .607862-01
 VELOCITA' SCUOTM. .104909 .964824-01 -.948344-01 -.101797
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 4308.95 3965.40 3381.44 3337.95
 II LATERALE 1607.50 79.1456 1095.88 61.6930
 II LONGITUDIN. 241.010 -70.2319 238.763 -31.4901
 QUOTA PESO+CAR.SCUOT. 4792.73 4307.67 3780.15 3690.53
 MOMENTO AUTALLIN. -57.8874 -2.91255 -29.3680 -1.79195
 II RES. AL ROTOL. 18.3653 16.5808 13.8533 13.4751
 II FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.6099 24.6238 24.5352 24.5439
 VEL.ROTATZ. RUOTA 81.7849 80.3901 81.8214 80.2887
 SCORRIMENTO .134097-01 -.425874-02 .168433-01 -.227538-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 449.917 * 4296.39 GIRT/1' * POTENZA DI ROTOLAMENTO = 6.82235 CV
 COPPIA 34.5185 * 3.51870 KGM * POTENZA AERODINAMICA = 9.35993 CV
 POTENZA 15530.5 * 21.1083 CV
 FARFALLA .310696
 COPPIA VOLANTE 4.36184 * RISULTANTE FORZE EXT. BAPIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BAPIC. .000000
 PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' Istante T = .2000
 *

 * VELOCITA' KM/H = 88.5027 RAGGIO EFFETTIVO = 308.332
 * ACCELERAZIONE LATERALE = .199646 G CONTINGENZA EFFETTIVA = .199812

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 4.91660 VINX = 24.5827 AINX = -.240594-01
 Y = .201589-01 VINY = .262237 AINY = 1.96001
 Z = .347672-01 VINZ = .108542-01 AINZ = .644887-01
 CURVATURA = .324326-02 VMORX = 24.5784 AMORX = -.207656-02
 VELOCITA' = 24.5841 VMORY = -.407812-01 AMORY = 1.95852
 RAGGIO = 308.332 VMORZ = .527434 AMORZ = .102668
 PASSO INT. = .200000-01 PSTAR = -.896141-01 PPUNTOS = 1.32999
 CONTINGENZA = .199812 RSTAR = -.148701-01 RPUNTOS = -.612462-01
 INDICE ESV = 3.93325 RSTAR = .137012 RPUNTOS = .627414

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: * ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO -.124019-02 - * OG -4P 15.83 -
 ASSETTO MIS. .000000 - * 414G 40P 5.6S -
 IMBARDATA .119073-01 .137306 * OG 40P 56.13 7G 52P 1.4S .628628
 BECCHEGGIO .210427-01 -.121957-01 * 1G 12P 20.4S OG-41P 55.5S
 ROLLIO -.195003-01 -.867251-01 * -1G 7P 2.2S -4G 53P 8.3S
 VOLANTE .723750 .000000 * 41G 28P 4.2S OG 0P .0S .000000

 \$\$\$\$ R U D T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .387965-01 .000000 .310216-01 .000000
 DERIVA -.328673-01 -.906287-02 -.251418-01 -.892254-02
 CONVERGENZA -.962883-04 .712442-04 .549118-06 -.141543-03
 CAMPANATURA .108191-02 .176874-01 .686109-03 -.196994-01
 CAMP. RTF. AL SUOLO -.279963-01 -.211224-01 -.282425-01 -.444894-01
 SCUOTIMENTO .223693-01 .784387-01 -.591275-02 .503593-01
 VELOCITA' SCUOTIM. .902273-01 .574064-01 -.382271-01 -.701256-01
 VFL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 4752.05 4404.59 3014.15 2837.28
 ii LATERALE 1602.83 451.561 952.276 330.626
 ii LONGITUDIN. 217.875 -78.5638 252.607 -21.2901
 QUOTA PESO+CAR.SCUOT. 5251.05 4851.18 3398.67 3175.59
 MOMENTO AUTOALLIN. -66.1914 -18.4450 -22.2260 -7.59716
 ii RES. AL ROTOL. 20.5314 18.6646 12.2328 11.3197
 ii FRENANTE .000000 .000000 .000000 .000000
 VFL.CENTRO RUOTA 24.6691 24.6812 24.4760 24.4840
 VFL.ROTAZ. RUOTA 81.7873 80.5726 81.8719 80.1318
 SCOPRIMENTO .110645-01 -.431861-02 .198201-01 -.178781-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 450.063 = 4297.78 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.87420 CV
 COPPIA 34.4973 = 3.51651 KGM * POTENZA AERODINAMICA = 9.35993 CV
 POTENZA 15525.3 = 21.1020 CV
 FARFALLA .310605
 COPPIA VOLANTE 4.50003 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CTRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' Istante T = .3000
 *
 *
 * VELOCITA' KM/H = 88.4990 RAGGIO EFFETTIVO = 227.936
 * ACCELERAZIONE LATERALE = .270049 G CONTINGENZA EFFETTIVA = .270265
 *

 \$\$\$\$ VEICOLI \$\$\$\$
 X = 7.37468 VINX = 24.5781 AINX = -.748928-01
 Y = .572526-01 VINY = .401257 AINY = 2.65034
 Z = .361552-01 VINZ = .170744-01 AINZ = .647497-01
 CURVATURA = .438721-02 VMORX = 24.5770 AMORX = -.919777-03
 VELOCITA' = 24.5830 VMORY = -.218232 AMORY = 2.64918
 RAGGIO = 227.936 VMORZ = .499925 AMORZ = .126248
 PASSO INT. = .200000-01 PSTAR = -.183572-01 PPUNTOS = -.139174
 CONTINGENZA = .270265 QSTAR = -.144472-01 QPUNTOS = .499306-01
 INDICE ESV = 5.30179 RSTAR = .187901 RPUNTOS = .385732

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO -.842317-02 - * OG-28P 53.35 -
 ASSETTO MIS. .000000 - * OG OP .05 -
 IMBARDATA .283881-01 .188223 * 1G 37P 35.55 10G 47P 3.75 .384545
 BECCHEGGIO .193443-01 -.100834-01 * 1G 8P 13.25 OG-34P 39.85
 ROLLIO -.232054-01 -.146223-01 * -1G 19P 46.55 OG-50P 16.15
 VOLANTE .723750 .000000 * 41G 28P 4.25 OG OP .05 .000000

 \$\$\$\$ RUOTE \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .387966-01 .000000 .310216-01 .000000
 DERIVA -.372714-01 -.190584-01 -.296831-01 -.190542-01
 CONVERGENZA -.200767-03 .669191-04 .703918-06 -.147592-03
 CAMPANATURA .960596-03 .174041-01 .658315-03 -.197700-01
 CAMP. RIF. AL SUOLO -.298340-01 -.206761-01 -.300488-01 -.473345-01
 SCUOTIMENTO .279586-01 .808013-01 -.569685-02 .473887-01
 VELOCITA' SCUOTIM. .406374-01 .136504-01 .189536-01 -.787688-02
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 4841.39 4418.48 3021.42 2726.39
 II LATERALE 1804.33 939.449 1105.56 660.928
 II LONGITUDIN. 210.344 -72.4027 269.857 -22.9940
 QUOTA PESO+CAR.SCUOT. 5360.39 4883.74 3384.00 3045.09
 MOMENTO AUTOALLIN. -75.3149 -37.1351 -25.1041 -13.8855
 II RES. AL ROTOL. 21.0665 18.8297 12.1600 10.7817
 II FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.6991 24.7151 24.4328 24.4445
 VEL.ROTAZ. RUOTA 81.8371 80.7129 81.8480 79.9844
 SCORRIMENTO .104641-01 -.395340-02 .212654-01 -.201365-02

 \$\$\$\$ PILOTAGGIO \$\$\$\$
 VELOCITA' DI ROTAZ. 450.134 = 4298.46 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.88378 CV
 COPPIA 34.4865 = 3.51544 KGM * POTENZA AERODINAMICA = 9.35875 CV
 POTENZA 15523.5 = 21.0080 CV
 FARFALLA .310696
 COPPIA VOLANTE 5.11328 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTAT ALL' ISTANCE T = .4000
 *
 *
 * VELOCITA' KM/H = 88.4849 RAGGIO EFFETTIVO = 180.462
 * ACCELERAZIONE LATERALE = .341212 G CONTINGENZA EFFETTIVA = .341255
 *

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 9.83198 VINX = 24.5664 AINX = -.167809
 Y = .120843 VINY = .792159 AIHY = 3.34404
 Z = .381030-01 VINZ = .207572-01 AINZ = -.955797-02
 CURVATURA = .554134-02 VMORX = 24.5708 AMORX = -.410326-02
 VELOCITA' = 24.5791 VMORY = -.421742 AMORY = 3.34729
 RAGGIO = 180.462 VMORZ = .481555 AMORZ = .807275-01
 PASSO INT. = .200000-01 PSTAR = -.691988-01 PPINTOS = -.325502
 CONTINGENZA = .341255 QSTAR = -.806661-02 OPINTOS = .637398-01
 INDICE ES = 6.25502 RSTAR = .218207 RPINTOS = .217419

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO -.166243-01 - * 0G-57P 9.05 -
 ASSETTO MIS. .000000 - * 0G 0P .05 -
 IMBARATA .468588-01 .218385 * 2G 47P 57.95 12G 30P 45.25 .215659
 BCCHEGGIO .192075-01 -.217471-02 * 1G 6P 1.35 0G -7P 28.65
 ROLLIO -.269013-01 -.650044-01 * -1G 32P 47.45 -3G 43P 28.15
 VOLANTE .723750 .000000 * 41G 28P 4.25 0G 0P .05 .000000

 \$\$\$\$ R U O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .387955-01 .000000 .310216-01 .000000
 DERIVA -.437325-01 -.289174-01 -.363534-01 -.290766-01
 CONVERGENZA -.356458-03 .614119-04 .710226-06 -.150604-03
 CAMPANATURA .581836-03 .169148-01 .657145-03 -.197981-01
 CAMP. RIF. AL SUOLO -.325894-01 -.216912-01 -.326756-01 -.505768-01
 SCUOTIMENTO .334544-01 .845684-01 -.568776-02 .457129-01
 VELOCITA' SCUOTIM. .703664-01 .640151-01 -.230F58-01 -.287536-01
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 5128.97 4585.86 2819.54 2587.74
 " LATERALE 2095.82 1415.05 1250.16 949.917
 " LONGITUDIN. 223.059 -68.9754 262.232 -24.1751
 QUOTA PESO+CAR.SCUOT. 5670.55 5072.60 3160.37 2886.16
 MOMENTO AUTOALLIN. -92.3479 -56.5747 -25.0459 -17.4646
 " RES. AL ROTOL. 22.5696 19.7173 11.2355 10.1395
 " FRENANTE .000000 .000000 .000000 .000000
 VEL. CENTRO RUOTA 24.7076 24.7296 24.3995 24.4155
 VEL. ROTAZ. RUOTA 81.8673 80.7866 81.8052 79.8719
 SCORRIMENTO .104902-01 -.362597-02 .221257-01 -.223366-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 450.009 = 4298.13 GIRI/1' = POTENZA DI ROTOLAMENTO = 6.97294 CV
 COPPIA 34.4916 = 3.51596 KGM = POTENZA AERODINAMICA = 9.35428 CV
 POTENZA 15524.6 = 21.1004 CV
 FARFALLA .310E06
 COPPIA VOLANTE 6.02384 = RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSEPIA 3 = RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CIRC.FRENANTE .000000 = RISULTANTE COMP. VELOC. VENTO .000000

A.3-23

	ANGOLI DI:	VELOCITA' DI:	*	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	-245070-01	-	*	-1G 24P 14.9S	-	
ASSETTO MIS.	.000000	-	*	0G 0P .0S	-	
IMBARDATA	.715063-01	.233723	*	4G 6P 1.6S	13G 23P 28.8S	.977903-01
BECCHEGGIO	.192781-01	.947397-03	*	1G 6P 16.4S	0G 3P 15.4S	
ROLLIO	-.324242-01	-.196887-01	*	-1G 51P 28.0S	-1G 7P 41.1S	
VOLANTE	.723750	.000000	*	41G 28P 4.2S	0G 0P .0S	.000000

