P.A.C. No. 597

PUBLIC ACCOUNTS COMMITTEE (1978-79)

(SIXTH LOK SABHA)

FIFTY-EIGHTH REPORT

DIESEL HYDRAULIC LOCOMOTIVES

MINISTRY OF RAILWAYS
(RAILWAY BOARD)

[Paragraph 8 of the Report of the Comptroller and Auditor General of India for the year 1974-75, Union Government (Railways)]

Presented in Lok Sabha on 20-4-79

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LOK SABHA SECRETARIAT
NEW DELHI

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INTRODUCTION

I, the Chairman of the Public Accounts Committee, as authorised by the Committee, do present on their behalf this Fifty Eighth Report of the Public Accounts Committee (Sixth Lok Sabha) on paragraph 8 of he Report of the Comptroller and Auditor General of India for the year 1974-75, Union Government (Railways) relating to Diesel Hydraulic Locomotives.

2. The Report of the Comptroller & Auditor General of India for the year 1974-75, Union Government (Railways) was laid on the Table of the House on 6 May, 1976. The Public Accounts Committee (1976-77) examined the paragraph at their sitting held on the 21 August 1976. The Committee also examined Shri M. M. Suri on 18 October, 1976. The Committee (1976-77) could not finalise the Report on account of the dissolution of the Lok Sabha on 18 January, 1977. When the draft Report was placed before the Public Accounts Committee (1977-78) on 5 December, 1977, it was decided that as desired by the Railway Board, an opportunity might be given to them for furnishing some additional information. The Public Accounts Committee (1977-78) on the basis of additional information took further evidence on the paragraph on 30 and 31 March, 1978 and also obtained additional written information from the Ministry of Railways (Railway Board) thereafter. The Committee (1977-78), however, decided on 18 April, 1978 that the draft Report might be placed before the next Committee, when some new members from Rajya Sabha would also be associated.

3. The Committee (1978-79) considered and finalised this Report at their sitting held on 12 April, 1979. The Minutes of the sitting form Part II* of the Report.

4. A statement containing conclusions and recommendations of the Committee is appended to this Report (Appendix). For facility of reference these have been printed in thick type in the body of the Report.

5. The Committee place on record their appreciation of the commendable work done by the Chairmen and Members of the Public Accounts Committee (1976-77) and (1977-78) in taking evidence and obtaining information for this Report.

6. The Committee also place on record their appreciation of the assistance rendered to them in the examination of the paragraph by the Comptroller and Auditor General of India.

7. The Committee would also like to express their thanks to the Chairmen and Members of the Railway Board for the cooperation extended by them in giving information to the Committee.

New Delhi ;
April 17, 1979
Chaitra 27, 1901(S)

P. V. NARASIMHA RAO,
Chairman
Public Accounts Committee

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REPORT

DIESEL HYDRAULIC LOCOMOTIVES (WDM-3)

Audit Paragraph

Introduction

1.1. A Mechanical Engineer of the Indian Railways, while working as an Inspecting Officer in United Kingdom, developed a new hydro-mechanical transmission for diesel locomotives. The design was examined by the Railway Board and the National Research and Development Corporation and was patented in India (as Suri transmission) sometime in 1956-57. In this invention the transmission is hydraulic at low speeds and changes over to mechanical at higher speeds leading to increased transmission efficiency, resulting in saving in fuel consumption. With a view to developing this transmission, the Railway Board placed orders on a West German firm in 1959 for supply of 7 diesel shunters of 650 horse-power fitted with this transmission. Subsequently, the manufacture of these shunters in collaboration with the same West German firm was established in Chittaranjan Locomotive works.

1.2. In 1962, the Railway Board thought of developing Suri transmission in high horse-power locomotives in order to realise its maximum benefit. For this purpose the Railway Board, in April 1962, authorised the Additional Member, Mechanical, and the Director, Finance, to conduct negotiations with West German firms for 5000 horse-power locomotives and with ALCO (U.S.A.) for 2600 horse-power locomotives already under manufacture at Diesel Locomotive Works, Varanasi.

Selection of locomotives

1.3. Between 1962 and 1964, the Railway Board considered the question of procurement and development of Suri transmission in 5000 horse-power locomotive or alternatively 2500 or 2600 horse-power locomotive. Having regard to the then technical assessment that the maximum benefits of Suri transmission were likely to show up in the higher horse-power range due to a better power/weight ratio, the Board considered it desirable to procure a few 5000 horse-power locomotives with Suri/Mekydro transmission provided the prices were found to be reasonable and adequate guarantees on the performance of these locomotives, engines and transmission systems were forthcoming.

1.4. As efforts were then being made to procure West German Credit for purchase of these locomotives, the Railway Board, in September 1964, issued tender enquiries to three West German firms. In response, offers were received from two firms who offered locomotives of 5000 horse-power with two 2500 horse-power Maybach engines. In June 1965, the Railway Board appointed a Technical Committee to examine these offers. The Committee was specifically asked to determine (i) technical suitability of the

5000 horse-power locomotives for the development of Suri transmission and (ii) in view of the difficulties experienced by American Railroads with 16 cylinder high speed Maybach engines, what precautions should be taken to ensure that 20 cylinder high speed Maybach engines (which were proposed to be fitted in the 5000 horse-power locomotives) gave minimum trouble under Indian conditions of working. The Technical Committee on various considerations came to the conclusion (December 1965) that no economic benefits of capital and maintenance costs could be expected of 5000 horse-power locomotives as compared to those of dual coupled 2600 horse-power diesel locomotives of ALCO design. The Committee also stated that 5000 horse-power locomotives could not be adopted as a standard unit taking into account the restrictions imposed by track and bridge conditions, hauling capacity of the locomotives, impracticability of multiple operation and lesser flexibility.

1.5. About 2500 horse-power Maybach diesel engine, the Committee observed that the 20 cylinder engine of the MD series offered by the tenderers had not been installed on any locomotive and the experience so far was limited to bench tests only. The Committee, however, felt that there might not be undue risk in providing 20 cylinder MD 1080 series Maybach engines on the locomotives subject to proper observance of maintenance schedules and the use of recommended lubricants.

1.6. On 9th June 1966, the Railway Board decided that taking all factors into consideration, procurement of 5000 horse-power locomotives for developing Suri transmission could not be justified. Since the standard broad-gauge diesel locomotive was of 2600 horse-power, the Board felt that it should be possible to design and fit 2600 horse-power Suri transmission in a diesel locomotive of equivalent horse-power and decided that it would be more prudent to go in for 2600 horse-power locomotives rather than for 5000 horse-power locomotives. Accordingly, the Board decided to procure six or eight numbers of 2600 horse-power Co Co type locomotives fitted with medium speed engines and Suri transmission and to depute a senior Mechanical Engineer of the Railways to West Germany to have informal talks with the representatives of the firms there and obtain their reaction to the proposal of procuring 2600 horse-power locomotives instead of 5000 horse-power.

1.7. In the light of the report of the Railway Engineer deputed to West Germany, the Railway Board decided (August 1966) to go in for 2500 horse-power BB 19 tonne axle load mixed service locomotives with Maybach MD 1080 diesel engine and fitted with 2500 horse-power Suri/Mekydro transmission. In arriving at this decision the Board, *inter alia*, took into account the following observations in the report of the Engineer :—

(i) the leading locomotive manufacturers of West Germany and the German Federal Railways indicated that a 2500 horse-power diesel hydraulic locomotive could be built easily on four axles and that these locomotives would more or less perform what the six axle 2600 horse-power WDM-2/WDM-4 diesel locomotives on the Indian Railways were performing ;

(ii) the capital cost of a four axle diesel hydraulic locomotive would be less than a six axle diesel electric locomotive when produced

in series ; with Suri transmission a higher efficiency and also savings in fuel to the extent of 5 to 9 per cent were anticipated ; from the maintenance angle also a four axle diesel hydraulic locomotive should, if at all, be cheaper than a six axle locomotive of the same power ;

(iii) M/s. Maybach who were developing Suri transmission, had no doubt about the proper functioning of either Suri transmission or their own transmission and they would not be interested in developing Suri transmission alone without matching it with their engine as they would not be able to guarantee performance with any other engine in the developmental stages ;

(iv) M/s. Maybach had stated that their modified 20 cylinder MD engine would be a good trouble-free engine ;

(v) the German Federal railways stated that they were quite satisfied with the performance of Maybach engines but they needed greater amount of attention and skill ; there were over 1000 Maybach engines of the MD series in use on the German Railways : and

(vi) the German firm interested in developing Suri transmission system were of the view that it would be rather cumbersome to couple all the six axles together with Suri transmission.

1.8. Further, in December 1975, the Railway Board stated that there was no other diesel engine known at that time (1966) which could be used with Suri transmission. As such, the possibility of procuring this engine from various engine builders in West Germany alone was pursued as they were pioneers in hydraulic and hydro-mechanical transmission system.

1.9. The Railway Board decided to call for tenders for 2500 horse-power BB 19 tonnes axle load mixed service locomotives with Maybach MD 1080 diesel engine and fitted with 2500 horse-power Suri/Mekydro transmission. Tenders were to be obtained for 5 different combinations of Suri and Mekydro transmissions. The Board further decided that tenders should be called for from at least all those firms who were previously addressed for 5000 horse-power locomotives.

Procurement of locomotives

1.10. On 30th August 1966, formal tender enquiry was issued to two West German locomotive manufacturer (firms A and B) soliciting offer by 15th September 1966 which was extended upto 28th September 1966 Both the firms submitted their offers.

1.11. The Tender Committee found the offer of firm A superior from technical as well as financial point of view and accordingly recommended its acceptance. The Research, Designs and Standards Organisation of the Railways (R.D.S.O.) also, after technical scrutiny, found the offer of firm B

unacceptable. The Committee found that the guarantee terms offered by firm A were more comprehensive than those of firm B. Firm A quoted for locomotives fitted with Suri transmission as well as Mekydro transmission. The slightly higher price (DM 67,500 per locomotive) quoted for the locomotive fitted with Suri transmission over that fitted with Mekydro transmission was found more than justified considering the developmental expenses involved and the expected savings in fuel due to higher efficiency of Suri transmission. The Committee stated that Suri transmission would provide an efficiency of 92 per cent in the final stage as against a maximum efficiency of about 80—83 per cent in the Mekydro transmission and this higher efficiency should result in corresponding saving in fuel. On the assumption that a locomotive earned (ran) about 400 kms per day on line and that fuel is consumed at the rate of 4 litres per km therefor, the Committee assessed, on a rough basis, the annual saving at about Rs. 20,000 per locomotive even at 5 per cent higher efficiency. Accordingly, the Committee recommended placement of order for 6 locomotives fitted with Suri transmission and 2 locomotives with Mekydro transmission on firm A. The estimated f.o.b., value of the locomotives was about 10.4 DM (c & f value 11.02 million DM—approximately Rs. 2.08 crores). The Railway Board approved of these recommendations. Advance letter of acceptance of tender of firm A was issued in December 1966.

1.12. The contract for the supply of the locomotives was executed with the firm on 23rd June, 1967. The firm had given a guarantee that the locomotives would be built fully in accordance with the specifications and would operate properly. It also guaranteed proper functioning of Suri transmission. The guarantee was to last for a period of 24 months from the dates of commissioning of the locomotives in India or 26 months from the dates of shipment from Germany or 3,00,000 kms run by each locomotive, whichever event should first occur.

1.13. The eight locomoitves (WDM-3) arrived in India in the second half of 1970 and were commissioned between August 1970 and May 1971 at Gooty in Southern Railway. The expenditure booked upto August 1975 towards the cost of these locomotives was Rs. 3.37 crores.

Performance of locomotives

1.14. These locomotives were utilised mainly on freight services on the Guntakal Division of Southern Railway till November 1972, when they were introduced on express (passenger) service also. In July 1971, Southern Railway Administration reported to the Railway Board that the locomotives had developed defects in the transmission system and convertor turbine wheels leading to failures. On the recommendations of the manufacturers certain modifications were carried out in torque convertor, turbine blades and mechanical clutches and thus the trouble in the system was overcome. Nevertheless, the performance of these locomotives had not been satisfactory as the extent of ineffectiveness of each locomotive ranged from 15.5 per cent to 45.3 per cent (average 27.09 per cent) during the period from the dates of commissioning to end of April 1973. In April 1973, the Board called for a detailed report on the performance of these locomotives.

1.15. The appreciation report submitted by the Railway Administration in May 1973 and subsequent performance report on these locomotives disclosed that :—

(i) the locomotive availability in terms of hours per day per locomotive in use was less for WDM-3 locomotives as compared to WDM-2 locomotives (manufactured in the country) as indicated in the table below :—

Year	Average availability per day in use (hours)	
	WDM-3 locomotives	WDM—2 locomotives
1971-72	20.96	22.40
1972-73	20.77	22.60
1973-74	18.50	22.10
1974-75	18.40	22–40

(ii) on account of lower horse-power (less than 2600 horse-power), lower axle load (76 tonnes against 110 tonnes of WDM-2 locomotives) and lower convertor efficiency at low speeds, the WDM-3 locomotives hauled smaller loads, 23 per cent less in the up direction and 25 per cent less in the down direction, than WDM-2 locomotives particularly on stiff gradients ;

(iii) the maintenance costs were more in case of WDM-3 locomotives (Rs. 6,851 for cylinder heads) as compared to WDM-2 locomotives (Rs. 2,632 for cylinder heads) ;

(iv) the locomotive failure rate was higher in WDM-3 locomotives (43,379 kms. per failure on the average during 1971-72 to 1974-75) when compared to WDM-2 locomotives (being 1,12,893 kms. per failure in the same period) ;

(v) the fuel consumption of WDM-3 locomotives (both Suri and Mekydro transmissions) was approximately 20 per cent more than that of WDM-2 locomotives ; (a representative of the manufacturer had stated on 31st January 1973 that the MTU Maybach high speed engine fitted on WDM-3 locomotives was likely to consume 10 per cent more fuel than WDM-2 engine on account of precombustion chamber configuration) ; and

(vi) The WDM-3 locomotives posed major maintenance problems, pertaining to cylinder heads, gas inlet casing, turbo changer, vulkan coupling, dog clutches, shock absorbers, wheels etc.

1.16. The R.D.S.O., who examined this report observed in April 1974, amongst others, that :—

(i) the power rating of the WDM-2 locomotives is 2,635 under standard conditions (ambient temperature 15.5° C) and the locomotives deliver 2,430 horse-power at site at an ambient temperature of 55° C. Against this the WDM-3 locomotives deliver 2,440 horse-power at site conditions of 40° C but at site temperature of 55° C the power output was only 2,090 horse-power and consequently the hauling capacity of WDM-3 locomotives was lower than that of WDM-2 locomotives ;

(ii) the large difference of 20 per cent in fuel consumption between the two locomotives could be accounted for only by the vast difference in the diesel engines leading to the conclusion that the MD 1080 engine had not been as efficient under working conditions as it was presumed to be on the basis of bench test results ; and

(iii) any performance evaluation should be done keeping in view that the WDM-3 locomotives used Suri/Mekydro transmission—an absolutely new development—and the MD 1080 engines of the MTU, which were being used on these locomotives for the first time.

1.17. The various major defects in these locomotives transmissions and engines were brought to the notice of the manufacturers from time to time. The manufacturers advised the Railway Board in November 1973 that, as there had been engine damages on the locomotives equipped with Suri transmission, it would be necessary to operate these transmissions purely hydraulically. The Railway Board agreed to the modifications being carried out. The modifications in essence meant dummying Suri transmission and converting into simple hydraulic Mekydro transmission. This modification in all the locomotives fitted with Suri transmission was carried out in December 1973—January 1974.

118. The question of restoration of all stages of Suri transmission was discussed (July 1975) by the Railway Board with the representatives of the manufacturers. The manufacturers stated that after taking into account all aspects with MTU (the engine transmission suppliers) they had come to the conclusion that the mechanical (Suri transmission) portion was to be blanked off.

1.19. With reference to a suggestion of August 1975 from the Railway Board to use these locomotives for passenger service, Southern Railway Administration indicated (August 1975) that it was not very sure about their reliability in service and it would be desirable to consider them as casual addition rather than regular allotment for firm service.

1.20. The Railway Board stated (December 1975) that :—

(i) the designing and building of this locomotive in India with imported engine, transmission, drive and auxiliaries was not considered financially viable ;

(ii) the locomotives represented a new development incorporating the first application of a newly developed transmission system ; and, therefore, higher incidence of repairs and limited availability should be expected on such locomotives which were placed on line on trial basis as a Research Programme ;

(iii) power rating of WDM-3 locomotives was lower than that of WDM-2 locomotives ; WDM-3 four-axle locomotive had a total weight of 76 tonnes against 113 tonnes on six-axle WDM-2 locomotive ; WDM-3 locomotive was, therefore, constrained to start lighter loads as compared to WDM-2 ; on the sections where these locomotives were operating WDM-3 locomotives could haul 1,350 tonnes in the up direction and 900 tonnes in the down direction against WDM-2 which could haul 1,750 tonnes in the up direction and 1,200 tonnes in the down direction ;

(iv) on freight service, fuel consumption in litres per one thousand gross tonne kilometres had been higher on WDM-3 locomotives as compared to WDM-2 locomotives ; however, WDM-3 locomotives fitted with Suri transmission gave favourable fuel consumption on fast passenger trains ; and

(v) the Maybach MD 1080 engine with pre-combustion engine had shown a specific fuel consumption on bench tests which was comparable with that for ALCO type of diesel engine (manufactured in the country). The design feature in this respect furnished by the manufacturers at the time this engine was selected had been physically established during bench testing of the engines. The field experience in India under the high ambient temperature when compared to ALCO engine in this regard was found not favourable and at variance with the bench tests.

1.21. It may be stated that these WDM-3 locomotives were procured against West German Credit to haul heavy freight trains on graded sections. The objective was development of Suri transmission and as such the Railway Board had stipulated obtaining of adequate guarantees on the performance of these locomotives, and their engines and transmissions. As a matter of fact, the Board had earlier contemplated a guarantee period of 60 months for the diesel engine and transmission and 24 months for the remaining portions of the locomotives.

1.22. The following other aspects of the case also deserve mention :

(a) The Railway Board, while deciding not to procure 5000 horse-power locomotives fitted with Suri transmission but to obtain 2500 horse-power locomotives did not consider the possibility of obtaining offers from locomotive manufacturers other than from West Germany, though one of the Member of the Technical Committee constituted by the Board in July 1965, pointed out (November 1965) that building of a 2500 horse-power locomotive with Suri or any other hydraulic transmission

should present no problem as a 2600 horse-power locomtive was already being manufactured in the country. He had, therefore, suggested development of 2500 horse-power locomotive with Suri/Mekydro/electric transmission and ALCO (manufactured in India)/Maybach engines. He had also suggested designing and building of such locomotives in India with imported engines, transmission, drives and auxiliaries or in the alternative obtaining such locomotives from the manufacturers. This was endorsed by the Member, Mechanical, Railway Board.

(b) The Member, Mechanical, Railway Board in February 1966, had stated that the performance of the Maybach engine had to be viewed with a certain amount of reservation in the light of the experience. He also observed :

"Taking all things into consideration and particularly the limitations imposed by Indian track and bridge standards and the technical and operational disabilities from which the proposed 5000 horse-power locomotives would suffer as pointed out by the Committee, I am of the opinion that even though there will be some further delay in finalising this issue the best and safest course for us would be to go in for the following prototype locomotives which incidentally will provide an adequate means of comparison not only between themselves but also with the 2600 horse-power ALCO locomotives already in use on the Indian Railways :—

		Numbers
(i)	2500 horse-power locomotives fitted with Maybach engine and Suri/Mekydro transmission	... 4
(ii)	2500 horse-power locomotives fitted with Maybach engine and Mekydro transmission	... 2
(iii)	2600 horse-power locomotives fitted with ALCO engine and Suri transmission	.. 4

(c) The desirability of developing Suri transmission with proven locomotives already in use viz., ALCO was not pursued because of the apprehension that utilisation of ALCO engines of American make with Suri transmission to be developed by M/s. Maybach of Germany might not be looked at with favour by the German Credit Loan authorities, even though the Railway Board was aware at that time that ALCO had collaboration with Mark of Germany for manufacture of diesel hydraulic locomotives and Mark held the licence for Suri transmission. Consequently, enquiries were issued only to the West German manufacturers.

It was also considered in April 1966 that the suggestion of Member, Mechanical, made in February 1966 for the development of 2500/2600 horse-power locomotives fitted with ALCO

engine of American make with Suri transmission was not feasible as this would involve a *de novo* examination of the matter leading to further delay, it having already taken over four years in discussions with the manufacturers and the German Bank authorities.

(d) The Railway Board in 1964 itself had indicated that adequate guarantees on the performance of the locomotives, engines and transmissions should be forthcoming. The four-axle locomotive fitted with high speed Maybach engines and Suri/Mekydro transmission were entirely new to the country. The Maybach 2500 horse-power high speed engine had undergone only bench tests and were being used in this country for locomotive traction for the first time. The Railway Board, however, did not obtain specific guarantees covering locomotive/engine/transmission performance, maintenance, fuel consumption etc.

(e) These locomotives were obtained with a view to developing Suri transmission and effecting savings in fuel. As stated earlier, Suri transmission on all the six locomotives had been dummied (January 1974) and the manufacturers did not agree to restore the same. Repercussions of this are :—

(i) the efficiency of the transmission would be further lowered by about 5 per cent and to that extent the specific fuel consumption would increase as compared to ALCO locomotives (WDM-2) [cf. paragraph 8.15-item (v)] ; and

(ii) reduction in maximum speed of the engine.