\$\$\$\$\$ P I L O T A G G I O \$\$\$\$\$									
VELOCITA' DI ROTAZ.	449.997	=	4297.15	GIRI/1'	* POTENZA DI ROTOLAMENTO	=	7.29127	CV	
COPPIA	34.5068	=	3.51751	KGM	* POTENZA AERODINAMICA	=	9.34484	CV	
POTENZA	15527.9	=	21.1040	CV					
FARFALLA	.310696								
COPPIA VOLANTE	7.01553	*	RISULTANTE FORZE EXT. BARIC.			.000000			
MARCIA INSERITA	3	*	RISULTANTE MOM. EXT. BARIC.			.000000			
PRESS.CIRC.FRENANTE	.000000	*	RISULTANTE COMP. VELOC. VENTO			.000000			

 *
 * RISULTATI ALL' Istante T = .6000
 *
 *
 * VELOCITA' KM/H = 68.4086 RAGGIO EFFETTIVO = 137.953
 * ACCELERAZIONE LATERALE = .445833 G CONTINGENZA EFFETTIVA = .445639
 *

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 14.7403 VINX = 24.5076 AINX = -.429862
 Y = .353783 VINY = 1.57183 AINY = 4.35313
 Z = .383578-01 VINZ = -.208777-01 AINZ = -.519556-01
 CURVATURA = .724883-02 VMORX = 24.5418 AMORX = -.125910-01
 VELOCITA' = 24.5580 VMOBY = -.782334 AMOBY = 4.37362
 RAGGIO = 137.953 VMORZ = .424190 AMORZ = .924848-01
 PASSO INT. = .200000-01 PSTAR = -.267828-01 PPUNTOS = -.618368
 CONTINGENZA = .445639 QSTAR = -.991466-02 QPUNTOS = -.478304-03
 INDICE FSV = 6.88624 RSTAR = .240152 RPUNTOS = .368326-01

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO -312731-01 - -1G 47P 30.5S
 ASSETTO MIS. .000000 - -0G 0P .0S
 IMBARDATA .953219-01 .240393 5G 27P 41.6S 13G 46P 24.5S .368350-01
 BECCHEGGIO .191777-01 -.196712-02 1G 5P 55.7S 0G -6P 45.7S
 ROLLIO -.330773-01 -.221729-01 -1G 53P 42.7S -1G 16P 13.5S
 VOLANTE .723750 .000000 41G 28P 4.2S 0G 0P .0S .000000

 \$\$\$\$ R U O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .387366-01 .000000 .310216-01 .000000
 DERIVA -.569506-01 -.446965-01 -.499762-01 -.451154-01
 CONVERGENZA -.539463-03 .574714-04 -.613857-05 -.156607-03
 CAMPANATURA .315163-03 .162573-01 .122314-02 -.198318-01
 CAMP. RTE. AL SUOLO -.379571-01 -.255093-01 -.372002-01 -.562755-01
 SCUOTIMENTO .381578-01 .891477-01 -.979133-02 .415417-01
 VELOCITA' SCUOTIM. -.280170-02 -.825515-02 -.338776-01 -.391087-01
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 5397.73 4943.68 2512.14 2333.86
 " LATERALE 2610.16 2126.53 1465.62 1263.41
 " LONGITUDIN. 231.932 -66.9355 259.595 -22.8847
 QUOTA PESO+CAR.SCUOT. 5973.04 5462.27 2818.73 2600.68
 MOMENTO AUTOALLIN. -117.323 -88.3261 -23.4791 -18.6404
 " RES. AL ROTOL. 24.0462 21.5629 9.85553 9.00914
 " FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.6802 24.7145 24.3414 24.3687
 VEL.ROTAZ. RUOTA 81.7554 80.7664 81.8173 79.7100
 SCUOTIMENTO .103545-01 -.326777-02 .245591-01 -.234653-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 449.852 = 4295.77 GRI/1' * POTENZA DI ROTOLAMENTO = 7.05579 CV
 COPPIA 34.5281 = 3.51968 KGM * POTENZA AERODINAMICA = 9.33012 CV
 POTENZA 15532.5 = 21.1112 CV
 FARFALLA .310695
 COPPIA VOLANTE 7.29543 * RISULTANTE FORZE EXT. RARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. RARIC. .000000
 PRESS.CTRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

A.3-25

ANGOLI VEICOLO

\$\$\$\$\$ R U D E \$\$\$\$\$\$

***** P I L O T A G G I D *****

VELOCITA' DI ROTA7.	449.745	=	4204.74	GIRI/1'	* POTENZA DI ROTOLAMENTO	=	7.03462	CV
COPPIA	34.5440	=	3.52131	KGM	* POTENZA AERODINAMICA	=	9.31088	CV
POTENZA	15536.0	=	21.1158	CV				
PARAFALLA	.310806							
COPPIA VOLANTE	7.74931	*	RISULTANTE FORZE EXT. BARIC.			.000000		
MARCIA INSERITA	3	*	RISULTANTE MOM. EXT. BARIC.			.000000		
PRESS.CIRC.FRENANTE	.000000	*	RISULTANTE COMP. VELOC. VENTO			.000000		

 *
 * RISULTATI ALL' ISTANCE T = .8000
 *
 *
 * VELOCITA' KM/H = 88.2799 RAGGIO EFFETTIVO = 155.450
 * ACCELERAZIONE LATERALE = .370300 G CONTINGENZA EFFETTIVA = .370496

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 19.6314 VINX = 24.3987 AINX = -.455772
 Y = .758338 VINY = 2.47790 AINY = 3.60697
 Z = .345972-01 VINZ = -.131233-01 AINZ = -.103767-01
 CURVATURA = .604414-02 VMORX = 24.4950 AMORX = .652130-01
 VELOCITA' = 24.5222 VMORY = -1.05529 AMORY = 3.63265
 RAGGIO = 165.450 VMORZ = .409947 AMORZ = .133078
 PASSO INT. = .200000-01 PSTAR = .167678-01 PPINTOS = 3.21979
 CONTINGENZA = .370496 OSTAR = -.687424-02 OPINTOS = .252304
 INOTCE FSV = .108478+07 RSTAR = .232989 RPINTOS = -.825965

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: * ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO -.423597-01 - -2G 25P 37.35 -
 ASSETTO MTS. .000000 - -0G 0P .05 -
 IMBARDATA .143580 .233121 * 8G 13P 35.45 13G 21P 24.78 -.835353
 BECCHEGGIO .189414-01 .224622-02 * 1G 5P 6.98 0G 7P 43.35
 ROLLIO -.391328-01 .211832-01 * -2G 14P 31.75 15 12P 49.48
 VOLANTE .445545-05 -.903726-03 * 0G 0P .95 05 -3P 6.45 10856.0

 \$\$\$\$ R U O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .238834-06 .000000 .190973-06 .000000
 DERIVA -.294774-01 -.553347-01 -.304273-01 -.558786-01
 CONVERGENZA -.581728-03 .573476-04 -.536144-04 -.160536-03
 CAMPANATURA .228413-03 .162170-01 .250820-02 -.107430-01
 CAMP. REF. AL SUOLO -.432685-01 -.297307-01 -.412369-01 -.618452-01
 SCUOTIMENTO .390884-01 .894138-01 -.176042-01 .330823-01
 VELOCITA' SCUOTIM. -.310700-01 -.249810-01 -.101872-02 .487967-02
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 5658.14 5060.41 2373.54 2021.29
 " LATERALE 1482.82 2540.46 890.2F4 1302.54
 " LONGITUDIN. 209.199 -61.4217 261.9P7 -20.8883
 QUOTA PESO+CAR.SCUOT. 6259.24 5594.08 2666.44 2273.37
 MOMENTO AIRBALLIN. -80.1600 -104.272 -14.6333 -15.2443
 " RES. AL ROTOL. 25.4745 22.1748 9.25559 7.75008
 " FREMANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.6649 24.6631 24.3264 24.3274
 VEL.ROTAZ. RUOTA 81.5957 80.6258 81.9044 79.5672
 SCORRIMENTO .891264-02 -.292794-02 .261989-01 -.244307-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 449.625 = 4293.60 GIRI/1' * POTENZA DI ROTOLAMENTO = 7.06531 CV
 COPPIA 34.5617 = 3.52311 KGM * POTENZA AERODINAMICA = 9.28941 CV
 POTENZA 15539.8 = 21.1210 CV
 FARFALLA .310696
 COPPIA VOLANTE 4.92424 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CTRC.FREMANTE .000000 * RISULTANTE COMP. VELOC. VENTC .000000

 *
 * RISULTATI ALL' ISTANCE T = .9000
 *
 *
 * VELOCITA' KM/H = 88.2672 RAGGIO EFFETTIVO = 218.883
 * ACCELERAZIONE LATERALE = .279078 G CONTINGENZA EFFETTIVA = .279970
 *

 \$\$\$\$\$ V E I C O L O \$\$\$\$\$

 X = 22.0695 VINX = 24.3648 AINX = -.336451
 Y = 1.01943 VINY = 2.74226 AINY = 2.72598
 Z = .339814-01 VINZ = .973000-02 AINZ = .276020
 CURVATURA = .456865-02 VMORX = 24.4864 AMORX = .935858-01
 VFLOCITA' = 24.5187 VMOBY = -1.16020 AMOBY = 2.73775
 RAGGIO = 218.883 VMORZ = .484521 AMORZ = .341041
 PASSO INT. = .200000-01 PSTAR = .152681 PPUNTOS = -2.23435
 CONTINGENZA = .279970 QSTAR = .200037-01 QPUNTOS = .915725-01
 INDICE ESV = -2.05538 RSTAR = .722361-01 RPUNTOS = -1.48655

 \$\$\$\$\$ ANGOLI VEICOLO \$\$\$\$\$

 ANGOLI DI: VFLOCITA' DI: * ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO - .468694-01 - * -2G 41P 7.58 -
 ASSETTO MIS. .000000 - * -2G -3P 6.45 -
 IMBARDATA .158948 .717513-01 * 0G 6P 25.38 4G 6P 39.88 -1.48857
 BECCHEGGIO .204714-01 .225593-01 * 1G 10P 22.58 1G 17P 33.25
 ROLLIO - .229979-01 .154149 * -1G 19P 3.68 8G 49P 55.68
 VOLANTE - .723750 .000000 * -41G 28P 4.25 0G 0P .05 .000000

 \$\$\$\$\$ R U O T E \$\$\$\$\$

 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO - .310216-01 .000000 - .387966-01 .000000
 DERIVA - .118683-01 - .509507-01 - .441125-02 - .509481-01
 CONVERGENZA - .136538-03 .694767-04 - .300309-05 - .140679-03
 CAMPANATURA .104816-02 .175785-01 .103768-02 - .197901-01
 CAMP. RIF. AL SUOLO - .299917-01 - .211781-01 - .299942-01 - .474317-01
 SCUOTIMENTO .248436-01 .793647-01 - .850602-02 .462464-01
 VFLOCITA' SCUOTIM. - .131883 - .705551-01 .936456-01 .153409
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 4446.16 4159.29 3184.83 2892.05
 II LATERALE 592.386 2226.72 177.871 1715.14
 II LONGITUDIN. 247.464 -22.8596 264.383 -65.8441
 QUOTA PESO+CAR.SCUOT. 4972.50 4632.18 3541.26 3204.86
 MOMENTO AUTOALLIN. -24.7543 -70.7760 -4.82491 -32.5355
 II RES. AL ROTOL. 10.1763 17.6051 12.8217 11.4270
 II FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.5643 24.5428 24.4610 24.4389
 VEL.ROTAZ. RUOTA 81.6220 80.3624 81.8202 79.6886
 SCORRIMENTO .132711-01 - .131599-02 .199088-01 - .547870-02

 \$\$\$\$\$ P I L O T A G G I O \$\$\$\$\$

 VELOCITA' DI ROTAZ. 449.491 = 4292.32 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.66823 CV
 COPPIA 34.5816 = 3.52514 KGM * POTENZA AERODINAMICA = 9.28541 CV
 POTENZA 15544.1 = 21.1269 CV
 FARFALLA .310696
 COPPIA VOLANTE 1.31967 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' ISTANTE T = 1.0000
 *
 *
 * VELOCITA' KM/H = 88.2625 RAGGIO EFFETTIVO = 305.678
 * ACCELERAZIONE LATERALE = .200287 G CONTINGENZA EFFETTIVA = .200454
 *

 \$\$\$\$ VEICOLI \$\$\$\$
 X = 24.5043 VINX = 24.3349 AINX = -.230249
 Y = 1.30649 VINY = 2.98571 AINY = 1.95295
 Z = .357208-01 VINZ = .198946-01 AINZ = -.235805-01
 CURVATURA = .327141-02 VMORX = 24.4935 AMORX = .829203-01
 VELOCITA' = 24.5174 VMORY = -.922055 AMORY = 1.96481
 RAGGIO = 305.678 VMORZ = .563502 AMORZ = .142712-01
 PASSO INT. = .200000-01 PSTAR = -.120345-01 PPINTOS = .156756
 CONTINGENZA = .200454 QSTAR = .254370-01 QPINTOS = -.118058-01
 INDICE ESU = 1.67334 RSTAR = -.579437-01 RPINTOS = -1.07246