(f) The engine manufacturers have also pointed out that the pre-combustion chamber configuration of the Maybach engine would consume 10 per cent more fuel compared to an open combustion chamber engine like ALCO and that any advantage gained in transmission efficiency was likely to be offset and in fact over-shadowed by the lower engine efficiency. The extensive difficulties and maintenance problems posed by these locomotives resulted in operational deterioration and doubts about the reliability of these locomotives.

Conclusion

1.23. The objective of purchasing 2500 horse-power locomotives viz., development of Suri transmission for high speed traction with a view to obtaining operational efficiency and fuel economy has not been realised. In March 1976, the Railway Board stated that Suri transmission was being successfully used in lower horse-power range of locomotives and 257 broad gauge and 15 narrow gauge locomotives had been built with this transmission.

[Paragraph 8 of the Report of C&AG for the year 1974-75—Union Govt. (Railways)].

Concept of Suri Transmission

1.24. Explaining the concept of Suri transmission the Member Mechanical has stated in evidence (August, 1976) :

> "The basic concept of Suri transmission was the provision of a mechanical clutch. The ordinary transmission was hydraulic transmission only but here there was the introduction of a mechanical clutch in the transmission which comes into operation at a particular speed, resulting in better performance as far as efficiency goes."

1.25. In regard to the development of the concept of Suri transmission, the Additional Member Mechanical has stated (August, 1976) :

> "The concept of this Suri transmission was examined initially by the Railway Board as well as by the NRDC ; and they came to this fundamental conclusion that if the Suri transmission could be developed and if we could have the mechanical transmission at the final stage, the efficiency of the diesel engine would be increased by about 4 per cent to 5 per cent ; and that if this was to be equated in terms of money, the gains that India and its railways would acquire would be so great that it was worth making a development effort. We did not have sufficient background knowledge of how really to make the hardware of Suri transmission itself. Our state of knowledge was not that great. We did not know much ; but we had an idea about the Suri transmission and that he had developed it when he was abroad. He gave the concept, but the physical development, the design and how the component members were to be made how the transmission was to be effected and how the matching in different stages was to be done—about these matters we did not know enough at that moment. That is why we decided that we should go to an organisation or a country that had a background and expertise to do this developmental activity for us. So, it was basically a technical idea and we did it in order to have a long-term gain of 4 per cent to 5 per cent efficiency in the diesel locomotive fleet, which was growing in India."

1.26. The Railway Board have stated that Suri transmission was intended to be developed as an improvement on the hydraulic transmission of the Voith and Mekydro types which already existed when the idea of Suri transmission was patented. In a note, the Ministry of Railways have further stated :

> "Voith and Mekydro are straight hydraulic transmissions in which the torque transmitting elements are convertors/couplings working in conjunction with gears. Suri transmission retains the basic features of these transmission in the lower speed range. In the upper speed range, the hydraulic element is disconnected and torque is transmitted through a direct mechanical clutch. This has the advantage of higher efficiency in comparison to the straight hydraulic transmissions to the extent of about 5 to 10 per cent.".

1.27. It is seen from the Audit Paragraph that the Suri transmission was first used in diesel shunters and then in lower horse power range of BG and NG locomotives. As to the role and utility of Suri transmission in those locomotives, the Ministry of Railways have, in a note, stated :

> "Suri transmission was first developed by M/s Mak for the WDS3 type of diesel locomotives. These locomotives were designed as shunting-cum-shuttle service locomotives. For this purpose, the reversing gear box attached to the Suri transmission was designed to have two gear stages; in the lower gear, designated as "shunting gear", the locomotive was designated to have a maximum speed of 27 Km|h and in the higher speed gear designated as "Mainline gear", the maximum locomotive speed was 65 Km/h. The locomotive was thus fit for both shunting and mainline type of services upto a limited speed of 65 Km|h.
>
> Subsequently, it was decided to manufacture locomotives of similar type indigenously at Chittaranjan. These locomotives are designated as WDS4|WDS4B class and are currently under manufacture at Chittaranjan. In shuttle services, the mainline gear is used going upto 65 Km|h speed. The advantage of mechanical clutch efficiency can thus be made use of since this clutch comes into the circuit at about 46 Km|h speed. In shunting the speeds are low and even in shunting gear stage, the mechanical clutch does not generally come into the circuit.
>
> After more than 100 locomotives had been manufactured at Chittaranjan, it was decided by the Board that this number was sufficient to cater to the needs of multi-purpose locomotives on all the zonal railways for shunting-cum-shuttle duties and that further locomotives could be manufactured for shunting services only. Locomotives manufactured currently are provided with a simplified transmission in which the mechanical clutch is not being fitted.
>
> In regard to the role and utility of Suri transmission in lower horse power BG and Narrow Gauge locomotives, it may be stated that wherever locomotives can be used predominantly in their upper speed range, the advantage of the direct mechanical drive of the Suri transmission can be made use of.".

1.28. The Chairman, Railway Board informed the Committee (August, 1976) that "Suri transmission which was fitted to the low horse power engines which were manufactured in the country had not been quite satisfactory." He further stated :

> "While it is true that Suri transmission part of it has not given us much benefit, since Suri transmission is an addition to hydraulic transmission we go in for it. In our diesel shunters, we are doing it. This can apply for hydraulic transmission in the smaller horse power engines. This is the sum total of the achievement that is obtained. . Suri transmission itself has not given

much benefit but this type of use of hydraulic transmission which can be cheaper than diesel engine transmission has been established at least in respect of small horse power engines in India."

1.29. Enquired whether any evaluation of the working of Suri transmission in diesel shunters had been made, the Member Mechanical has stated (August, 1976) :—

"When the lot of 7 WDS3 shunters came, they were fitted with the Suri transmission. Initially we had a lot of troubles with these locomotives, but the trouble was confined more to the power pack than to the transmission. But in course of time, we tried to go into detail about the troubles that were being experienced and we were able to get over a lot of these difficulties and in-fact the transmission was also modified to suit with the engine. Although initially we had to trouble with these locomotives, out of 7 locomotives, five are still—after 15 years of service—working. They did not have trouble. But we tried to get over those difficulties and tried to make use of those locomotives."

1.30. The Committee desired to know whether any such evaluation had been made at the Railway Board's level and if so, when and what were the main findings thereof. In a note furnished to the Committee, the Railway Board have *inter alia* stated (1976) :—

"Suri transmission has been used on the following the classes of diesel shunters :—

WDS3 class imported from M|s Mak of West Germany and placed in service during 1961-62. Transmission fitted on these locomotives was designed and manufactured by Mak.

WDS4|WDS4B class manufactured in CLW and brought into service progressively from 1969-70 onwards. A few earlier units have imported Suri transmissions while the subsequent ones are fitted with transmissions manufactured indigenously in accordance with Mak design.

An evaluation report on the working of WDS3 locomotives transmission was prepared by Northern Railway in December 1962 based on the service experience with these locomotives This report stated that :

"(i) The Suri transmission have now cummulated 20885 hrs. of service and earned 320698 kms., the first transmission of locomotive 19046 having earned 5624 hrs. and 70404 kms. upto 29-11-1962.

(ii) The transmission has been functioning satisfactorily throughout. The repairs necessary have been of a very minor nature, there being no defect found in the transmission relating to its principles or any weaknesses in its fundamental design.

(iii) Economy of fuel consumption of the order of 10—15 percent has been returned every month on the Northern Railway when compared with the WDS3 hydraulic transmission locomotives."

In 1964 the Board *vide* letters No. 62M(L)|466|7 dated 9th and 16th May 1964 appointed a Committee to report on the performance of WDS3 locomotives working on the Northern Railway.

The Committee in their report submitted in November 1964 stated in regard to the Suri transmission that "the claims made for the Suri transmission are (i) higher transmission efficiency compared with any other known make of transmission, especially at high speeds, and (ii) no break in tractive effort at the time of circuit change over in the transmission." In regard to these claims, the Committee recorded that tests and operating experience have proved :

(i) The proper and smooth operation of the transmission as designed, and

(ii) No break in tractive effort at the circuit change over point.

In regard to the transmission efficiency, the Committee drew attention to the results obtained during tests conducted in the Works of M|s Mak in October 1960 and witnessed by a representative of the Indian Railways. These results indicated that "beyond 68 per cent of the maximum output speed of the transmission, the transmission efficiency is about 94 per cent at full load; about 91 per cent 3/4 load ; about 90 per cent at 1|2 load and about 88 per cent at 1|4 load. The results also show that at part loads the Brockhouse convertor returns efficiencies better than at full load. These efficiencies are higher than those claimed for any other known make of locomotive transmission."

In regard to the service experience with WDS3 locomotives, the Committee concluded that this had been generally satisfactory.

In regard to WDS4|WDS4B class locomotives, a service report prepared in July 1971 by the Northern Railway states as under :—

"It can be emphatically stated that the performance of the OCO diesel hydraulic shunters type WDS4 has more than come up to the design expectations. The reliability and fuel consumption figures have been of a high standard and there have been no major difficulties in the maintenance of this class of locomotives during the period under review. It is to be specially noted that difficulties in respect of the transmission have been conspicuously absent. Their load hauling capabilities have also been found to be adequate for the duties required of this locomotives.".

Bulk of the WDS4|WDS4B shunters in service are fitted with indigenously manufactured Suri transmission Service experience with the transmissions of these locomotives was reviewed in May 1976 in RDSO Report No. MP-253|76. This report brought out that :

(i) There is a waiting period of about 12 to 15 seconds at the time of operating the reverser to change the direction of running of the locomotion. This is on account of the time required for emptying of the convertor-coupling. This is an inherent feature of the design of the Trilok type torque convertor—the type which has been employed in this transmission for obtaining optimum efficiency in shunting duties.

(ii) Arising from the oil emptying feature mentoined above, the driving crew has to ensure that reverser is not operated before convertor has been fully emptied ; other wise there are chances of damage to the reverser mechanism. The Railways have to train the drivers in the importance of this feature.

(iii) There were initial failures with the types of flexible coupling used between the engine and transmission. A new type of flexible coupling is now employed and has been in use for the last two years. The performance with this has been better than with the previous couplings.

(iv) Some features were recorded in the ZF type of torque convertors used on some of the transmissions. The design of this convertor has been strengthened to take care of these failures Since Twin-disc type of convertors are being manufactured indigenously, their use in these transmission has already been introduced to minimise import of the ZF type convertors.

(v) Since some failures on the mechanical clutch portion of the transmission were experienced, simplified version of the transmission is now being employed eliminating the mechanical clutch portion.

(vi) Most of the WDS4B locomotives now manufactured are required for purely shunting duties in which the mechanical clutch is not required. These locomotives are being fitted with simplified transmissions without mechanical clutch."

1.31. The Committee desired to known the precise benefits which had been derived by installation of Suri Transmission in 257 BG and 15 NG locomotives and also whether the main objective of saving in fuel consumption due to higher efficiency of Suri Transmission had been achieved. In a note, the Ministry of Railways have stated (1978) :

"A detailed comparative evaluation of Suri Transmission with comparable Voith transmission was carried out by RDSO on the WDS4-locos, the results of which are published in RDSO. Report No. M-312. Broadly, the Report brings out that —

(1) In the shunting speed range upto 18 Kmph, the Suri transmission recorded significantly high efficiency and fuel savings ;

(2) For shuttle service operation, the Suri transmission recorded a higher efficiency at speeds higher than 18 Kmph, in both stages. When the mechanical clutch was operative, the efficiency and fuel savings were the highest. The exact quantum of improvement is indicated in the Synopsis of the Report.

Similar advantages can be expected in the NG-Main-Line locos especially since in main-line operations, the major portion of loco running is in the higher speed range (as a percentage of the maximum permissible speed) where the second stage and the mechanical clutch can be utilised."

1.32. In another note, the Ministry of Railway have stated :

"When the mechanical clutch is removed, the realisation of the highest obtainable efficiency in the high speed ranges (in relation to the maximum permissible speed) will not be possible. The clutches have been removed from about 100 WDS4 locos on account of the locos not being utilised in the relevant speed range and also due to defects arising out of manufacture and result of disuse. Efforts are being made to make the clutch portion on some locos operative, where the service permits of its use for reasonable periods."

1.33. Commenting on the above information furnished by the Ministry of Railways, the Audit have *inter alia* observed :

"An evaluation of the precise benefits (including savings in fuel consumption) actually achieved if any attributable specifically to Suri Transmission in the case of these lower horse power B.G. shunters (referred by the PAC) has not been furnished. We would be justified in drawing the inference that there have been no benefits or no tangible benefits of the Suri transmission in low horse power shunter.

The Railway Board have referred to R.D.S.O's Report No. M-312 about the comparative performance of Suri transmission and Voith transmission. This Report deals with the performance of one 600/700 HP locomotive fitted with Suri transmission with that of another 600/700 HP locomotive fitted with Voith transmission. This study would appear to be totally irrelevant to the issue under consideration as it does not, in fact, give the results of the evaluation of the benefits of the Suri transmission as actually fitted and operating in these BG shunting-cum-shuttle locomotives.

Regarding NG diesel locos it has been stated by the Railway Board that similar advantages can be expected, since in main line operations the major portion of loco running is in higher speed range where the mechanical clutch can be utilised. The reply only indicates the expectation and not what was realised. It has not thus been indicated whether in actual operation of these locos the expected advantages of Suri transmission have actually been realised and if so to what extent. The Railway Board's reply does not therefore furnish the precise evaluation, as asked for in this question, of the benefits particularly the saving in fuel consumption derived, if any, by installation of Suri transmission in the low horse power NG locos.

In view of R. D. S. O's observations as above and also in absence of any precise quantification of the benefits, if at all actually achieved by installation of Suri transmission in low horse power BG and NG diesel locos, the

claim of the Railway Board that Suri transmission is being successfully employed in 257 BG and 15 NG diesel locomotive (cf : sub-para 8.23 of the Audit Para) remains unestablished."

1.34. Referring to the utility of the Suri Transmission on low horse power locomotives the Chairman, Railway Board, stated (August 1976) :

> "There is one advantage in the whole thing. Suri transmission is a modification, an extra device added on to hydraulic transmission. By having this development in the country, although the mechanical part of Suri transmission has not been found to be very effective, we have at least been able to develop hydraulic transmission without going out ; that is one advantage that finally arose out of it. All our shunting locomotives are now being fitted with hydraulic transmission, plus of course Suri transmission which is being put out of commission very often since it is not working satisfactorily."

1.35. In the same context the Member Mechanical stated (August 1976) :

> "There are certain basic advantages of hydraulic transmission as such and those advantages are : (1) that the initial cost of the locomotive having hydraulic transmission is much less, almost about 40 per cent less ; (2) the maintenance cost of the hydraulic transmission fitted with locomotive is also low. These are the two basic important factors which made us to go in for the development of hydraulic transmission..."

1.36. The Committee inquired what were the considerations which made the Railway Board take up Suri transmission for development with the help of West German firm. The Chairman, Railway Board stated in evidence (August 1976) :

> "The consideration for adopting the Suri transmission was : (1) it was an innovation of an Indian and we have very pround of it. (2) we thought we could try it on high horse-power engine."

1.37. Asked whether any trial was made before agreeing to take up development of Suri transmission on high horse power the locomotives Chairman, Railway Board stated (August 1976) :

> "It was also expected that the Suri transmission will consume less fuel oil at higher speeds. So that was definitely an economy that was expected to be achieved. So, for these two reasons, at that time the Railway Board wanted to go in for the Suri transmission. The Suri transmission can only be coupled with hydraulic transmissions. It could only be tried in a perfect hydraulic transmission. At that time, it was only in West Germany that the hydraulic transmission system had developed and more or less perfected. So, the attention was drawn to the West Germany, but, of course, AICO was consulted. It was mainly for

2600 horse-power locomotives and if they were interested in making Suri plus hydraulic transmission, it would have been advantageous but they said that they were not interested in the manufacture of Suri transmission."

1.38. The Committee asked whether before taking up development of Suri transmission for high horse-power locomotives, any evaluation of the system had been made and if so, what were the initial results. The Member Mechanical stated during evidence (August, 1976) :

"initially the locomotives with the Suri transmission were not giving good performance. We had trouble with them. So the evaluation showed that it was not good because the engine did not function well....The Technical Committee at that time said that there would not be an undue risk in going in for the development of high power engine but for the constraints which these engines would have, the manufacturers will be able to iron out in course of time."

1.39. On being pointed out by the Committee that even inspite of the negative report of the Technical Committee, the Railway Board felt encouraged to go in for the development of Suri transmission, the Member Mechnical stated (August 1976) :

"That was the decision taken by the Board then."

1.40 The Committee enquired how did the Railway Board come to the conclusion that there would be 4 per cent to 5 per cent saving in fuel consumption if Suri transmission was used on high horse-power locomotives. The Member Mechanical stated in evidence (August 1976) :

"It was just a theoretical conclusion."

1.41. Asked why could not the Railway Board wait till the results of the experiments of Suri transmission on the low horse power engines were known, the Member Mechanical stated (August 1976) :

"At that time the driving force in people's mind was that we must try to develop the higher H. P., while we were still developing the low HP range."

He added :

"The low HP locomotive was being used for shunting purposes and the claim of the transmission was that at the high speed range, fuel economies were effected. It was also decided that as high H.P. engine should be developed for the high speed locomotive. We could have waited; but as I mentioned earlier, it did take 5 years ; it was not done hurriedly."

1.42. The Committee pointed out that the whole matter was dealt with in a hurried manner and it looked as if proper attention was not paid to all aspects with the result that not only the ultimate object had not been achieved but the patent had also suffered. To this the Member Mechanical replied (August 1976) :

"This is true."

1.43. When aksed whether the Members of the Railway Board did not take this into account, the Member Mechanical stated (August 1976) :

> "They went by the report of the Technical Committee which was set up."

1.44. In reply to a question as to what were the pressing reasons for which a decision to develop Suri transmission was taken, the Member Mechanical stated (August 1976) :

> "There were two reasons, probably. One was the development of the indigenous transmission ; and the second was the possible economy in the fuel consumption if this was done."

1.45. The Committee enquired since the Suri transmission did not succeed on the low HP engines, who gave the report that it will be successful for the high H.P. engine. The Member Mechanical stated (August 1976) :

> "On the low HP. any transmission would give some trouble in the early days.....But whenever we put a new transmission on the line, we have trouble. I can say this from my experience of 40 years."

1.46. On being pointed out that that was all the more reason for thoroughly examining all aspects, the Member Mechanical stated (August 1976) :

> "I agree with you ; but initially, with every new unit one does experience trouble, e. g., with all our steam locomotives and the diesel ones, we always had some trouble or the other."

1.47. It is seen that the Ministry of Railways entrusted National Research Development Corporation with the development and exploitation of the invention and patent in respect of Suri transmission. The patents of the invention were taken out in India, U.K., West Germany, Canada, France, Czechoslovakia, Italy, U. S. A., Brazil, Japan and Australia. The Committee called for particulars of the agencies (indigenous and foreign) to whom licences hd been issued for the manufacture of Suri transmissions together with dates of issue of licences. The information furnished by the Ministry of Railways is given below :

Name of the Agency	*Date of issue of licence*
(a) Messrs Kirlosk r Pneumatic Co., Industrial Estate, Pune.	1-7-1971. The licence is valid for a period of 10 years. The agreement was executed on 22-9-79.
(b) Messrs Mak, Keil, West Germany.	1-10-19599 The licence was valid for a period of 14 years. The agreement was executed on 28-4-1961.

1.48. The total number of transmissions manufactured so far by each agency and the parties to whom the manufactured transmissions have been applied are given below :—

Supplies made by Messrs Kirloskar Pneumatic Co., Pune.

Year	No. received	Value in Rupees	To whom supplied
1969-70	13	9,54,122	CLW
1970-71	27	19,58,536	CLW
1971-72	36	30,65,072	CLW
1972-73	47	43,49,870	CLW
1973-74	46	42,49,038	CLW
1974-75	31	29,65,3330	CLW
1975-76	24	24,94,257	CLW
	1	2,45,210	Central Railway
	1	2,52,350	Vizag Port
	38	26,19,240	CLW
1976-77	21	24,67,016	CLW
	10	32,74,050	CLW
	265	2,88,94,091	

Supplies by Messrs Mark, West Germany

Year	No. received	Unit Price (In DMs)	To whom supplied
1961-62	8	55,500	Indian Railway
1964-65	28	65,000	,,
1967-68	21	56,100	,,
1968-69	9	56,100	,,
	1	54,499	,,
1969-70	14	54,4499	,,
	10	79,200	,,
	7	201,767	,,
	98		

1.49. The Committee enquired about the total amount of royalty paid by the Railways for exploiting this transmission system. In a note, the Ministry of Railways have stated (1978) :

"Out of the total of Rs. 3,04,934.23 received from M/s. Mak as royalties, a sum of Rs. 91,487.67 and Rs. 85,381.83 was paid to National Research and Development Corporation and Shri Suri respectively representing 30 per cent and 28 per cent as their share.

A sum of Rs. 7012.70 was received by National Research and Development Corporation as royalties paid by M/s. K. P. C. Ltd. Out of this a sum of Rs. 2103.81 was retained by N. R. D. C. Arrangements are being made to pay the share of Shri Suri amounting to Rs. 1963.56."

1.50. From the above it is seen that the total amount of royalty so far paid to NRDC and the inventor for exploiting the Suri Transmission system works out to about Rs. 1.81 lakhs.