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO -.371899-01 - -2G 7P 51.05
 ASSETTO MIS. .000000 - - -0G 0P .05
 IMBARDATA .159272 -.584148-01 - 9G 7P 32.35 -3G 20P 48.95 -1.07235
 SFECHEGGIO .228748-01 .243723-01 - 1G 18P 38.35 1G 23P 47.15
 ROLLIO -.183022-01 -.33706-01 - -1G 2P 55.15 0G-45P 57.95
 VOLANTE -.723750 .000000 - -41G 28P 4.25 0G 0P .05 .000000

 \$\$\$\$ RUOTE \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO -.310216-01 .000000 -.387966-01 .000000
 DERIVA -.917637-02 -.340170-01 -.133115-02 -.337041-01
 CONVERGENZA -.673250-04 .664057-04 .125993-06 -.131234-03
 CAMPANATURA .108545-02 .173681-01 .750155-03 -.195456-01
 CAMP. RTE. AL SUOLO -.286030-01 -.228954-01 -.288796-01 -.442222-01
 SCUOTIMENTO .201421-01 .811058-01 -.540035-02 .547624-01
 VELOCITA' SCUOTIM. -.211162-02 .628254-01 -.195007-01 .455471-01
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 4606.29 4267.38 3194.12 3075.93
 ii LATERALE 463.315 1593.31 54.2572 1266.50
 ii LONGITUDIN. 288.929 -31.9628 218.181 -71.9816
 QUOTA PESO+CAR.SCUOT. 5116.39 4724.57 3566.79 3403.85
 MOMENTO AUTOALLIN. -20.3754 -56.3023 -1.50720 -28.4314
 ii RES. AL ROTOL. 10.8002 17.9912 12.9589 12.2732
 ii FRENANTE .000000 .000000 .000000 .000000
 VEL. CENTRO RUOTA 24.4778 24.4593 24.5427 24.5428
 VEL. ROTAZ. RUOTA 81.4820 80.0496 81.8689 80.0144
 SCORRIMENTO .150590-01 -.180406-02 .163121-01 -.563923-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI POTAZ. 449.215 = 4289.60 GRI/11 + POTENZA DI ROTOLAMENTO = 6.88665 CV
 COPPIA 34.6225 = 3.52031 KGm + POTENZA AERODINAMICA = 9.28394 CV
 POTENZA 15553.0 = 21.1380 CV
 FARFALLA .310606
 COPPIA VLANTF .954135 + RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 + RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CTFC.FRENANTE .000000 + RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' Istante T = 1.1000
 *
 *
 * VELOCITA' KM/H = 88.2720 RAGGIO EFFETTIVO = INFINITO
 * ACCELERAZIONE LATERALE = .399163-01G CONTINGENZA EFFETTIVA = .000000
 *

***** V E I C O L O *****

X	= 26.3370	VINY	= 24.3224	AINX	= -.111565-01
Y	= 1.61242	VINY	= 3.10689	AINY	= .392549
Z	= .373319-01	VINZ	= .104867-01	AINZ	= -.126848
CHRVATURA	= .649998-03	VMORX	= 24.5064	AMOBX	= .502282-01
VFLOCITA'	= 24.5200	VMORY	= -.536745	AMOBY	= .391579
RAGGIO	= 1538.47	VMORZ	= .613991	AMORZ	= -.120219
PASSO INT.	= .200000-01	PSTAR	= .136105	PPUNTOS	= 1.89373
CONTINGENZA	= .396367-01	QSTAR	= .156844-01	QPUNTOS	= -.224063
INDICE ESV	= 4.27792	RSTAR	= -.149089	RPUNTOS	= -.724004

***** ANGOLI VEICOLO *****

	ANGOLI DI:	VELOCITA' DI:	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	= .215426-01	-	-1G 14P 3.5S	-	
ASSETTO MIS.	= .000000	-	0G 0P .0S	-	
IMBARDATA	= .148593	= -.149338	8G 30P 49.4S	-8G 33P 23.2S	= -.721052
BECCHEGGIO	= .249222-01	= .136164-01	1G 25P 40.6S	0G 46P 48.6S	
ROLLIO	= .138613-01	= .132383	0G-47P 39.1S	7G 35P 6.0S	
VOLANTE	= -.723750	= .000000	-41G 28P 4.2S	0G 0P .0S	= .000000

***** R U O T E *****

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	= -.310216-01	= .000000	= -.387966-01	= .000000
DERIVA	= .163316-02	= -.131854-01	= .963595-02	= -.128959-01
CONVERGENZA	= -.289634-04	= .643486-04	= .130415-05	= -.110907-03
CAMPANATURA	= .102383-02	= .172013-01	= .465917-03	= -.191339-01
CAMP. RIF. AL SUOLO	= -.280056-01	= .251466-01	= -.282778-01	= -.413484-01
SCUOTIMENTO	= .159455-01	= .824063-01	= -.415949-02	= .624639-01
VFLOCITA' SCUOTIM.	= -.101112	= -.641213-01	= .881350-01	= .123596
VEL. DEF. LAT. PNELM.	= .000000	= .000000	= .000000	= .000000
CARICO SCUOTIMENTO	= 4169.79	= 4187.54	= 3550.02	= 3395.40
II LATERALE	= -79.3647	= 638.234	= -424.758	= 849.175
II LONGITUDIN.	= 266.884	= -40.7009	= 223.762	= -71.6383
QUOTA PESO+CAR.SCUOT.	= 4634.19	= 4601.53	= 3968.36	= 3766.14
MOMENTO AUTOALLIN.	= 3.13852	= -23.8069	= 13.1209	= -15.5847
II RES. AL ROTOL.	= 17.5641	= 17.4128	= 14.6944	= 13.8214
II FRENANTE	= .000000	= .000000	= .000000	= .000000
VFL.CENTRO RUOTA	= 24.4179	= 24.4083	= 24.6328	= 24.6227
VFL.ROTAZ. RUOTA	= 81.3072	= 79.8383	= 81.9961	= 80.3206
SCORRIMENTO	= .153574-01	= -.235869-02	= .150364-01	= -.507245-02

***** P I L O T A G G I O *****

VELOCITA' DI ROTAZ.	= 449.084	= 4288.44	GIRI/1'	* POTENZA DI ROTOLAMENTO = 6.93768	CV
COPPIA	= 34.6420	= 3.53130	KGM	* POTENZA AERODINAMICA = 9.28693	CV
POTENZA	= 15557.2	= 21.1446	CV		
FARFALLA	= .310696				
COPPIA VOLANTE	= -.838351	*	RISULTANTE FORZE EXT. BARIC.	.000000	
MARCIA INSERITA	= 3	*	RISULTANTE MOM. EXT. BARIC.	.000000	
PRESS.CIRC.FRENANTE	= .000000	*	RISULTANTE COMP. VELOC. VENTO	.000000	

 *
 * RISULTATI ALL' Istante T = 1.2000
 *
 *
 * VELOCITA' KM/H = 88.2852 RAGGIO EFFETTIVO = -449.478
 * ACCELERAZIONE LATERALE = -.136411 G CONTINGENZA EFFETTIVA = -.136393
 *

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 29.3696 VINX = 24.3322 AIMX = .194975
 Y = 1.92214 VINY = 3.05862 AINY = -1.32404
 Z = .378848-01 VINZ = .286937-02 AINZ = -.105991-01
 CURVATURA = -.222480-02 VMORX = 24.5155 ANORX = .212288-01
 VELOCITA' = 24.5237 VMOBY = -.130933 ANOBY = -1.33819
 RAGGIO = -449.478 VMORZ = .617502 ANORZ = -.200782-02
 PASSO INT. = .260000-01 PSTAR = .230831 PRUNTOS = -.281027
 CONTINGENZA = -.136393 QSTAR = -.130760-01 QPUNTOS = -.284279
 INDICE ESV = 5.91701 RSTAR = -.206418 RPUNTOS = -.406594

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO -.549070-02 - 0G-18P 52.5S -
 ASSETTO MIS. .000000 - 0G 0P .0S -
 IMBARDATA .130538 -.206558 7G 28P 45.3S -11G 50P 5.5S -.408428
 BECCHEGGIO .250332-01 -.118321-01 1G 26P 3.5S 0G-40P 40.5S
 ROLLIO .602539-02 .225661 0G 20P 42.8S 12G 55P 45.9S
 VOLANTE -.723750 .000000 -41G 28P 4.2S 0G 0P .0S .000000

 \$\$\$\$ IR U O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO -.310216-01 .000000 -.387966-01 .000000
 DERIVA .146993-01 .619441-02 .226688-01 .628568-02
 CONVERGENZA .110631-05 .937783-04 .456600-02 -.731573-04
 CAMPANATURA .188694-03 .186557-01 -.821740-03 -.177967-01
 CAMP. RIF. AL SUOLO .257867-01 .351534-01 .255997-01 -.276635-01
 SCUOTIMENTO .192898-02 .688153-01 .106702-01 .774840-01
 VELOCITA' SCUOTIM. -.145702 -.175796 .181229 .148424
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 3254.32 3363.27 4366.40 4139.74
 ii LATERALE -605.775 -263.432 -1098.43 -304.776
 ii LONGITUDIN. 234.730 -35.1248 249.372 -72.7675
 QUOTA PESO+CAR.SCUOT. 3664.28 3725.98 4839.43 4561.87
 MOMENTO AUTOALLIN. 16.4209 7.59121 42.2075 11.5671
 ii RES. AL ROTOL. 13.3118 13.5725 18.6053 17.3376
 ii FRENANTE .000000 .000000 .000000 .000000
 VEL. CENTRO RUOTA 24.3736 24.3742 24.6692 24.6710
 VEL. ROTAZ. RUOTA 81.3022 79.7145 82.0095 80.5445
 SCORRIMENTO .172824-01 -.251386-02 .137411-01 -.425367-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 449.127 = 4288.66 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.86597 CV
 COPPIA 34.6385 = 3.53094 KGM * POTENZA AERODINAMICA = 9.29109 CV
 POTENZA 15555.4 = 21.1436 CV
 FARFALLA .310596
 COPPIA VOLANTE -2.95576 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSEFITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

A.3-31

X	=	31.8040	VINX	=	24.3575	AINX	=	1294131
Y	=	2.21900	VINY	=	2.85664	AINY	=	-2.64976
Z	=	.382077-01	VINZ	=	.253859-02	AINZ	=	-.807743-01
CURVATURA	=	-.443261-02	VMORX	=	.24.5171	AMOBX	=	.813284-02
VELOCITA'	=	24.5245	VMORY	=	.223389	AMORY	=	-2.66720
RAGGIO	=	-225.601	VMORZ	=	.558219	AMORZ	=	-.159463-01
PASSO INT.	=	.200000-01	PSTAR	=	.124824	PPUNTOS	=	-1.40645
CONTINGENZA	=	-.271762	QSTAR	=	-.355874-01	QPUNTOS	=	-.190532
INDICE ES	=	6.78370	RSTAR	=	-.235958	RPUNTOS	=	-.192735

	ANGOLI DI:	VELOCITA' DI:		ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	.855437-02	-	*	0G 29P 24.5S	-	
ASSETTO MTS.	.000000	-	*	0G 0P .0S	-	
IMBARDATA	.108192	-.235813	*	6G 11P 56.2S	-13G 34P 6.2S	-.197349
BECCHIEGGIO	.228752-01	-.298560-01	*	1G 18P 38.4S	-1G 42P 38.3S	
ROLLIO	.242479-01	.119408	*	1G 23P 21.5S	6G 50P 29.6S	
VOLANTE	-.723750	.000000	*	-41G 28P 4.2S	0G 0P .0S	.000000