Selection of Locomotives

1.51. The Committee have been informed (1978) that the initial development of the Suri Transmission patent in order to prove the principles, was carried out on seven 650 H. P. Diesel shunting-cum-shuttle services locomotives, developed and manufactured by M/s Mak, West Germany. The development was restricted to the lower horse power range to minimise overall expenditure. Consequent to the trials with these transmissions, it was proposed to develop this transmission for the higher horse power range for mainline applications, where advantages of the concept could be realised to the maximum. This was mooted by the Chairman, Railway Board, and followed up with a Technical Memorandum by the Additional Member (Mechanical), which was discussed in a Board meeting when a decision to develop high horse-power Suri Transmission for use with both 2600 HP and 5,000 HP diesel locomotives was taken. Extracts from the minutes of the Railway Board meeting held on 30 April 1962 are reproduced below :

"The Board considered in detail AMM's note dated 28-3-1962 regarding Suri Transmission. It is very important that Suri Transmission for high horse power is developed expeditiously, its efficiency having been fully proved for 600 HP range. The present standard for BG locomotives on Indian Railways being 2600 HP, Suri Transmission for this horse power should be developed. Simultaneously, transmission of 5000 HP equivalent to two 2600 HP, as a more efficient substitute for two coupled 2600 HP transmission should also be developed.

xx xx xx xx xx

For 5000 HP range, the choice is confined to European countries, because of the lack of experience in USA in hydraulic transmission. Krupps have already shown interest in the matter and Dr. Kornarkar who was the principal mover in Mak, is with Krupps. Accordingly, it was decided that negotiations for 5000 HP locomotive using two 2600 HP Suri Transmissions may be made with Krupps."

1.52. The Railway Board as per minutes of Board meeting held on 30 April, 1962 had nominated Additional Member Mechanical and Director Finance to negotiate with M/s ALCO regarding development of 2600 HP broadgauge locomotives, using Suri transmission and to negotiate with M/s. Krupp of West Germany regarding development of 5000 HP locomotive using two 2600 HP Suri transmission. The Committee enquired whether negotiations were held with West German firms and with ALCQ (USA) and if so, with what result. In a note, the Ministry of Railways have stated (1976) :

> "Negotiations were conducted with West German firms for 5000 horse power locomotive and offers for these locomotives were received from two West German firms *viz.* M/s. Henschel and M/s. Mak. However, after consideration of these offers by the Technical Committee, the Board decided to go in for 2600 horse power locomotives.
>
> Discussions were also held with ALCO regarding the 2600 horse power locomotive. M/s ALCO were dependent on the development of 2600 horse-power Suri Transmission elsewhere, and only after that was made available to them, they were in a position to consider the matter further. As such it (Board) ruled out 2600 horse power ALCO locomotives for the time being as per Member Mechanical's noting of 7-8-1964, extract of which is reproduced below :
>
> 'At the Board meeting held on 30-4-62, it was decided that negotiations should be started with ALCO to develop a 2600 HP Board Gauge locomotive using Suri Transmission. This matter was pursued by Shri K. C. Lall who recorded in para 3 of his note dated 2-5-1964 that ALCO were prepared to start negotiations for a 2600 horse power locomotive with Suri Transmission only after this transmission had been fully developed in West Germany on a 5000 horse power locomotive, because ALCO were unable to develop the transmission themselves for the 2600 horse-power locomotive. This rules out the 2600 horse power ALCO loco also for the time being and leaves us with only a 5000 horse power locomotives with two Maybach engines on which Suri Transmission can be developed'."

1.53. From the information made available to the Committee it is seen that the then Additional Member Mechanical of the Railway Board had recorded on 28 September 1963 the following note on the outcome of the negotiations with M/s ALCO (USA) :

> "It has not been possible thus far to progress negotiations with ALCOs who have shown keen interest in the Suri Transmission locomotive, but can only base a proposal if a Suri Transmission of 2600 HP capacity is first developed and supplied to them. ALCOs appear greatly satisfied with latest projected developments in the 5000 HP prototype which they seem to have discussed with Mak of West Germany. ALCOs now await the

finalisation of 5000 HP locomotive from which the 2600 HP transmission will become available, before the matter can be persued further with them."

1.54. In a supplementary memorandum furnished to the Committee in Febraury 1978, the Ministry of Railways have stated :

"In fact, as early as 1962, when the question of development of Suri Transmission in the higher HP range was mooted, it had been realised that the development of this transmission in conjunction with Alco engines, which had been taken up for indigenous production, would be the most desirable line of action. Accordingly, negotiations were ordered with this firm, amongst others, at that time. Unfortunately, Alco did not respond positively to the suggestion to undertake development of the Suri Transmission but instead only indicated their interest in using such a transmision in conjunction with their 16-cylinder engine after it had been successfully developed elsewhere. In this connection, attention is invited to the letter of M/s. Alco to the Chairman, Railway Board, dated 12 July 1963 reproduced below :

'RE : SURI TRANSMISSION

In the course of last month, I had occasion to visit the German Locomotive Manufacturer, Mak Machinenbau Kiel GMBH in Kiel, where I joined our Chief Engineer, Mr. A. ROSS, for joint discussions with Mak and your Mr. M. M. Suri in relation to the proposed 2600 HP locomotive with Suri Transmission. We were able to clarify a number of problems related to our preliminary studies.

I was informed at that time that Mak plan to submit their proposal on the project 5000 HP locomotive with Suri Transmission to you by the end of June 1963 and I presume it is now in your hands. As you are aware, it is planned that the same transmission used in this locomotive would be embodied in the proposed ALCO 2600 HP locomotives.

During the general discussions at Kiel, Mr. Suri was able to submit additional uptodate data to us on the performance and design characteristics of the transmission which he invented. We wish you to know that the awareness of this additional information has further strengthened our confidence in the capabilities of the transmission and we wish to take this opportunity to reaffirm our readiness to co-operate with you in the development of the 2600 HP locomotive. We understand that the availability of the 2600 Suri transmission is related to the development of 5000 HP locomotive. In the circumstances we assume you will wish to reach some conclusive stage in your negotiations relative to that locomotive before initiating discussions relative to the 2600 HP ALCO locomotive. In any event, we are available to join you for this purpose at any time at your convenience.

1.55. During evidence before the Committee in August 1976, the Chairman, Railway Board, while explaining the reasons why Suri Transmision was developed with the help of West German manufacturers, stated (August 1976) :

> "At that time it was hydraulic transmission of which Suri transmission was a part and that was only developed in a few countries and the leader in hydraulic transmission manufacture at that time was West Germany and therefore I think talks were held only with West Germany People. Of course talks were held with Alco because they manufactured engines for us but they said they were not interested in Suri transmission."

He added :

> "Since they (ALCO) were making high powered 2600 HP engines, the question arose whether Suri transmission could be fitted to that but for that ALCO said that they could not."

1.56. The Committee desired to know whether efforts were made to ensure that the Suri Transmision could be fitted in the locomotives being manufactured by ALCO. In this context the Member Mechanical stated (August 1976) :

> "In regard to the question of loco of 2600 HP, ALCO manufacture only diesel electric system. They do not touch the hydraulic system at all. Therefore, they had no interest. When we discussed it with them, they said that if there is no objection to give transmission to them they will try."

He added :

> "The hydraulic system was not being manufactured ; and nobody was prepared to make the Suri transmission or a hydraulic transmission to match the 2600 HP locomotives with power-packs that we were making here. The loco made at Varanasi is a diesel electric one. Hydraulic system is a separate thing which has to be matched with the power pack. It is to be designed specially and matched."

1.57. Explaining the reasons why the choice of locomotives for development of Suri transmission was restricted to West Germany, a representative of the Ministry of Railways deposed before the Committee in March 1978 as under :

> "There is a catalogue which is called the JANES BOOK printed by an organisation in the United Kingdom and it lists the different types of rolling stock available and operating in different countries of the world. Extracts from this have been given in the annexure. There were 1996 diesel hydraulic locomotives operating in Germany and in no other country barring the United Kingdom, which has 325 locomotives operationg with hydraulic transmission manufactured under licence from Germany. There

was virtually no other country in the World where diesel hydraulic transmission had been developed. It was, therefore, obvious that if we are to develop a new type of hydraulic transmission, we had no choice except to go to Germany."

1.58. It is seen from the Audit paragraph that in June 1966 the Railway Board had decided that procurement of 5,000 horse-power locomotives for developing Suri transmission could not be justified. This decision was preceded by an examination of the offers by a Technical Committee appointed by the Railway Board in June 1965. That Committee on various considerations came to the conclusion that no economic benefits of capital and maintenance costs could be expected of 5000 horse-power locomotives as compared to those of dual coupled 2600 horse-power diesel locomotives of ALCO design. Since the standard broad gauge diesel locomotive was of 2600 horse power, the Board felt that it should be possible to design and fit 2600 horse-power Suri transmission in a diesel locomotive of equivalent horse-power and decided that it would be more prudent to go in for 2600 horse power locomotives rather than for 5000 horse power locomotives. Accordingly, the Board decided to procure six or eight number of 2600 horse power Co Co type locomotives fitted with medium speed engines and Suri transmission. A senior Mechanical Engineer of the Railways was deputed to West Germany to have informal talks with the representatives of the firms there and obtain their reaction to the proposal of procuring 2600 HP locomotive instead of 5000 HP locomotives. In the light of the report of the Railway Engineer, the Railway Board, however, decided in August 1966 to go in for 2500 horse power BB 19 tonne axle load mixed service locomotives with Maybach MD 1080 diesel engine and fitted with 2500 HP Suri/Mekydro transmission.

1.59 The Committee asked when the Railway Board had felt that it should be possible to design and fit 2600 HP Suri transmission in a diesel locomotive of equivalent horse-power and had decided that it would be more prudent to go in for 2600 HP locomotives, on what consideration it went in for 2500 horse power locomotives. The Chairman, Railway Board stated in evidence (August 1976) :

"It was true that it was tried on the 650 HP locomotives and by the time a decision was taken to use it in a higher HP engine, it had not been established by then that Suri transmission was not effective. Trials were going on with 650 HP. At the same time they took a decision that they should go in for a higher HP engine as the report was that Suri transmission was more beneficial at higher speeds. The question was : why did you go in for 2500 and not for 2600 HP ? 2600 HP locomotives which were being manufactured in India were six axle locomotives by Alco and they said that they could not manufacture Suri transmission ; that was out of question. The German firms agreed to develop Suri transmission and gave a positive opinion that since Suri transmission had a large number of gears fitted, such transmission cannot be worked on six axle locomotives but only on 4 axle locomotives. Having decided on 4 axle locomotives, the maximum horse power locomotives that they could develop was 2500 HP and that too with 20 cylinder engines. Those are the steps that led to 2500 HP."

1.60. The Committee enquired whether the possibility of providing Suri transmission in 2600 HP locomotives instead of in 2500 horse-power locomotives as it actually did was explored. The Railway Board have, in a note, stated (1976) :

> "After a decision to go in for 2600 horse-power loco with Suri transmission was taken, an officer was deputed to West Germany to have discussions with the firm concerned and the German Credit Loan Authorities in regard to the decision to go in for fresh tenders for 6 to 8 numbers of 2600 horse power locomotives instead of 5000 horse power locomotives. As a result of his discussions with the firms, KFW and West German Railways, it was known that there was no suitable engines of more than 2500 horse power made in West Germany which were suitable for rail traction. Accordingly 2500 horse power loco was decided by the Board at that time."

1.61. The Committee desired to know what were the relative merits and demerits of the CO CO and BB design locomotives on which the decision to go in for BB locomotives rather than CO CO type locomotives was taken. The Railway Board have, in a note, stated :

> "It is presumed that Board's decision to go in for 2500 horse power BB type (4 axle) locomotives with MD-1080 diesel engine in modification of the earlier decision to go in for 2600 HP CC type (6 axle) locomotives was based on the report of the Railway Engineer.
>
> The Report of the Railway Engineer clearly brings out that coupling six axles together with a single Suri transmission would not be technically desirable. This type of drive system consists of axle drives having gears mounted on individual axles, coupled through cardan shafts to each other and to the output flange of the transmission. Larger the number of axles, greater the difficulties. Considering that a new transmission with mechanical drive was being developed, the transmission and locomotive manufacturers in Germany felt it necessary to restrict the number of axles to be coupled to one transmission to four only. The satisfactory riding, stability and the trouble-free operation obtained with the four axle WDM-3 locomotives in actual service with this type of system has proved that selection of this drive system was prudent.
>
> Other factors which apparently weighed in favour of the BB arrangement in preference to the CC arrangement, as brought out in the Report of the Railway Engineer are—
>
> 1. Ease of manufacture and of maintenance of 4 axle BB type locomotives.
>
> 2. Lower cost of BB type of locomotives compared to the CC type."

1.62. It has been stated that the only established firm who offered to develop Suri transmission was M/s Maybach. The Committee enquired whether other leading firms outside West Germany were contacted and if not, why not. In a note, the Ministry of Railways have stated :

"Suri transmission for this application in 2500 HP range could be developed only by one of the leading hydraulic transmission manufacturers. Hydraulic transmission in this high horse power range were not known to be manufactured by any country other than West Germany. M/s. ALCO of USA were, however, approached for development of such a locomotive and they evinced their interest in development of such a locomotive if the Suri Transmission could be supplied to them.

Since there were no known leading firms outside West Germany, who could undertake development of such an hydraulic transmission, the question of approaching firms in other countries obviously, did not arise.

Even Messrs Mak and Voith in West Germany did not come forward for the development of high horse power Suri transmission."

1.63. The Audit para further points out that the Railway Board, while deciding not to procure 5000 HP locomotives fitted with Suri transmission but to obtain 2500 horse power locomotives did not consider the possibility of obtaining offers from locomotive manufacturers other than from West Germany, though one of the members of the Technical Committee constituted by the Board in July 1965 had pointed out in November 1965 that building of a 2500 HP locomotive with Suri or any other hydraulic transmission should present no problem as a 2600 horse power locomotive was already being manufactured in the country. He had also suggested development and designing and building of a 2500 HP locomotives in India. The Committee desired to know why the suggestion of a member of the Technical Committee for the development of 2500 HP loco with Suri/Mekydro/electric transmission and ALCO (manufactured in India)/Maybach engines was not accepted by the Board particularly when the suggestion had been endorsed by the then Member Mechanical, Railway Board. In a note, the Railway Board have stated :—

"Records indicate that ALCO engine (manufactured in India) was not used while developing the WDM-3 locos on account of the following :

(a) Suri transmission for this application could be developed only by one of the leading hydraulic transmissoin manufacturers in the West Germany. Joint Director Mechanical Engineer (Special), Railway Board, after his visit to West Germany in July-August 1966 reported that the only established firm, who offered to develop this was M/s. Maybach. This firm was agreeable to develop the transmission provided their own Maybach engine was used.

(b) West German loco builders advised against 6-axle loco with single Suri transmission mechanical drive. ALCO engine was, therefore, ruled out, as ALCO engine could not be used with 4-Axle loco because of weight limitation."

1.64. Asked why the other suggestion of this member for designing and building of such locos in India with imported engines, transmissions, drives and auxiliaries or obtaining of such locos from the manufacturers was not accepted, the Railway Board stated :

> "There is nothing on the files to show as to why this course was not adopted.".

1.65. It is further seen that the then Member Mechanical had in February 1966 observed :

> "Taking all things into consideration and particularly the limitations imposed by Indian track and bridge standards and the technical and operational disabilities from which the proposed 5000 horse power locomotives would suffer as pointed out by the Committee, I am of the opinion that even though there will be some further delay in finalising this issue, the best and the safest course for us would be to go in for the following prototype locomotives which incidentally will provide an adequate means of comparison not only between themselves but also with the 2600 HP ALCO locomotives already in use on the Indian Railways :

	No.
(i) 2500 HP locomotives fitted with Maybach engines and Suri-Mekydro transmission	4
(ii) 2500 HP locomotives fitted with Maybach engine and Mekydro transmission	2
(iii) 2600 HP locomotives fitted with Alco engine and Suri transmission	4"

1.66. Referring to the above observation, the Committee enquired whether the Railway Board gave due consideration to the apprehension of the then Member Mechanical and considered his suggestions and if so, what were their findings. In a note, the Ministry of Railways have stated (1976):

> "This was considered by the Railway Board in a meeting on 24-8-1966 and keeping in view the fact that M|s Maybach, who were the only transmission manufacturer prepared to develop Suri transmission were agreeable to develop the transmission only if their own engine was used, it was decided to call for tenders for 2500 HP locomotives with Maybach 20 cylinder MD-1080 engine. Suggestions as per items (i) and (ii) of Member (Mechanical)'s proposal was accepted and six locomotives with Suri transmission and 2 locos with Mekydro transmission with Maybach engines were ordered as prototypes. Suggestion at item (iii) to carry out simultaneous trials with Alco engine and Suri transmission was dropped in view of the technical difficulties of connecting 6-axle loco with single Suri transmission."

1.67. In another note furnished to the Committee, the Railway Board have stated (1976) :

> "The proposal for use of Alco engines of the first Member Mechanical as per his notings of 9-2-1966 was commented upon by the subsequent Member Mechanical vide his noting of 4-4-1966 as under :
>
> "We have already taken over 4 years of discussions in stages with the manufacturers and more recently with the German Bank authorities in regard to the development of 5000 HP locomotives and we are now in the final stages. If the development of 2500|2600 HP locomotives, as suggested by Shri Khan has now to be examined *de novo*, there will be inevitable delay and even the firms who have shown their keenness may or may not show sufficient interest in our revised projects at this stage. In any case, the proposal of Shri Khan against sub-item (c) of para 7 above of utilising ALCO engines of American make with Suri transmission proposed to be developed by M|s. Maybach of Germany may not be looked at with favour by the German Credit Loan Authorities. This would leave only the proposal for the manufacture of a few 2500 HP locomotives with Maybach engine and Suri transmission or full Mekydro transmission. It is understood that the only developed high speed engine of 2500 HP available at present for the application of Suri transmission is Maybach. Therefore, the problem becomes one of a research programme of developing 2500 HP transmission either on a single locomotive developing 2500 HP (one Maybach engine) or a single loco (fitted with 2 Maybach engines) developing 5000 MP."

1.68. It is seen from the above that the desirability of developing Suri transmission with proved locos already in use viz. ALCO was not pursued because it would have involved *de-novo* examination leading to delay and further because of the apprehension that utilisation of Alco engines of American make with Suri transmission to be developed by M/s. Maybach of Germany might not be looked at with favour by the German Credit Loan Authorities. The Committee asked what was the basis of the apprehension of the then Member Mechanical that the German Credit Authorities would not favour utilisation of ALCO engines with Suri transmission. In a note, Ministry of Railways have stated (1976) :

> "There is nothing on record to indicate the basis of this noting of the then Member Mechanical (Railway Board)".

1.69. In another note the Ministry of Railways have stated (1976) :

> "The files show that it was not feasible to develop a locomotive using Suri transmission with Alco engine because such a locomotive could not be built on 4-axles on account of heavier weight of Alco engine (Alco engine weights 19 tonnes against 9.2 tonnes for Maybach engine). The manufacturers of the loco advised against incorporation of 6-axles driven from Suri transmission mechanical drive. It is a fact that procurement of these locos was

being financed by KFW (German Bank) and the then Member Mechanical recorded that engines other than of West German make may not be favoured by German Credit Loan Authorities. Records show that due to M/s. Maybach the firm who undertook to develop Suri transmission agreeing to this development only if their own engine was used, no other alternative was possible."

1.70. It has been stated that suggestion to carry out simultaneous trials with ALCO engine and Suri transmission was dropped in view of the technical difficulties of connecting 6-axle loco with single Suri transmission. The Committee asked what technical difficulties were aprehended in this regard and what considerations weighed with the Railway Board in arriving at the decision to rule out the suggestion of the Member Mechanical to go in for the prototype of 2600 horse power locomotive with ALCO engine and Suri transmission also. In a note, the Ministry of Railways have stated :

"The coupling of one Suri transmission mechanically to six axles would have been technically difficult and would have introduced another element of trial on the locomotive. Hence 2600 horse power engine, which due to its weight and axle load considerations could be accommodated on six axles only, was not considered."

1.71. In the Supplementary Memorandum furnished to the Committee in February 1978, the Railway Board have stated :

"The maximum permissible axle load for locomotives on Main Line sections of Indian Railways is limited to 18.8 Metric tonnes. The weight of the 16-cyclinder 2600 HP ALCO engine considered for this application is 19.03 tonnes as compared to 9.20 tonnes of the MD-1080Z Maybach engine. In order to develop a locomotive design within the limited permissible axle load, the use of the heavier 2600 HP ALCO engine necessitates use of 6-Axles divided into two 3-axle bogies. With Hydraulic transmission, the transfer of power to the axles is made through a cardon shaft and gear boxes, and development of an arrangement for distributing power from a single transmission to two 3-axle bogies presented serious technical problems. The German Federal Railways who have been pioneers in the use of Hydraulic transmissions have not adopted such an arrangement, and this would have introduced a new element of risk. Notwithstanding this technical problem, ALCO were in any case not willing to develop a hydraulic transmission to match their engine.".

1.72. The Committee were given to understand that R.D.S.O. in March 1975 made a reference to the manufacturers of WDM 3 locomotives in regard to the possibility of using ALCO engine in place of Maybach engine in the locomotives fitted with Suri transmission. The Committee asked if the Railway Board had earlier come to the findings that ALCO engines could not be used on these locomotives, what was the need for the reference by R.D.S.O. to the manufacturers. In a note, the Ministry of Railways have stated :

"The earlier reference to the possible use of an ALCO engine in conjunction with Suri transfission on WDM3 locomotive are for

the 16 cylinder 2600 Horsepower engine. In 1975, a number of WDM3 locomotives were out of commission due to defective MD 1080 engines and the Board directed RDSO to make an all out effort to examine if these could not be repowerpacked with 12-cylinder 251B Alco engines (Not 16-cylinder). The reference to the manufacturers was in this context.