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	- .310216-01	.000000	-.387966-01	.000000
DERIVA	.272464-01	.220522-01	.348982-01	.219401-01
CONVERGENZA	.243627-05	.135594-03	.178007-03	-.582422-04
CAMPANATURA	-.997122-03	.196153-01	-.994650-03	-.164495-01
CAMP. RIF. AL SUOLO	.326379-01	.494673-01	.326449-01	.241687-01
SCUOTIMENTO	-.821786-02	.529705-01	.269446-01	.878579-01
VELOCITA' SCUOTIM.	-.480164-01	-.126787	.127932	.477843-01
VFL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	2815.35	2694.50	4946.60	4775.34
" LATERALE	-968.937	-763.932	-1707.54	-1103.22
" LONGITUDIN.	234.678	-28.4276	252.369	-72.9475
QUOTA PESO+CAR.SCUOT.	3181.96	3015.81	5463.65	5239.00
MOMENTO AUTOALLIN.	20.4845	15.4096	74.0238	47.5738
" RES. AL ROTOL.	11.3080	10.6407	21.5515	20.4843
" FRENANTE	.000000	.000000	.000000	.000000
VFL.CENTRO RUOTA	24.3400	24.3501	24.6774	24.6907
VFL.ROTAZ. RUOTA	81.4044	79.6358	81.9184	80.6524
SCORRIMENTO	.196674-01	-.251365-02	.123175-01	-.371305-02

VELOCITA' DI ROTAZ.	449.138	=	4288.95	GIRI/1'	* POTENZA DI ROTOLAMENTO	=	6.99268	CV
COPPIA	34.6340	=	3.53948	KGM	* POTENZA AERODINAMICA	=	9.29199	CV
POTENZA	15555.4	=	21.1423	CV				
PARFALLA	310696							
COPPIA VOLANTE	-4.84607	*	RISULTANTE FORZE EXT. BARIC.			.000000		
MARCIA INSERITA	3	*	RISULTANTE MOM. EXT. BARIC.			.000000		
PRESS.CITR.FRENANTE	.000000	*	RISULTANTE COMP. VELOC. VENTO			.000000		

 *
 * RISULTATI ALL' Istante T = 1.4000 *
 *
 * VELOCITA' KM/H = 88.2726 RAGGIO EFFETTIVO = -166.753 *
 * ACCFLERAZIONE LATERALE = -.367513 G CONTINGENZA EFFETTIVA = -.367539 *

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 34.2412 VINX = 24.3881 AINX = .304020
 Y = 2.48970 VINY = 2.54161 AINY = -.3.59340
 Z = .379213-01 VINZ = -.700064-02 AINZ = -.241107-01
 CURVATURA = -.599689-02 VMORX = 24.8107 AMORX = .303917-02
 VELOCITA' = 24.5202 VMORY = .500006 AMORY = -.3.60530
 RAGGIO = -166.753 VMORZ = .454690 AMORZ = .855669-01
 PASSO INT. = .200000-01 PSTAR = .337355-01 PPIINTOS = -.771788-01
 CONTINGENZA = -.367539 QSTAR = -.403424-01 QPIINTOS = .146269
 INDICE FSU = 7.20877 RSTAR = -.250494 RPIINTOS = -.109015

 \$\$\$\$ ANGOLI VETCOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .201493-01 - 1G 9P 16.15 -
 ASSETTO MT3. .000000 - 0G 0P .05 -
 IMBARDATA .836911-01 -.251652 4G 47P 42.55 -14G 25P 6.95 -.104539
 BECCHEGGIO .194586-01 -.327100-01 1G 6P 53.65 -1G 52P 26.95
 ROLLIO .303998-01 .280390-01 1G 44P 30.45 1G 39P 8.55
 VOLANTE -.723750 .000000 -41G 28P 4.25 0G 0P .05 .000000

 \$\$\$\$ R U O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO -.310216-01 .000000 -.307966-01 .000000
 DERIVA .381658-01 .345957-01 .454113-01 .342993-01
 CONVERGENZA .329844-05 .154173-03 .427227-03 -.587525-04
 CAMPANATURA -.105770-02 .198230-01 -.542526-03 -.165474-01
 CAMP. RTE. AL SUOLO .352252-01 .530589-01 .356489-01 .238865-01
 SCUOTIMENTO -.864728-02 .434298-01 .354276-01 .871865-01
 VELOCITA' SCUOTIM. .129388-01 -.743097-01 .555664-01 -.319899-01
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 2738.82 2417.52 5287.68 4700.51
 II LATERALE -1271.82 -1043.97 -2169.55 -1666.26
 II LONGITUDIN. 249.465 -25.2026 248.686 -67.0657
 QUOTA PESO+CAR.SCUOT. 3072.94 2709.36 5836.27 5193.93
 MOMENTO AUTOALLIN. 24.3160 17.1654 99.0271 67.3202
 II SFS. AL ROTOL. 10.8604 9.42375 23.3626 20.2715
 II FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.3116 24.3300 24.5687 24.6920
 VEL.ROTAZ. RUOTA 81.4740 79.5726 81.8102 80.6787
 SCORRIMENTO .216486-01 -.248054-02 .113625-01 -.344329-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 449.033 = 4287.95 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.98422 CV
 COPPIA 34.6496 = 3.53207 KGM * POTENZA PERODINAMICA = 9.28712 CV
 POTENZA 15558.8 = 21.1460 CV
 FARFALLA .310696
 COPPIA VOLANTE -6.35059 * RISULTANTE FORZE EXT. PARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. PARIC. .000000
 PRESS.CTRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' Istante T = 1.5000
 *

 * VELOCITA' KM/H = 88.2369 RAGGIO EFFETTIVO = 142.558
 * ACCELERAZIONE LATERALE = -.429401 G CONTINGENZA EFFETTIVA = -.429570

 * \$\$\$\$ VEICOLI \$\$\$\$
 *
 * X = 36.6815 VINX = 24.4158 AINX = .240433
 * Y = 2.72475 VINY = 2.14916 AINY = -.420021
 * Z = .372973-01 VINZ = -.439615-02 AINZ = .346417-01
 * CURVATURA = -.701467-02 VMORX = 24.4258 AMORX = -.497642-02
 * VELOCITA' = 24.5103 VMORY = .741877 AMORY = -.421243
 * RAGGIO = -142.553 VMORZ = .397306 AMORZ = .178613
 * PASSO INT. = .200000-01 PSTAR = .512318-01 PPUNTOS = -.283245-01
 * CONTINGENZA = -.429570 QSTAR = -.141861-01 QPUNTOS = .298186
 * INDICE ESV = 7.42081 RSTAR = -.258681 RPUNTOS = -.431500-01

 * \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 *
 * ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 * ASSETTO VERO .297008-01 - 1G 42P 6.29 -
 * ASSETTO MIS. .000000 - 0G 0P .03 -
 * IMBARDATA .580961-01 -.259054 3G 19P 43.29 -14G 50P 33.7S -.329401-01
 * BOCCHIEGGIO .174226-01 -.533804-02 0G 59P 53.7S 0G-18P 21.1S
 * ROLLIO .343790-01 .467186-01 1G 57P 29.9S 2G 40P 36.4S
 * VOLANTE -.723750 .000000 -41G 28P 4.2S 0G 0P .0S .000000

 * \$\$\$\$ R U O T E \$\$\$\$
 *
 * ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 * STERZO -.310216-01 .000000 -.387966-01 .000000
 * DERIVA .474134-01 .446600-01 .543138-01 .442030-01
 * CONVERGENZA .516920-05 .160167-03 .630430-03 -.594250-04
 * CAMPANATURA -.117118-02 .198125-01 -.128023-03 -.166576-01
 * CAMP. RIF. AL SUOLO .373399-01 .567314-01 .382503-01 .247098-01
 * SCUOTIMENTO -.943636-02 .372105-01 .401073-01 .864180-01
 * VELOCITA' SCUOTIM. -.309651-01 -.454885-01 .360776-01 .210994-01
 * VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 * CARICO SCUOTIMENTO 2506.53 2217.03 5629.27 4701.23
 * LATERALE -1406.04 -1193.74 -2514.91 -2080.15
 * LONGITUDIN. 247.247 -22.1966 248.708 -63.0798
 * QUOTA PESO+CAR.SCUOT. 2819.31 2489.52 6198.61 5214.27
 * MOMENTO AUTOALLIN. 22.8346 16.6591 120.900 80.9159
 * RES. AL ROTOL. 9.84442 8.56820 25.1502 20.3627
 * FRENANTE .000000 .000000 .000000 .000000
 * VEL.CENTRO RUOTA 24.2829 24.3083 24.6493 24.6810
 * VEL.ROTAZ. RUOTA 81.5226 79.5098 81.6914 80.6603
 * SCORRIMENTO .233861-01 -.237761-02 .106905-01 -.322601-02

 * \$\$\$\$ P I L O T A G G I O \$\$\$\$
 *
 * VELOCITA' DI ROTA7. 448.839 = 4286.09 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.98318 CV
 * COPPIA 34.6785 = 3.53502 KGM * POTENZA AERODINAMICA = 9.27586 CV
 * POTENZA 15565.1 = 21.1554 CV
 * FARFALLA .310696
 * COPPIA VOLANTE -7.45959 * RISULTANTE FORZE EXT. RARIC. .000000
 * MARCIA INSERITA 3 * RISULTANTE MOM. EXT. RARIC. .000000
 * PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' ISTANTE T = 1.6000 *
 *

 * VELOCITA' KM/H = 88.1841 RAGGIO EFFETTIVO = -178.417 *
 * ACCELERAZIONE LATERALE = -.343405 G CONTINGENZA EFFETTIVA = -.342823 *

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 39.1241 VINX = 24.4353 AINZ = .169842
 Y = 2.91792 VINY = 1.71770 AINT = -3.35946
 Z = .368546-01 VINZ = -.756979-02 AINZ = -.214719
 CURVATURA = -.560485-02 VMORX = 24.4740 AMORX = .654653-01
 VELOCITA' = 24.4956 VMORY = .945553 AMORY = -3.36881
 RAGGIO = -178.417 VMORZ = .403858 AMORZ = -.881172-01
 PASSO INT. = .200000-01 PSTAR = -.175154-01 PPUNTOS = -3.59990
 CONTINGENZA = -.342823 QSTAR = .979020-02 QPUNTOS = .287494
 INDICE FSV = 505445. RSTAR = -.250435 RPUNTOS = .915670

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: * ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .379691-01 - * 2G 10P 31.79 -
 ASSETTO MIS. .000000 - * 0G 0P .05 -
 IMBARCATA .322113-01 -.249938 * 1G 50P 44.15 -14G 19P 13.45 .925899
 BECCHEGGIO .182367-01 .191133-01 * 1G 2P 41.65 1G 5P 42.45
 ROLLIO .372635-01 -.220732-01 * 2G 8P 6.15 -1G 15P 52.95
 VOLANTE -.102520-04 .216514-02 * 0G 0P -2.15 2G 7P 26.65 -10855.6

 \$\$\$\$ R J O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO -.439423-06 .000000 -.549555-06 .000000
 DERIVA .251584-01 .524699-01 .241392-01 .519205-01
 CONVERGENZA .196975-04 .160672-03 .668812-03 -.573842-04
 CAMPANATURA -.173863-02 .197927-01 -.486982-04 -.162294-01
 CAMP. RFF. AL SUOLO .399307-01 .598977-01 .414411-01 .278391-01
 SCUOTIMENTO -.131254-01 .356942-01 .408742-01 .893324-01
 VELOCITA' SCUOTIM. -.159587-01 .346644-01 -.471242-01 .370755-02
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 2487.94 2162.37 5753.55 5034.16
 ii LATERALE -784.250 -1325.80 -1227.82 -2413.31
 ii LONGITUDIN. 250.277 -23.4322 215.974 -50.4340
 QUOTA PESO-CAR.SCUOT. 2787.93 2421.59 6337.47 5560.77
 MOMENTO AUTOALLIN. 14.0353 17.1140 69.0497 99.6824
 ii RES. AL ROTOL. 9.72301 8.30545 25.8655 22.0082
 ii FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.2917 24.2920 24.6547 24.6528
 VEL.ROTOL. RUOTA 81.5983 79.4435 81.5762 80.5946
 SCORRIMENTO .239392-01 -.258037-02 .908766-02 -.289811-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 448.730 = 4285.06 GIRI/1' * POTENZA DI ROTOLAMENTO = 7.19382 CV
 COPPIA 34.6947 = 3.53666 KGM * POTENZA AERODINAMICA = 9.25921 CV
 POTENZA 15568.6 = 21.1601 CV
 FARFALLA .310696
 COPPIA VOLANTE -4.30299 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