The 12-cylinder 251B engine has a lower power rating of 1977 Horsepower and its weight is still about 5 tonnes more than that of the MD-1080 engine rated at 2500 Horsepower. The use of even this lower Horsepower engine was viewed with reservation by RSDO since this would have increased the axle load to about 21-5 tonnes thus necessitating operation at restricted speeds only.

MTU advised that K 252|253 transmissions as supplied by them could not be modified to match with 12 cylinder 251-B Alco engine because of comparatively much lower rated rpm of Alco engine compared with Maybach MD-1080-engine.".

Selection of 20 *cylinder Maybach MD* 1080 *diesel engine*

1.73. In 1962 the Railway Board thought of developing Suri Transmission in high horse power locomotives in order to realise its maximum benefit. Between 1962 and 1964, the Railway Board considered the question of procurement and development of Suri transmission in 5,000 horse-power locomotive. In September, 1964 tender enquiries were issued for purchasing these high horse power locomotives against a West German Credit. As already stated earlier a Technical Committee was appointed by the Rly. Board in June, 1965 to examine the offers of two West German firms who had offered to supply 5,000 horse-power locomotives fitted with two 2500 HP Maybach engines and on the basis of the findings of the Technical Committee, the Railway Board had decided on the 9th June, 1966 that procurement of 5,000 HP locomotives for developing Suri Transmission could not be justified. The Board had decided that since the standard B.G. diesel locomotive in use on Indian Railways was of 2600 HP, it would be more prudent to go in for 2600 HP locomotive and for this purpose a senior Engineer of the Railways was deputed to West Germany. In the light of the Report submitted by the Engineer, the Railway Board had decided in August 1966 to go in for a 2500 HP mixed service locomotives. These locomotives were also to be fitted with Maybach MD 1080 diesel engine and 2500 HP Suri Mek-hydro transmission.

1.74. In regard to 2500 HP Maybach diesel engine, the Technical Committee had observed that these engines had not been installed on any locomotive and the experience so far was limited to bench tests only. The Technical Committee, had, however, felt that there might not be undue risk in providing 20 cylinder MD 1080 series Maybach engines on the locomotives subject to proper observance of maintenance schedule and the use of recommended lubricants. The Committee asked why the Railway Board confined their choice to Maybach diesel engines even though the Technical Committee

had given only conditional approval of these engines. The Member Mechanical state during evidence (August, 1976) :

> "Maybach diesel engine of 2500 horse-power had not been tried either in Germany or anywhere else. Only the bench test had been considered. This belonged to a family of other horse-power locomotives which had been used in Germany in very large numbers and also had been used in small numbers in the U.S.A. We had used lower horse-power locomotives in our country. Taking all these things into account the Committee then concluded that on the basis of experience gained and the improvements that are likely to occur in the course of the experience, there would not be undue risk in going in for 2500 horse-power locomotive.".

1.75. On being asked whether enough data had been examined before arriving at a decision, the Member Mechanical stated (August, 1976) :—

> "The whole issue had been examined by the experts of the Research Organisation, the manufacturers at the Chittaranjan and the DLW Workshops. At that time the driving force behind all this development was that the indigenous hydro-mechanical drive that had come up should be encouraged. Somehow we were trying to make it a success. With that background, the engine available was 2500 horse-power. There was no other engine for this horse-power available. So, that chance was taken then. Calculated chance was then taken."

1.76. When the Committee asked whether the decision was justified by the results, the Member Mechanical stated (August 1976) :

> "Unfortunately the whole development of this has not been a success."

He added :

> "At this stage we are wiser after the event. At that time they had gone into it as much as possible, with the information that was available and they had consulted the German Railways. They had consulted other manufacturers. This took about five years it started in 1961 and the decision was taken in 1966. It is unfortunate that the decision has not proved to be successful."

1.77. In the same context the Chairman, Railway Board stated (August, 1976) :

> "In retrospect after seeing all that has happened and the performance of this locomotive, one can say that the decision to go in for 2500 horse-power diesel engine could perhaps have waited. I fully agree.

Certain circumstances led to it. First of all the idea was to have Suri transmission tried on a high horse-power engine. Having come to that ideological concept they went to Germany, because that was the only country where hydraulic transmission was there. Suri transmission as I explained earlier is hydraulic transmission with certain mechanical gears. They said this cannot be tried on a six axle engine because if it is to be tried on a six axle engine it s very much complicated. It should be only a four axle engine. When the number of axle was limited, they had to go in for 16 cylinder Maybach engines. Step by step, this went on. But I agree that when we went in for an altogether untried engine, from 16 to 20 cylinders, perhaps some performance tests could have been held so that we did not run tnto difficulties.".

1.78. The Committee pointed out that it appeared that the West German firms wanted to test the feasibility or otherwise of the new series of the diesel engines and the Indian Railways were made the subject of this experimentation. The Member Mechanical stated (August 1976) :—

"At that time the high horse power engine was not available anywhere and the only engine that was available was this engine and if we wanted to try our transmission, it had to be tried out in this engine which was he only one available at that time."

1.79. The Committee enquired when the Railway Board decided in August, 1966 to go in for 2500 HP locomotive with 20 cylinder Maybach diesel engine, whether it was fully satisfied that these engines had been put to field trials in West Germany and other countries, if not in India, and there were no adverse reports about their performance. The Ministry of Railways have, in a note, stated :

"Maybach MD series is a family of diesel engines, manufactured in various horse-power ranges, with different number of cylinders. The Technical Committee appointed by the Railway Board, in their Report of December, 1965, had come to the conclusion that Maybach 20-cylinder 2500 HP engine in combination with either Suri-Makydro or Mekydro Transmission provides satisfactory means for furthering the research programme in a loco developing 2500 hp|5000 hp.

Maybach MD engines in smaller HP range had been in use for rail traction on the German Railways. The Technical Committee had also observed that 26-Cylinder MD 870 engines had been used on 4000 hp diesel-hydraulic locos in U.S.A.

20-Cylinder Maybach engines had not been used for rail traction elsewhere prior to its application for WDM3 locos on the Indian Railways. The Technical Committee, on the basis of their investigation, had felt that there may not be "undue risk" in providing MD 1080, 20-Cylinder Maybach engines.

Joint Director Mechanical Engineering (Special), during his visit to West Germany, in July/August 1966, had discussed the performance of Maybach engines with the Exports of the German Federal Railways. He was informed that German Railways were quite satisfied with the performance of Maybach engines; about a thousand of which were in service, but he had cautioned that these engines needed greater amount of attention and skill."

1.80. Since Maybach engines had no been tried in Indian conditions, the Committee enquired as to how the Railway Board had saisfied themseleves that the engines would give trouble-free service in Indian conditions of working. In a note, the Ministry of Railways have stated (1976) :—

"Maybach 8-cylinder MD 435 engines had been in use on WDS3 and ZDM2 locomotives on the Indian Railways. The Technical Committee, in their December 1965 Report had made the following observations :

"On the basis of a careful investigation, the Committee feel that there may not be undue risk in providing MD-1080, 20-Cylinder Maybach engine with normal governing subject, of course, to proper observance of maintenance schedules and the use of recommended lubricants.".

The above recommendations had been made taking into consideration the performance of Maybach MD 435 engines fitted on WDS3 (B.G.) and ZDM2 (N.G.) locomotives on the Indian Railways.

The records suggest that with proper observance of maintenance schedules and recommended lubricants, Maybach engine on WDM3 loco is expected to give satisfactory service."

1.81. In regard to the performance of Maybach MD 435 engines fitted on WDS3 (B.G.) and ZDM2 (N.G.) locomotives, the Railway Board, have in another note, stated (1976) :—

"After experience with the performance of Maybach MD 435 engine on WDS3 and ZDM2 locomotives, it was decided to go in for an alternative medium speed engine instead of using Maybach MD 435 high speed engine. The experience in the Indian Railways with Maybach MD 435 engine on WDS3 and ZDM2 was not satisfactory in respect of crankshafts and bearing failures, turbo defects and cylinder head cracking, etc."

1.82. The Audit Paragraph points out that the Maybach MD-1080 engine with precombustion chamber had shown a specific consumption on bench tests which was comparable with that for ALCO type of diesel engine The Committee asked whether it was prudent to have gone in for an engine which had undergone bench tests only and simultaneously to experiment with a new transmission system in a locomotive fitted with such an engine. The Ministry of Railways in a note, have stated (August 1976) :—

"Every diesel engine after manufacture is subjected to run in bench test where output, specific fuel consumption and other leading

performance characteristics are measured to ascertain that the recorded values are within the designed range specified. The specific fuel consumption comparison of engines is normally based on the results recorded during such bench tests. The statement that Maybach MD-1080 engine with pre-combustion chamber had shown a specific fuel consumption on bench test which was comparable with that for Alco type of diesel engine, is based on the result of fuel consumption obtained during such bench tests—both for the Maybach and Alco engines. Thus the reference to bench tests in regard to fuel consumption is applicable equally to the Alco and Maybach engines.

The Technical Committee appointed by the Board to consider procurement of 5000 hp heavy freight diesel-hydraulic locomotives had gone into the question of the use of Maybach MD-1080 engine with Suri transmission and concluded in its report of December 1965 that "there may not be undue risk in providing MD-1080 20-Cylinder Maybach engine."

1.83. It has been stated *inter alia* that the Technical Committee appointed by the Railway Board in their Report of December, 1965 had concluded that Maybach 20-Cylinder 2500 HP engine in combination with either Suri Mekydro or Mekydro transmission provides satisfactory means for furthering the research programme in a loco developing 2500 HP/5000 HP and that there may not be 'undue risk' in providing 20-Cylinder Maybach engines. The Committee desired to know whether the conclusions of the Technical Committee were accepted by the Ministry of Railways. In this connection, the Ministry of Railways have, in a note, stated :

"The report of the Technical Committee was considered in the Board Meeting held on 9-6-1966 and keeping in view the above report as also the limitations placed by bridge and track standards in India, it was decided that it would be more prudent to go in for 2600 HP locos rather than 5000 HP locos. It was also decided by the Board that in view of the fact that number of firms interested in these locomotives is only two or three. it would be advantageous to depute Shri K. S. Rajan, Joint Director Mechnical Engineering (Special), a senior Mechnical Engineer, to Germany to have informal talks with representatives of the firms, explain the latest thinking of the Indian Railways, obtain their reaction to the proposal of procuring 2600 HP locos instead of 5000 HP and make them feel interested in the development of Suri Transmission and give them all the technical advice that they may need. He was also to suitably explain to the German Credit Loan authorities the technical reasons for tht revision in the Board's earlier decision of procuring 5000 HP locos with Suri Transmission."