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*****
*
*          RISULTATI ALL' ISTANCE T      =      1.7000
*
*****
*   VELOCITA' KM/H      = 89.1529      RAGGIO EFFETTIVO      = -151.629
*   ACCELERAZIONE LATERALE = -.402287   G.   CONTINGENZA EFFETTIVA = -.403104
*****
          $$$$$$ V E I C O L O $$$$$$
X      = 41.5684      VINX      = 24.4501      AINX      = .120798
Y      = 3.07140      VINY      = 1.34225      AINY      = -3.95377
Z      = .361793-01   VINZ      = .237190-02     AINZ      = .216835
CURVATURA = -.659504-02   VMORX      = 24.4586      AMORX      = .708748-01
VELOCITA' = 24.4869      VMORY      = 1.07638      AMORY      = -3.94644
RAGGIO     = -151.629     VMORZ      = .477138      AMORZ      = .338360
PASSO INT. = .200000-01   PSTAR      = -.157540-01     PPINTOS    = 1.63918
CONTINGENZA = -.403104   QSTAR      = .214153-01     QPINTOS    = -.715191-02
INDICE ESV = -.336926    RSTAR      = -.169155      RPUNTOS    = .695826

          $$$$$$ ANGOLI VEICOLO $$$$$$
ANGOLI DI:      VELOCITA' DI:      ANGOLI DI:      VELOCITA' DI:      ACCELERAZIONI DI:
ASSETTO VERO      .433588-01      -      *      2G 29P 3.48      -
ASSETTO MTS.      .000000      -      *      0G 7P 26.68      -
IMBARDATA      .114838-01      -.168463      *      0G 39P 28.75      -0G 39P 8.0S      .695438
BECCHIEGGIO      .207355-01      .265426-01      *      1G 11P 17.0S      1G 31P 14.8S
ROLLIO      .303743-01      -.192470-01      *      1G 44P 25.2S      -1G 6P 10.0S
VOLANTE      .000000      .000000      *      0G 0P .0S      0G 0P .0S      .000000

          $$$$$$ R U O T E $$$$$$
ANT.SIN.      POST.SIN.      ANT.DES.      POST.DES.
STERZO      .000000      .000000      .000000      .000000
DERIVA      .347553-01      .530900-01      .341122-01      .527777-01
CONVERGENZA      .140288-04      .154065-03      .311308-03      -.587212-04
CAMPANATURA      -.155473-02      .198224-01      -.767729-03      -.165418-01
CAMP. RIF. AL SUOLO      .355025-01      .543088-01      .361441-01      .249266-01
SCUOTIMENTO      -.119721-01      .435053-01      .320598-01      .872252-01
VELOCITA' SCUOTIM.      -.156599-01      .552140-01      -.470825-01      .240150-01
VEL. DEF. LAT. PNEUM.      .000000      .000000      .000000      .000000
CARICO SCUOTIMENTO      2638.79      2530.00      4977.51      4627.18
  II LATERALE      -1126.15      -1566.07      -1678.80      -2391.92
  II LONGITUDIN.      248.026      -42.2158      244.995      -44.7026
QUOTA PESO+CAR.SCUOT.      2956.96      2807.99      5540.98      5134.89
MOMENTO AUTOALLIN.      20.7954      24.5532      74.5247      87.5335
  II RES. AL ROTOL.      10.4029      9.81281      21.8783      19.9432
  II FRENANTE      .000000      .000000      .000000      .000000
VEL. CENTRO RUOTA      24.3389      24.3398      24.5838      24.5825
VEL. ROTAZ. RUOTA      81.6255      79.4828      81.5643      80.4111
SCORRIMENTO      .223677-01      -.400912-02      .117907-01      -.232151-02

          $$$$$$ P I L O T A G G I O $$$$$$
VELOCITA' DI ROTAZ.      448.772      =      4285.46      GIRI/1'      * POTENZA DI ROTOLAMENTO = 6.76948      CV
COPPIA      34.6884      =      3.53603      KGM      * POTENZA AERODINAMICA = 9.24940      CV
POTENZA      15567.2      =      21.1583      CV
FARFALLA      .310696
COPPIA VOLANTE      -4.30903      *      RISULTANTE FORZE EXT. RARIC.      .000000
MARCIA INSERITA      3      *      RISULTANTE MOM. EXT. RARIC.      .000000
PRESS.CTRC.FRENANTE      .000000      *      RISULTANTE COMP. VELOC. VENTO      .000000

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 *
 * RISULTATI ALL' ISTANCE T = 1.9000
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 *
 * VELOCITA' KM/H = 88.0952 RAGGIO EFFETTIVO = -181.276
 * ACCELERAZIONE LATERALE = -.336122 G CONTINGENZA EFFETTIVA = -.336736

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 46.4601 VINX = 24.4637 AIMX = .398734-01
 Y = 3.26202 VINY = .595275 AINY = -.330339
 Z = .360500-01 VINZ = -.688385-02 AINZ = .139213
 CURVATURA = -.551644-02 VMORX = 24.4506 AMORX = .711204-01
 VELOCITA' = 24.4709 VMORY = .863692 AMORY = -.329736
 RAGGIO = -181.276 VMOBZ = .495973 AMOBZ = .235970
 PASSO INT. = .200000-01 PSTAR = -.362445-01 PPUNTOS = .286995
 CONTINGENZA = -.336736 QSTAR = -.183580-01 QPUNTOS = .356465-01
 INDICE ESV = -.124536 RSTAR = -.617508-01 RPUNTOS = .339925

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .347024-01 - 1G 59P 17.9S -
 ASSETTO MIS. .000000 - 0G 0P .0S -
 IMBARCATA -.103742-01 -.622690-01 * 0G-35P 39.8S -3G 34P 3.9S .340891
 BENCHEGGIO .215732-01 -.165696-01 * 1G 14P 9.8S 0G-56P 57.7S
 ROLLIO .288429-01 -.375877-01 * 1G 39P 9.3S -2G 9P 13.0S
 VOLANTE .000000 .000000 * 0G 0P .0S 0G 0P .0S .000000

 \$\$\$\$ R U O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .000000 .000000 .000000 .000000
 DERIVA .315007-01 .381844-01 .311531-01 .382534-01
 CONVERGENZA .143751-04 .150692-03 .245592-03 -.587627-04
 CAMPANATURA -.156689-02 .197988-01 -.886840-03 -.165492-01
 CAMP. RIF. AL SUOLO .347747-01 .532088-01 .353106-01 .248308-01
 SCUOTIMENTO -.120496-01 .456613-01 .297637-01 .871740-01
 VELOCITA' SCUOTIM. .411839-01 -.302000-02 -.133789-01 -.571906-01
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 2777.23 2544.29 4954.42 4617.08
 " LATERALE -1082.95 -1195.90 -1543.59 -1825.40
 " LONGITUDIN. 250.637 -42.8671 252.414 -56.4036
 QUOTA PESO+CAR.SCUOT. 3112.14 2836.93 5502.14 5109.73
 MOMENTO AUTOALLIN. 21.7672 20.5341 68.6848 70.7997
 " RES. AL ROTOL. 11.0433 9.94320 21.6504 19.7880
 " FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.4100 24.4104 24.5007 24.5000
 VEL.ROTAZ. RUOTA 81.7892 79.7116 81.3249 80.0915
 SCORRIMENTO .214760-01 -.402944-02 .122335-01 -.294359-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 448.564 = 4283.47 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.80734 CV
 COPPIA 34.7195 = 3.53910 KGM * POTENZA AERODINAMICA = 9.23124 CV
 POTENZA 15573.9 = 21.1674 CV
 FARFALLA .310696
 COPPIA VOLANTE -4.11081 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CTRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

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*****
*
*          RISULTATI ALL' ISTANCE T      =      2.0000
*
*
*****
* VELOCITA' KM/H      = 86.0881      RAGGIO EFFETTIVO      = -223.244
* ACCELERAZIONE LATERALE = -.272918  G      CONTINGENZA EFFETTIVA = -.273389
*****
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X	=	48.9066	VINX	=	24.4671	AIUX	=	.318794-01
Y	=	3.30605	VINY	=	.295711	AIUY	=	-2.68175
Z	=	.361348-01	VINZ	=	.773012-02	AIUZ	=	.104771
CURVATURA	=	-4.47940-02	VMORX	=	24.4547	AMORX	=	.702062-01
VELOCITA'	=	24.4689	VMDRY	=	.677788	AMORY	=	-2.67732
RAGGIO	=	-223.244	VMORZ	=	.487578	AMORZ	=	.175505
PASSO INT.	=	.200000-01	PSTAR	=	-.330506-01	PPINTOS	=	-.280748
CONTINGENZA	=	-.273389	QSTAR	=	-.784140-02	QPINTOS	=	.118549
INDICE ESV	=	-.680687-01	RSTAR	=	-.338359-01	RPINTOS	=	.221638

	ANGOLI DI:	VELOCITA' DI:	*	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	.271788-01	-	*	1G 33P 26.0S	-	
ASSETTO MIS.	.000000	-	*	0G 0P .0S	-	
IMBARDATA	- .150933-01	- .340343-01	*	0G-51P 53.2S	-1G 57P .1S	.224675
BECCHIEGGIO	.203287-01	- .696390-02	*	1G 9P 53.1S	0G-23P 56.4S	
ROLLIO	.258594-01	- .337424-01	*	1G 28P 53.9S	-1G 55P 59.9S	
VOLANTE	.000000	.000000	*	0G 0P .0S	0G 0P .0S	.000000

	ANT. SIN.	POST. SIN.	ANT. DES.	POST. DES.
STERZO	.000000	.000000	.000000	.000000
DERIVA	.254279-01	.290071-01	.251467-01	.291615-01
CONVERGENZA	.248774-05	.149867-03	.232314-03	-.629642-04
CAMPANATURA	-.100093-02	.197917-01	-.909299-03	-.170757-01
CAMP. RIF. AL SUOLO	.321112-01	.499713-01	.321819-01	.221464-01
SCUOTIMENTO	-.824505-02	.461395-01	.292531-01	.833683-01
VELOCITA' SCUOTIM.	.408268-01	.219898-01	-.774506-02	-.262330-01
VEL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	2950.87	2664.79	4898.23	4432.16
II LATERALE	-938.131	-976.534	-1261.81	-1408.03
II LONGITUDIN.	257.019	-42.6051	243.187	-56.8119
QUOTA PESO+CAR.SCUOT.	3304.92	2975.24	5426.03	4906.86
MOMENTO AUTOALLIN.	21.0553	18.7048	56.4548	53.6387
II RES. AL ROTOL.	11.8350	10.4091	21.2818	18.8376
II FRENANTE	.000000	.000000	.000000	.000000
VEL. CENTRO RUOTA	24.4347	24.4340	24.4843	24.4839
VEL. R-TAZ. RUOTA	81.8103	79.8086	81.2473	80.0273
SCORRIMENTO	.207383-01	-.381864-02	.119406-01	-.308748-02

VELOCITA' CT ROTAZ.	448.409	=	4281.99	GIRT/11	* POTENZA DI ROTOLAMENTO	=	6.80992	CV
COPPIA	34.7427	=	3.54156	KGM	* POTENZA AERODINAMICA	=	9.22902	CV
POTENZA	15578.3	=	21.1742	CV				
FARFALLA	.310695							
COPPIA VOLANTE	-3.54845	*	RISULTANTE FORZE EXT. HAPIC.			.000000		
MARCIA INSCRITA	3	*	RISULTANTE H04. EXT. HAPIC.			.000000		
PRESS.CIRC.FRENANTE	.000000	*	RISULTANTE COMP. VELOC. VENT			.000000		

 *
 * RISULTATI ALL' Istante T = 2.1000 *
 *

 * VELOCITA' KM/H = 88.0934 RAGGIO EFFETTIVO = -292.232 *
 * ACCELERAZIONE LATERALE = -.208754 G CONTINGENZA EFFETTIVA = -.20874 *

 \$\$\$\$ VEICOLI \$\$\$\$
 X = 51.3535 VINX = 24.4703 AINX = .334159-01
 Y = 3.32417 VINY = .592307-01 AINY = -.2.04898
 Z = .372289-01 VINZ = .121641-01 AINZ = -.129536-01
 CURVATURA = -.342194-02 VMORX = 24.4603 AMORX = .694972-01
 VELOCITA' = 24.4704 VMORY = .497634 AMORY = -.2.04788
 RAGGIO = -292.232 VMORZ = .493684 AMORZ = .310805-01
 PASSO INT. = .200000-01 PSTAR = -.644071-01 PPUNTOS = -.166781
 CONTINGENZA = -.20874 QSTAR = .985254-03 RPUNTOS = .512763-01
 INDICE FSV = -.304722-01 RSTAR = -.152568-01 RPUNTOS = .146024

 \$\$\$\$ ANGOLI VEICOLO \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .199131-01 - 1G 8P 27.4S -
 ASSETTO MIS. .000000 - 0G 0P .0S -
 IMBARDATA -.174926-01 -.152361-01 -1G 0P 8.1S 0G-52P 22.7S .147090
 BFCCHEGGIO .201021-01 .130266-02 1G 9P 6.4S 0G 4P 28.7S
 ROLLIO .208195-01 -.647133-01 1G 11P 34.3S -3G 42P 28.1S
 VOLANTE .000000 .000000 0G 0P .0S 0G 0P .0S .000000

 \$\$\$\$ RUOTE \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .000000 .000000 .000000 .000000
 DFRIVA .191275-01 .206553-01 .189301-01 .208451-01
 CONVERGENZA -.130445-05 .141135-03 .178763-03 -.673999-04
 CAMPANATURA -.354160-03 .196940-01 -.993691-03 -.174387-01
 CAMP. RIF. AL SUOLO .286857-01 .452253-01 .282330-01 .203861-01
 SCUOTIMENTO -.322408-02 .505465-01 .269755-01 .805209-01
 VELOCITA' SCUOTIM. .572409-01 .603374-01 -.360878-01 -.322953-01
 VFL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 3219.67 2929.43 4665.15 4313.10
 " LATERALE -768.073 -771.119 -949.467 -1013.60
 " LONGITUDIN. 265.895 -44.5910 231.668 -57.3074
 QUOTA PESO+CAR.SCUOT. 3593.46 3258.34 5174.17 4769.19
 MOMENTO AUTOALLIN. 19.8822 17.3671 40.7380 38.4575
 " RES. AL ROTOL. 13.0384 11.6494 20.0798 18.2019
 " FRENANTE .000000 .000000 .000000 .000000
 VFL.CENTRO RUOTA 24.4543 24.4544 24.4765 24.4763
 VFL.ROTA7. RUOTA 81.7918 79.8858 81.2207 79.9931
 SCORRIMENTO .197318-01 -.364930-02 .119397-01 -.320431-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTA7. 448.284 = 4280.80 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.86658 CV
 COPPIA 34.7613 = 3.54345 KGM * POTENZA AERODINAMICA = 9.23056 CV
 POTENZA 15582.9 = 21.1797 CV
 FARFALLA .310606
 COPPIA VOLANTE -2.81100 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

RISULTATI ALL' ISTANCE T = 2.2000

VELOCITA' KM/H = 88.1074 RAGGIO EFFETTIVO = -413.79
ACCELERAZIONE LATERALE = -.147833 3 CONTINGENZA EFFETTIVA = -.147779

VEICOLI

X	= 53.8007	VINX	= 24.4740	AINX	= .403014-01
Y	= 3.32007	VINY	= -.115203	AINY	= -1.44991
Z	= .381907-01	VINZ	= .551646-02	AINZ	= -.104091
CHIVATURA	= -.242026-02	VMORX	= 24.4668	AMORX	= .600558-01
VELOCITA'	= 24.4743	VMORY	= .341814	AMORY	= -1.45024
RAGGIO	= -413.179	VMOBZ	= .500091	AMOBZ	= -.821071-01
PASSO INT.	= .200000-01	PSTAR	= -.610945-01	PPUNTOS	= .189064
CONTINGENZA	= -.147779	QSTAR	= .418156-02	QPUNTOS	= .148960-01
INDICE ESV	= -.724492-02	RSTAR	= -.368149-02	RPUNTOS	= .831639-01

ANGOLI VEICOLI

	ANGOLI DI:	VELOCITA' DI:	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	.136751-01	-	OG 47P .7S	-	
ASSETTO MJS.	.000000	-	OG 2P .0S	-	
IMBARDATA	-.183821-01	-.362246-02	-1G 3P 11.6S	OG-12P 27.2S	.833845-01
BECCHEGGIO	.204077-01	.423344-02	1G 10P 9.4S	OG 14P 33.2S	
ROLLIO	.142078-01	-.6116P5-01	OG 48P 50.6S	-3G 32P 16.9S	
VOLANTE	.000000	.000000	OG 0P .0S	OG 2P .0S	.000000

R U O T E

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	.000000	.000000	.000000	.000000
DERIVA	.134847-01	.137597-01	.133810-01	.139568-01
CONVERGENZA	.121563-05	.126305-03	.101946-03	-.738289-04
CAMPANATURA	.208126-03	.194590-01	-.107874-02	-.178332-01
CAMP. RIF. AL SUOLO	.249851-01	.393683-01	.242659-01	-.207286-01
SCUOTIMENTO	.213840-02	.567042-01	.227531-01	.771589-01
VELOCITA' SCUOTIM.	.446472-01	.556488-01	-.442396-01	-.325483-01
VFL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARTO SCUOTIMENTO	3495.48	3209.39	4431.01	4131.82
II LATERALE	-581.046	-559.790	-664.469	-672.384
II LONGITUDIN.	268.549	-46.9605	226.550	-56.2073
QUOTA PESO+CAR.SCUOT.	3088.27	3556.13	4921.05	4570.00
MOMENTO AUTOALLIN.	17.1744	14.6426	27.1928	24.7608
II RES. AL ROTOL.	14.2946	12.8863	18.8992	17.2967
II FRENANTE	.000000	.000000	.000000	.000000
VEL. CENTRO RUOTA	24.4693	24.4694	24.4746	24.4746
VEL.RO-AZ. RUOTA	81.7325	79.9449	81.2421	79.9813
SCORRIMENTO	.184177-01	-.352147-02	.122765-01	-.327978-02

F I L T A G G I O

VELOCITA' DI ROTAZ.	448.180	=	4279.81	GIRI/1'	* POTENZA DI ROTOLAMENTO = 6.91211	CV
COPIA	34.7769	=	3.54504	KGM	* POTENZA AERODINAMICA = 9.23506	CV
POTENZA	15586.3	=	21.1842	CV		
PARFALLA	.310696					
COPIA VOLANTE	-2.08618	*		RISULTANTE FORZE EXT. RAPIC.	.000000	
MARCIA INSERITA	3	*		RISULTANTE MOM. EXT. MARIC.	.000000	
PRESS.CIRC.FRENANTE	.000000	*		RISULTANTE COMP. VELOC. VENT	.000000	

 *
 * RISULTATI ALL' Istante T = 2.3000
 *
 *
 * VELOCITA' KM/H = 88.1259 RAGGIO EFFETTIVO = -631.712
 * ACCELERAZIONE LATERALE = -.967409-01G CONTINGENZA EFFETTIVA = -.966973-01*

 \$\$\$\$\$ VEICOLI \$\$\$\$\$
 X = 56.2483 VINX = 24.4783 AINX = .455202-01
 Y = 3.30299 VINY = -.234130 AINY = -.949080
 Z = .381708-01 VTNZ = -.590869-02 AINZ = -.108801
 CURVATURA = -.158300-02 VMORX = 24.4733 AMOBX = .652367-01
 VELOCITA' = 24.4794 VMORY = .221065 AMOBY = -.949028
 RAGGIO = -631.712 VMORZ = .502699 AMORZ = -.987491-01
 PASSO INT. = .200000-01 PSTAR = -.398117-01 PPUNTOS = .166128
 CONTINGENZA = -.966973-01 QSTAR = .463445-02 QPUNTOS = -.434389-02
 INDICE ESV = .474439-02 RSTAR = .232920-02 RPUNTOS = .376449-01

 \$\$\$\$\$ ANGOLI VEICOLO \$\$\$\$\$
 ANGOLI DI: VELOCITA' DI: * ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .884181-02 - * OG 30P 23.85 -
 ASSETTO MIS. .000000 - * OG 0P .05 -
 IMBARDATA -.184062-01 .237219-02 * -1G 3P 16.65 OG 8P 9.35 .376116-01
 BECCHEGGIO .208650-01 .461285-02 * 1G 11P 43.75 OG 15P 51.55
 ROLLIO .918689-02 -.397622-01 * OG 31P 34.95 -2G 16P 41.65
 VOLANTE .000000 .000000 * OG 0P .05 OG 0P .05 .000000

 \$\$\$\$\$ RUOTE \$\$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .000000 .000000 .000000 .000000
 DERIVA .896134-02 .859207-02 .891454-02 .878873-02
 CONVERGENZA .202199-05 .115034-03 .500764-04 -.804289-04
 CAMPANATURA .466961-03 .192296-01 -.107206-02 -.181532-01
 CAMP. RTF. AL SUOLO .229899-01 .352530-01 .223876-01 -.227115-01
 SCUOTIMENTO .518038-02 .609460-01 .185115-01 .741721-01
 VELOCITA' SCUOTIM. .171941-01 .293214-01 -.407795-01 -.281958-01
 VFL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 3660.02 3378.97 4253.07 3982.89
 II LATERALE -401.093 -365.835 -436.860 -417.441
 II LONGITUDIN. 262.710 -48.1228 225.731 -54.9928
 QUOTA PESO+CAR.SCUOT. 4069.17 3741.05 4726.79 4405.68
 MOMENTO AUTOALLIN. 12.8671 10.4877 17.2228 14.9416
 II RES. AL ROTOL. 15.0801 13.6695 18.0085 16.5609
 II FRENANTE .000000 .000000 .000000 .000000
 VFL.CENTRO RUOTA 24.4802 24.4802 24.4768 24.4768
 VFL.ROTAZ. RUOTA 81.6689 79.9876 81.2869 79.9846
 SCOPRTMENTO .172163-01 -.343026-02 .127349-01 -.332860-02

 \$\$\$\$\$ P I L O T A G G I O \$\$\$\$\$
 VELOCITA' DI ROTAZ. 448.129 = 4279.31 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.90724 CV
 COPPIA 34.7846 = 3.54583 KGM * POTENZA AERODINAMICA = 9.24090 CV
 POTENZA 15588.0 = 21.1865 CV
 FARFALLA .310696
 COPPIA VOLANTE -1.42795 * RISULTANTE FORZE EXT. PARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. PARIC. .000000
 PRESS.CTRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' Istante T = 2.4000 *
 *
 * VELOCITA' KM/H = 88.1460 RAGGIO EFFETTIVO = INFINITO *
 * ACCELERAZIONE LATERALE = -.590593-015 CONTINGENZA EFFETTIVA = .000000 *

***** \$\$\$\$ VEICOLI \$\$\$\$ *****

X	= 58.6963	VINX	= 24.4831	AINX	= .493329-01
Y	= 3.27550	VINY	= -.309499	AINY	= -.580055
Z	= .370963-01	VINZ	= -.145624-01	AINZ	= -.543373-01
CURVATURA	= -.966422-03	VMORX	= 24.4794	AMOBX	= .609256-01
VELOCITA'	= 24.4850	VMORY	= .134927	AMOHY	= -.579372
RAGGIO	= -1034.75	VMORZ	= .505646	AMOBZ	= -.496648-01
PASSO INT.	= .200000-01	PSTAR	= -.288750-01	PPINTOS	= .644262-01
CONTINGENZA	= -.590606-01	QSTAR	= .350925-02	QPINTOS	= -.161315-01
INDICE ESV	= .938868-02	RSTAR	= .467283-02	RPINTOS	= .109684-01

***** \$\$\$\$ ANGOLI VEICOLI \$\$\$\$ *****

	ANGOLI DI:	VELOCITA' DI:	+	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	.538987-02	-	*	OG 18P 31.7S	-	
ASSETTO MIS.	.000000	-	*	OG 0P .0S	-	
IMBARDATA	-.180304-01	.469434-02	*	-1G 1P 59.0S	OG 16P 8.3S	.108763-01
BECCHIEGGIO	.212797-01	.348186-02	*	1G 13P 9.2S	OG 11P 58.2S	
ROLLIO	.584952-02	-.287761-01	*	OG 20P 6.6S	-1G 38P 55.5S	
VOLANTE	.000000	.000000	*	OG 0P .0S	OG 0P .0S	.000000

***** \$\$\$\$ RUOTE \$\$\$\$ *****

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	.000000	.000000	.000000	.000000
DERIVA	.563097-02	.501190-02	.561447-02	.521058-02
CONVERGENZA	.185157-05	.109830-03	.199189-01	-.874386-04
CAMPANATURA	.529360-03	.191079-01	-.981864-03	-.184357-01
CAMP. RIF. AL SUOLO	.222149-01	.327975-01	.218295-01	-.247243-01
SCUOTIMENTO	.600272-02	.628591-01	.144908-01	.712812-01
VELOCITA' SCUOTIM.	.198386-02	.111452-01	-.398750-01	-.303881-01
VEL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	3749.89	3469.38	4107.91	3863.89
II LATERALE	-257.066	-218.323	-271.081	-243.746
II LONGITUDIN.	256.073	-48.6157	226.347	-53.7967
QUOTA PESO+CAR.SCUOT.	4172.52	3844.67	4569.22	4275.25
MOMENTO AUTOALLIN.	8.65760	6.59752	10.3403	8.50143
II PES. AL ROTOL.	15.5342	14.1138	17.2958	15.9838
II FRENANTE	.000000	.000000	.000000	.000000
VEL. CENTRO RUOTA	24.4881	24.4881	24.4813	24.4813
VEL. ROTAZ. RUOTA	81.6246	80.0180	81.3410	79.9972
SCUOTIMENTO	.163657-01	-.337199-02	.132099-01	-.335555-02

***** \$\$\$\$ P I L O T A G G I O \$\$\$\$ *****

VELOCITA' DI ROTAZ.	448.155	=	4279.57	GIRI/1'	+ POTENZA DI ROTOLAMENTO = 6.86613	CV
COPPIA	34.7806	=	3.54542	KGM	+ POTENZA AERODINAMICA = 9.24723	CV
POTENZA	15587.1	=	21.1853	CV		
FARFALLA	.310696					
COPPIA VOLANTE	-.907299	+		RISULTANTE FORZE EXT. BARIO.	.000000	
MARCIA INSERITA	3	+		RISULTANTE MOM. EXT. BARIO.	.000000	
PRESS.CIRC.FRENANTE	.000000	+		RISULTANTE COMP. VELOC. VENTO	.000000	

 *
 * RISULTATI ALL' ISTANCE T = 2.5000
 *
 *

 * VELOCITA' KM/H = 88.1665 RAGGIO EFFETTIVO = INFINITO
 * ACCELERAZIONE LATERALE = -.335685-01G CONTINGENZA EFFETTIVA = .000000

 * \$ \$ \$ \$ V E I C O L O \$ \$ \$ \$

X	= 61.1449	VINX	= 24.4881	AINX	= .525354-01
Y	= 3.24211	VINY	= -.354134	AINY	= -.330326
Z	= .354799-01	VINZ	= -.166213-01	AINZ	= .124704-01
CURVATURA	= -.549408-03	VMORX	= 24.4853	AMORX	= .580364-01
VELOCITA'	= 24.4907	VMORY	= .769355-01	AMORY	= -.329307
RAGGIO	= -1820.14	VMORZ	= .510674	AMORZ	= .148119-01
PASSO INT.	= .200000-01	PSTAR	= -.219399-01	PPUNTOS	= .780697-01
CONTINGENZA	= -.335915-01	QSTAR	= .160085-02	QPUNTOS	= -.147703-01
INDICE ESV	= .100654-01	RSTAR	= .502561-02	RPUNTOS	= -.237084-02

 * \$ \$ \$ \$ ANGOLI VEICOLO \$ \$ \$ \$

	ANGOLI DI:	VELOCITA' DI:	*	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	.307262-02	-	*	OG 10P 33.8S	-	
ASSETTO MIS.	.000000	-	*	OG 0P .0S	-	
IMBARDATA	-.175329-01	.503270-02	*	-1G 0P 16.4S	OG 17P 18.1S	-.242020-02
BECCHIEGGIO	.215423-01	.178423-02	*	1G 14P 3.4S	OG 6P 8.0S	
ROLLIO	.330439-02	-.218315-01	*	OG 11P 21.6S	-1G 15P 3.1S	
VOLANTE	.000000	.000000	*	OG 0P .0S	OG 0P .0S	.000000

 * \$ \$ \$ \$ R U O T E \$ \$ \$ \$

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	.000000	.000000	.000000	.000000
DETTIVA	.333193-02	.267692-02	.333018-02	.288136-02
CONVERGENZA	.188464-05	.108232-03	.463214-05	-.953905-04
CAMPANATURA	.521792-03	.190683-01	-.823020-03	-.187073-01
CAMP. RIF. AL SUOLO	.218793-01	.310585-01	.216850-01	-.264836-01
SCUOTIMENTO	.590066-02	.634450-01	.106952-01	.682033-01
VELOCITA' SCUOTIM.	-.299856-02	.168048-02	-.347873-01	-.298683-01
VEL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	3810.59	3528.00	3994.02	3755.50
ii LATERALE	-153.931	-118.154	-158.514	-132.599
ii LONGITUDIN.	251.153	-49.0098	227.982	-52.4848
QUOTA PESO+CAR.SCUOT.	4241.02	3910.45	4445.19	4158.65
MOMENTO AUTOALLIN.	5.35298	3.69065	5.87833	4.49825
ii RES. AL ROTEL.	15.8376	14.3981	16.7411	15.4731
ii FRENANTE	.000000	.000000	.000000	.000000
VFL.CENTRO RUOTA	24.4943	24.4942	24.4869	24.4870
VFL.ROTAZ. RUOTA	81.5976	80.0406	81.3983	80.0150
SCORRIMENTO	.157919-01	-.334214-02	.136766-01	-.336550-02

 * \$ \$ \$ \$ P I L O T A G G I O \$ \$ \$ \$

VELOCITA' DI ROTAZ.	448.239	=	4280.37	GIRI/1'	* POTENZA DI ROTOLAMENTO =	6.81558	CV
COPPIA	34.7681	=	3.54415	KGm	* POTENZA AERODINAMICA =	9.25369	CV
POTENZA	15584.4	=	21.1817	CV			
FARFALLA	.310696						
COPPIA VOLANTE	-.538905	*		RISULTANTE FORZE EXT. BARIC.		.000000	
MARCIA INSERITA	3	*		RISULTANTE MOM. EXT. BARIC.		.000000	
PRESS.CIRC.FRENANTE	.000000	*		RISULTANTE COMP. VELOC. VENTO		.000000	

 *
 * PISULTATI ALL' ISTANCE T = 2.6000 *
 *

 * VELOCITA' KM/H = 88.1873 RAGGIO EFFETTIVO = INFINITO *
 * ACCELERAZIONE LATERALE = -.174004-01G CONTINGENZA EFFETTIVA = .000000 *

 \$\$\$\$ V E I C O L O \$\$\$\$
 X = 63.5940 VINX = 24.4935 AINX = .552361-01
 Y = 3.20534 VINY = -.378601 AINY = -.171756
 Z = .339696-01 VINZ = -.128399-01 AINZ = .565246-01
 CURVATURA = -.284756-03 VMORX = 24.4910 AMORX = .569190-01
 VELOCITA' = 24.4955 VMORY = .399823-01 AMORY = -.170698
 RAGGIO = -3511.56 VMORZ = .517706 AMORZ = .580396-01
 PASSO INT. = .200000-01 PSTAR = -.126671-01 PPIINTJS = .883523-01
 CONTINGENZA = -.174191-01 QSTAR = .801613-03 QPIINTJS = -.341749-02
 INOICE ESV = .890157-02 RSTAR = .444848-02 RPUNTOS = -.798461-02

 \$\$\$\$ ANGOLI VEICOLI \$\$\$\$
 ANGOLI DI: VELOCITA' DI: ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .159824-02 - 0G 5P 29.7S -
 ASSETTO MIS. .000000 - 0G 0P .0S -
 IMBARCATA -.170540-01 .445078-02 0G-58P 37.6S 0G 15P 18.0S -.799185-02
 BECCHEGGIO .216622-01 .794616-03 1G 14P 28.1S 0G 2P 43.9S
 ROLLIO .157279-02 -.125707-01 0G 3P 24.4S 0G-43P 12.9S
 VOLANTE .200000 .000000 0G 0P .0S 0G 0P .0S .000000

 \$\$\$\$ R U O T E \$\$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .000000 .000000 .000000 .000000
 DERIVA .182757-02 .123561-02 .183068-02 .144678-02
 CONVERGENZA .198204-05 .108491-03 -.645661-06 -.102328-03
 CAMPANATURA .491201-03 .190748-01 -.652903-03 -.189124-01
 CAMP. RTF. AL SUOLO .217601-01 .299268-01 .216823-01 -.277485-01
 SCUOTIMENTO .549480-02 .633501-01 .777664-02 .656153-01
 VELOCITA' SCUOTIM. -.470152-02 -.261097-02 -.230685-01 -.208438-01
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 3848.74 3565.91 3930.49 3675.22
 ii LATERALE -85.0248 -54.9680 -86.3574 -65.6987
 ii LONGITUDIN. 247.435 -49.3709 230.858 -51.4257
 QUOTA FESD+CAR.SCUOT. 4284.11 3952.52 4375.26 4073.06
 MOMENTO AUTOALLIN. 3.01700 1.75286 3.15358 2.18002
 ii RES. AL ROTOL. 16.0297 14.5812 16.4316 15.1015
 ii FRENANTE .000000 .000000 .000000 .000000
 VEL. CENTRO RUOTA 24.4997 24.4997 24.4932 24.4932
 VEL. ROTAZ. RUOTA 81.5833 80.0592 81.4517 80.0353
 SCORRIMENTO .154017-01 -.333093-02 .140705-01 -.336689-02

 \$\$\$\$ P I L O T A G G I O \$\$\$\$
 VELOCITA' DI ROTAZ. 448.346 = 4281.39 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.78379 CV
 COPPIA 34.7520 = 3.54251 KGM * POTENZA AERODINAMICA = 9.26022 CV
 POTENZA 15580.9 = 21.1760 CV
 FARFALLA .310696
 COPPIA VOLANTE -.295896 * RISULTANTE FORZE EXT. RAPIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BATIC. .000000
 PRESS.CIRC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

A.3-45

		ANGOLI DI:		VELOCITA' DI:		ACCELERAZIONI DI:	
ASSETTO VERO	711679-03	-	*	0G 2P 26.8S	-		
ASSETTO MIS.	.000000	-	*	0G 0P .0S	-		
IMBARDATA	-165535-01	.353708-02	*	0G-57P 15.0S	0G 12P 9.6S		-934134-02
BECCHIEGGIO	.217452-01	.108578-02	*	1G 14P 45.3S	0G 3P 44.0S		
ROLLIO	.695307-03	-.586672-02	*	0G 2P 23.4S	0G-20P 10.1S		
VOLANTE	.000000	.000000	*	0G 0P .0S	0G 0P .0S		.000000

VELOCITA' DI ROTAZ.				
448,455	=	4282,43	GIRI/1'	* POTENZA DI ROTOLAMENTO = 6.77386 CV
34,7358	=	3,54086	KGM	* POTENZA AERODINAMICA = 9.26681 CV
15577,4	=	21,1722	CV	
310696				
-146089	*		RISULTANTE FORZE EXT. BARIC.	.000000
3	*		RISULTANTE MOM. EXT. BARIC.	.000000
.000000	*		RISULTANTE COMP. VELOC. VENTO	.000000

 *
 * RISULTATI ALL' Istante T = 2.8000 *
 *

 * VELOCITA' KM/H = 88.2293 RAGGIO EFFETTIVO = INFINITO *
 * ACCELERAZIONE LATERALE = -.231177-02G CONTINGENZA EFFETTIVA = .000000 *

 \$\$\$\$ VEICOLI \$\$\$\$
 X = 68.4978 VINX = 24.5049 AINX = .581234-01
 Y = 3.12745 VINY = -.395340 AINY = -.236471-01
 Z = .327773-01 VINZ = .918660-03 AINZ = .578276-01
 CURVATURA = -.378032-04 VMORX = 24.5022 AMORX = .572213-01
 VELOCITA' = 24.5001 VMORY = .540555-02 AMORY = -.226785-01
 RAGGIO = -26452.8 VMORZ = .537825 AMORZ = .591012-01
 PASSO IN = .200020-01 PSTAR = -.316894-02 PPUNCS = .164504-01
 CONTINGENZA = -.231452-02 QSTAR = .220920-02 QPUNCS = .997888-02
 INDICE ESV = .523242-02 RSTAR = .261500-02 RPUNCS = -.846568-02

\$\$\$ ANGOLI VEICOLI \$\$\$
 ANGOLI DI: VELOCITA' DI: * ANGOLI DI: VELOCITA' DI: ACCELERAZIONI DI:
 ASSETTO VERO .214354-03 - * OG OP 44.38 -
 ASSETTO MIS. .000000 - * OG OP .05 -
 IMBARDA .163465-01 .261621-02 * OG-56P 11.78 OG OP 59.65 -.846511-02
 BECCHEGGIO .219251-01 .220852-02 * 1G 15P 19.13 OG 7P 35.59
 ROLLIO .260575-03 -.311163-02 * OG OP 53.89 OG-10P 41.89
 VOLANTE .000000 .000000 * OG OP .05 OG OP .05 .000000

\$\$\$ RUOTE \$\$\$
 ANT.SIN. POST.SIN. ANT.DES. POST.DES.
 STERZO .000000 .000000 .000000 .000000
 DERIVA .349126-03 -.425835-04 .353222-03 .172876-03
 CONVERGENZA .203303-05 .108236-03 -.20087-.05 -.107213-03
 CAMPANAURA .447743-03 .190084-01 -.477283-03 -.190425-01
 CAMP. REF. AL SUOLC .219203-01 .292177-01 -.219106-01 -.288587-01
 SCUOTIMENTO .493535-02 .634433-01 .531351-02 .638188-01
 VELOCITA' SCUOTIM. .377725-03 .625701-02 -.417523-02 .173838-02
 VEL. DEF. LAT. PNEUM. .000000 .000000 .000000 .000000
 CARICO SCUOTIMENTO 3889.35 3607.51 3900.27 3621.10
 " LATERALE -16.3564 1.91002 -16.5855 -7.77449
 " LONGITUDIN. 242.965 -49.9633 235.961 -50.6316
 QUOTA PESO+CAR.SCUOT. 4329.86 3999.01 4342.73 4014.40
 MOMENTO AUTOALL'N. .592542 -.621963-01 .603262 .254338
 " RES. AL ROTOL. 16.2361 14.7857 16.2920 14.8511
 " FRENANTE .000000 .000000 .000000 .000000
 VEL.CENTRO RUOTA 24.5100 24.5100 24.5062 24.5062
 VEL.ROTOL. RUOTA 81.5815 80.0930 81.5297 80.0781
 SCORRIMENTO .149637-01 -.333171-02 .144903-01 -.336334-02

\$\$\$ P I L O T A G G I O \$\$\$
 VELOCITA' DI ROTAZ. 448.555 = 4283.39 GIRI/1' * POTENZA DI ROTOLAMENTO = 6.78932 CV
 COPPIA 34.7207 = 3.53932 KGM * POTENZA AERODINAMICA = 9.27344 CV
 POTENZA 15574.2 = 21.1678 CV
 FARFALLA .310656
 COPPIA VOLANTE -.576212-01 * RISULTANTE FORZE EXT. BARIC. .000000
 MARCIA INSERITA 3 * RISULTANTE MOM. EXT. BARIC. .000000
 PRESS.C'RC.FRENANTE .000000 * RISULTANTE COMP. VELOC. VENTO .000000

 *
 * RISULTATI ALL' ISTANCE T = 2.9000 *
 *
 * VELOCITA' KM/H = 88.2502 RAGGIO EFFETTIVO = INFINITO *
 * ACCELERAZIONE LATERALE = .432597-03G CONTINGENZA EFFETTIVA = .000000 *

 \$\$\$\$\$ V E I C O L O \$\$\$\$\$

X	= 70.9446	VINX	= 24.5108	AINX	= .581568-01
Y	= 3.08785	VINY	= -.396189	AINY	= .330647-02
Z	= .331014-01	VINZ	= .513670-02	AINZ	= .243982-01
CURVATURA	= .706569-05	VMDRX	= 24.5078	AMDBX	= .575410-01
VELOCITA'	= 24.5140	VMDRY	= -.908268-03	AMDBY	= .424377-02
RAGGIO	= 141531	VMDRZ	= .548321	AMDBZ	= .256795-01
PASSO INT.	= .200000-01	PSTAR	= -.231734-02	PPUNTOS	= .740205-02
CONTINGENZA	= .432820-03	QSTAR	= .260837-02	QPUNTOS	= -.193503-02
INDICE ESV	= .368413-02	RSTAR	= .183162-02	RPUNTOS	= -.680806-02

 \$\$\$\$\$ ANGOLI VEICOLO \$\$\$\$\$

	ANGOLI DI:	VELOCITA' DI:		ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	= .368953-04	-	*	0G 0P -7.6S	-	
ASSETTO MIS.	= .000000	-	*	0G 0P .0S	-	
IMBARDATA	= .161255-01	.183206-02	*	0G-55P 26.1S	0G 6P 17.9S	= -.680972-02
ECCHEGGIO	= .221600-01	.260838-02	*	1G 16P 10.8S	0G 8P 58.0S	
ROLLIO	= .146340-05	-.227674-02	*	0G 0P -.3S	0G -7P 49.6S	
VOLANTE	= .000000	.000000	*	0G 0P .0S	0G 0P .0S	= .000000

 \$\$\$\$\$ R U O T E \$\$\$\$\$

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	.000000	.000000	.000000	.000000
DERIVA	.564706-04	-.247323-03	.805271-04	-.356229-04
CONVERGENZA	.202499-05	.105855-03	-.202513-05	-.105861-03
CAMPANATURA	.463818-03	.190075-01	-.463653-03	-.190076-01
CAMP. RTF. AL SUOLO	.221649-01	.291950-01	-.221649-01	-.291968-01
SCUOTIMENTO	.514006-02	.643170-01	.513793-02	.643149-01
VELOCITA' SCUOTIM.	.348880-02	.104435-01	.171665-03	.715039-02
VFL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	3904.50	3634.40	3900.19	3630.74
II LATERALE	-2.65169	11.1455	-2.84120	1.60430
II LONGITUDIN.	241.702	-50.3815	237.174	-50.7054
QUOTA PESO+CAR.SCUOT.	4345.63	4026.50	4341.08	4022.74
MOMENTO AUTOALLIN.	.966588-01	-.365989	.103417	-.526623-01
II RES. AL ROTOL.	16.3081	14.9067	16.2869	14.8895
II FRENANTE	.000000	.000000	.000000	.000000
VEL.CENTRO RUOTA	24.5153	24.5153	24.5126	24.5126
VEL.ROTATZ. RUOTA	81.5881	80.1098	81.5575	80.0991
SCUOTIMENTO	.148319-01	-.333667-02	.145693-01	-.336125-02

 \$\$\$\$\$ P I L O T A G G I O \$\$\$\$\$

VELOCITA' DI ROTAZ.	448.650	=	4284.29	GIRI/1'	* POTENZA DI ROTOLAMENTO = 6.81564	CV
COPPIA	34.7066	=	3.53788	KGM	* POTENZA AERODINAMICA = 9.28006	CV
POTENZA	15571.1	=	21.1636	CV		
FARFALLA	.310606					
COPPIA VOLANTE	-.961407-02	*		RISULTANTE FORZE EXT. RARIC.	.000000	
MARCIA INSERITA	3	*		RISULTANTE MOM. EXT. RARIC.	.000000	
PRESS.CIRC.FRENANTE	.000000	*		RISULTANTE COMP. VELOC. VENTO	.000000	

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*****
*
*          RISULTATI ALL' ISTANTE T      =      3.0000
*
*****
* VELOCITA' KM/H      =      98.2710      RAGGIO EFFETTIVO      =      INFINITO
* ACCELERAZIONE LATERALE =      .159849-026      CONTINGENZA EFFETTIVA =      .000000
*****
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X	=	73.3959	VINX	=	24.5166	AINX	=	.578584-01
Y	=	3.04829	VINY	=	-.395191	AINY	=	.147583-01
Z	=	.336663-01	VINZ	=	.606193-02	AINZ	=	-.493194-02
CURVATURA	=	.260952-04	VMORX	=	24.5135	AMORX	=	.577113-01
VELOCITA'	=	24.5197	VMORY	=	-.362229-02	AMORY	=	.156812-01
RAGGIO	=	38321.3	VMORZ	=	.555074	AMORZ	=	-.363802-02
PASSO INT.	=	.208000-01	PSTAR	=	-.915755-03	PPUNTOS	=	.160540-01
CONTINGENZA	=	.159927-02	QSTAR	=	.188452-02	QPUNTOS	=	-.111393-01
INDICE ES	=	.245133-02	RSTAR	=	.122567-02	RPUNTOS	=	-.509905-02

	ANGOLI DI:	VELOCITA' DI:	*	ANGOLI DI:	VELOCITA' DI:	ACCELERAZIONI DI:
ASSETTO VERO	- .143826-03	-	*	0G 0P-29.7S	-	
ASSETTO MIS.	.000000	-	*	0G 0P .0S	-	
IMBARDATA	- .159740-01	.122566-02	*	0G-54P 54.9S	0G 4P 12.8S	- .509845-02
BECCHEGGIO	- .223926-01	.188472-02	*	1G 16P 58.8S	0G 6P 28.8S	
ROLLIO	- .167846-03	- .88831-03	*	0G 0P-34.6S	0G -3P 3.2S	
VOLANTE	.000000	.000000	*	0G 0P .0S	0G 0P .0S	.000000

	ANT.SIN.	POST.SIN.	ANT.DES.	POST.DES.
STERZO	.000000	.000000	.000000	.000000
DERIVA	- .819692-04	- .316826-03	- .779943-04	- .110090-03
CONVERGENZA	.197146-05	.103048-03	- .200527-05	- .103704-03
CAMPANATURA	.495534-03	.189323-01	- .476520-03	- .189502-01
CAMP. RIF. AL SUOLO	.223950-01	.292159-01	- .224016-01	- .294441-01
SCUOTIMENTO	.555231-02	.653496-01	.530661-02	.651079-01
VELOCITA' SCUOTIM.	.433426-02	.937283-02	.302445-02	.807190-02
VFL. DEF. LAT. PNEUM.	.000000	.000000	.000000	.000000
CARICO SCUOTIMENTO	3916.91	3654.64	3902.7	3641.27
" " " LATERALE	3.85627	14.3287	3.66189	4.96687
" " " LONGITUDIN.	240.749	-50.7246	237.681	-50.8076
QUOTA PESTI-CAR.SCUOT.	.4358.79	4047.80	4342.91	4033.35
MOMENTO AUTOALLIN.	- .141134	- .473751	- .133356	- .163571
" " " RES. AL ROTAZ.	16.3686	15.0011	15.2773	14.9377
" " " FRENANTE	.000000	.000000	.000000	.000000
VFL. CENTRO RUOTA	24.5205	24.5206	24.5.38	24.5189
VFL. ROTAZ. RUOTA	81.5973	80.1268	81.5.813	80.1196
SCORRIMENTO	.147288-01	- .334170-02	.146456-01	- .335917-02

VELOCITA' DI ROTAZ.	448.741	=	4285.16	GIRI/1'	POTENZA DI ROTOLAMENTO	=	6.84057	CV
COPPIA	34.5931	=	3.83650	KGM	POTENZA AERODINAMICA	=	9.28663	CV
POTENZA	15566.2	=	21.1596	CV				
FARFALLA	.310696							
COPPIA VCLANTE	.132814-01	=		RISULTANTE FORZE EXT. BARIC.			.000000	
MARCIA INSERITA	3	=		RISULTANTE MON. EXT. BARIC.			.000000	
PRESS.CIEC.FRENANTE	.000000	=		RISULTANTE COMP. VELOC. VENTO			.000000	

APPENDIX A.3-2

CURVMAGN COMPUTER SIMULATION MODEL

APPENDIX A.3-3

CURVMAGNCAR COMPUTER SIMULATION MODEL

APPENDIX A.3-4

PRESTMCC COMPUTER SIMULATION MODEL

The CURVMAGN program provides the values of the various magnetic quantities in the different sections in which the magnetic circuit of the DC electric machine is divided. The no-load magnetization curve is plotted, once the geometrical quantities of the magnetic circuit, the magnetic characteristic curve of the laminations and of the iron used are known together with the Lehman diagram at no-load relative to the salient pole and assuming the necessary approximations for what non-linear magnetic phenomena are concerned.

Simulation of the magnetization curve of a DC electric machine has proved to be reliable, after comparison with that obtained by means of the experimental data relative to a DC compensated electric machine.

The CURVMAGNCAR program provides the values of flux distribution in the air gap and draws by means of a plotter the magnetization curve under load conditions for all the values of current considered, once the geometric quantities of the magnetic circuit, the magnetic characteristic of the laminations, the Lehman diagram at load relative to the salient pole, the degree of compensation and the auxiliary poles excitation are known.

The PRESTMCC program provides the mechanical power curves versus motor speed as in motoring as in generating conditions, at different values of armature current with the following input data: supply voltage, geometric and magnetic quantities of the electric machine.

Furthermore this program provides the efficiency map of the motor/generator DC machine.