1.84. From the information made available to the Committee it is seen that there were serious misgivings about the Maybach engines, which had been expressed by different Members Mechnical of the Railway Board from time to time. In August, 1964, the then Member Mechanical had observed that the use of 2500 HP high speed Maybach engines which were still in

the developmental stage would introduce an element of additional trial on the same locomotive, i.e., the engine and the transmission. He was, therefore, of the view that Suri Transmission should be developed with tried engines. In reply to a question as to how these misgivings had been resolved, the Ministry of Railways have in a note, stated (1976) :—

> "The notings of Members Mechanical of 7-8-1964 were discussed in the Board Meeting held on 11-8-1964. Member Mechnical in his note had indicated that 2500 HP, high speed Mayback engine which are still under developmental stage would introduced an additional element of trial on the same locomotive and since Alco's are also unable to develop the transmission themselves, the only choice is to develop a 3000 HP locomotive which will have two tried 1500 HP engines.
>
> The matter was discussed in the Board's meeting at length and it was felt that as the maximum benefits of the Suri Transmission are likely to show up in the higher horse power range due to better power/weight ratio, it would be desirable in the interest of developing the transmission to procure 5000 HP locos.
>
> In the higher HP range no alternative diesel engine was available which could be utilised for development of 2500 HP Suri Transmission."

1.85. Another Member Mechanical had suggested in February 1966 that keeping in view the unsatisfactory experience about the Mayback engines in use in India the best and safest course would be to go in for prototype locos with ALCO and Maybach engines fitted with Suri/Meykdro transmission to provide an adequate means of comparison. When asked to elucidate this, the Ministry of Railways, in a note, stated (1976) :—

> "The subsequent Member Mechanical in his notings dated 4-4-1966 commented upon previous Member Mechnical notings of February 1966 as under :—
>
> "While it is correct that some trouble has been experienced on the locomotive referred to regarding their crankshaft bearings and lube oil filterations under Indian conditions, but it has to be remembered that the WDS3 locomotives were supplied to us in 1961 and since then Maybach, I understand, have improved the design in their new product to eliminate the difficulties that had been experienced on the older Maybach engines. In any case, this Firm which is a well known diesel engine manufacturing concern in Germany has a reputation to maintain and there is no reason to doubt that they will not try to give every satisfaction in respect of the suitability of their product in actual service after overcoming the teething troubles. In any case the risk can be further minimised by ordering the minimum number of locomotives required for our trial. For the same reason, an attempt has also been made to obtain from the tenderer M/s. Henschel more favourable guarantee, and they have now offered as against the normal

guarantee of twelve months that they usually offer, a guarantee of 24 months for the complete locomotive, which, however, falls short of the period of 60 months for the engine and transmission, which had been stipulated by the Board earlier."

The use of Maybach MD-1080 engine was also cleared by the Technical Committee. This was considered by the Board in a meeting on 24-8-1966 and keeping in view the fact that M/s. Maybach, who were the only transmission manufacturers prepared to develop Suri transmission were agreeable to develop the transmission only if their own engine was used, it was decided to call for tenders for 2500 HP locomotives with Maybach 20 cylinder MD-1080 engine."

1.86. During evidence the Committee enquired whether any effort had been made to assess the working of an alternative engine for use in conjunction with Suri Transmission. To this the Member Mechnical Replied (August 1976) :

"At that time, the only engine that was available of high horse power was this engine. There was no other engine available at that time for this application."

1.87. It was stated during evidence that during the relevant period there had been two Members Mechanical who had given different viws on the selection of a high horse power engine. The Member Mechanical stated in this connection (August 1976) :

"There were a number of technical officers involved in the whole scheme. While one Member Mechnical has said so, another Member Mechnical had stated that there would not be undue risk in going in for this. Frank technical opinions were expressed and a decision was taken after the technical committee had expressed its views on the matter. A man was specially deputed to Germany to make further enquiries."

1.88. In a note on the subject, the ministry of Railways stated (1976) :

"In regard to the prototype development of Suri Transmission in high horse power range Shri M. M. Khan had opined that we should develop these locomotives using Maybach diesel engine in 2500 HP range and also Alco diesel engines in 2600 HP to serve as a comparison between the existing Alco engin with electric transmission in use on Indian Railways. He had expressed his reservations regarding the use of Maybach 2500 HP diesel engines for these prototype as these engines were still in the developmental stage but had, however, recommended use of these Maybach diesel engines also to serve as a comparison with Alco diesel engines already in use on our system.

Mr. G. P. Bhalla was of the view that we should process the development of Suri Transmission in high horse power range expeditiously to enable benefits of this invention being realised and to

enable the Indian Railways to take a lead over other advanced countries in this regard. He opined that we should not be unduly concerned about our earlier experience with low horse power Maybach engines fitted in WDS-3 locomotives as it was understood that in the intervening years the manuafcturers had improved the design of their new product to eliminate the difficulties encountered earlier. He felt that since 2500 HP Maybach engines had also been cleared for use on these prototypes by the Technical Committee and since this was the only developed engine of 2500 HP available at that time for application of Suri Transmission, we should go ahead with development of prototypes with Maybach MD-1080, 2500 HP engine. He had also recommended development of 2500 HP Suri Transmission along with 5000 HP locomotive using two such transmissions and two Maybach 2500 HP diesel engines and to limit the developmental expenditure to the barest minimum he recommended going in for a minimum number (not less than four) of 5000 HP locomotives."

1.89. Although it had been decided in June 1966 to procure locomotives fitted with medium speed engines, this decision was changed, following the report of the Railway Engineer who visited West Germany. It was then decided to procure high speed engines. Explaining the reasons why this change was made, the Ministry of Railways have, in a note, stated (1976) :

"In regard to selection of the engine, the decision to adopt the high speed MD-1080 engine was based as per report of the Railway Engineer on the fact that :

1. Maybach, who were the only transmission manufacturers prepared to develop Suri transmission, were not interested in developing this transmission alone without matching it with their engine, as they would not be able to guarantee performance with any other engine in the developmental stage.

2. If the Alco 2600 horse power engine (medium speed engine) had been used, it would not have been possible to build a locomotive on 4 axles, within acceptable axle load.

The choice of the engine was not thus made due to its being a high speed engine but rather the engine chosen on account of various other considerations happened to be a high speed engine."

1.90. As to the reasons why ALCO engine was not used for developing Suri transmission, the Ministry of Railways have, in a note, stated (1976) :

"Alco engine was not used for developing Suri transmission in 2500/2600 HP range as Suri transmission for this application could be developed only by one of the leading hydraulic transmission manufacturers in the West Germany and as per JDME (Special) Railway Board's report on his visit to West Germany in July-August 1966, only one established firm M/s. Maybach were willing to develop it provided their own Maybach engine was

used. Besides West German loco builders advised against 6-axle loco with single Suri transmission mechanical drive. These points were considered by full Board including Member Mechanical, in a meeting on 24-8-1966 and it was decided to call for tenders for 2500 horse power locomotives with Maybach 20 cylinder MD-1080 engines."

1.91. During further evidence before the Committee in March 1978, a representative of Ministry of Railways stated :

"The Audit has based their arguments on the basis of noting by the then Member Mechanical that the locomotive should be with ALCO engines. Obviously, that engine was the most obvious choice. It was an engine which we had been using and an engine which we would have manufactured of ALCO in which an engine which we would have manufactured in the country. I would like to draw your attention to the clear letter from the manufacturers of ALCO in which they have themselves said that they would not be able to develop a hydraulic transmission. Specifically in the face of this letter from the manufacturers of ALCO saying that they were not in a position to develop a hydraulic transmission, it was difficult to consider how we could have considered ALCO as a possible source for supply of locomotive of this design. Besides, there are some technicalities involved in the use of this."

1.92. The witness further stated (March 1978) :

To our minds, the use of ALCO engine is a suggestion which was not very carefully thought of. The ALCO engine had a weight of about nineteen tonnes and Maybach had a weight of nine tonnes. The difference in weight of ten tonnes could not be accommodated on two-axle bogies. Therefore, if an ALCO engine had to be used, assuming that a hydraulic transmission was developed, it involved the use of three-axle bogies as we have track limitations, which do not permit us to exceed a load of 18.8 tonnes. Therefore, if ALCO engine is to be used, the number of axles had to be increased so that the weight is distributed evenly. The use of three axle bogies presented major problems. Nowhere in the world had any hydraulic manufacturer developed three axle bogies. The transmission of power from the engine to the wheels is by means of a system of cardon shaft which is similar to propeller-shaft as we have in the motor cars. When you increase the number of axles, with the distance that the Cordon shaft has to move, the angularity will increase to such an extent that there is a heavy torsinol vibration which could not be tolerated. Therefore, the manufacturers of these hydraulic locomotives have basically confined themselves to two axle bogies. Therefore, if we have to start embarking upon using the ALCO, we would have willy nilly to embark on three-axle bogies on account of its heavy weight. This is going to present new difficulties which we were reluctant to try out on the locomotive where we were already considering a new type of transmission.

The disadvantages of Maybach engine had been well known to the Railway Board as far back as 1965. It was then decided by the Board and they set up a Technical Committee consisting of three very senior experienced officers—one was the General Manager of the Chittaranjan Loco Works, the second was the Chief Design Engineer of the RDSO and the third was a specialist from NIDC, who was an ex-railwayman. They sat together and reviewed the possible alternative type of engine which could be used for the development of this transmission."

1.93. On the question of choice of Diesel engine, the Railway Board have, through a Supplementary Memorandum furnished in February 1978. submitted as under :

"Whilst the decision to develop the Suri Transmission in the high horse power range has not been questioned, the choice of the Maybach MD-1080Z diesel engine for development of this transmission has been questioned. The principal objection raised are—

(i) it was not indigenously available whereas the Alco engine was,

(ii) MD-1080Z engine had not hitherto been tried out for rail traction,

(iii) the previous experience with Maybach Engines was unsatisfactory,

(iv) the choice of a German make of engine was governed not by its suitability but by the fact that a West German loan was available.

With regard to the use of indigenously available ALCO engine, Audit has relied upon the views of one of the three members of the Technical Committee of 1965 which has been supported by then Member Mechnical, Shri M. M. Khan. It is pertinent that this member of the Technical Committee was a signatory to the Report of the same Committee recommending the use of the Maybach MD-1080Z engine and only a short time later suggested the use of an Alco engine.

* * * * *

The subsequent noting of the then Member Mechnical, Shri M. M. Khan, in February 1966 suggesting use of ALCO engine on prototypes with Suri transmission obviously overlooked his earlier noting dated 7-8-1964 wherein, as a result of discussions and negotiations with Alco by a negotiating committee comprising the then Additional Member Mechanical and Director, Finance, Railway Board, Shri Khan had ruled out the feasibility of the use of Alco engine for development of the Suri transmission because of the incapability of Alco to develop hydraulic transmission as they had no experience in this line. There is no record of any fresh proposal from Alco for matching their engine with the Suri transmission or for developing the transmission between April 1964 and February 1966.

As can be seen from the evolution of the process of decision-making indicated above, reference to the attitude of KFW, West German Bank, in the note of the then Member, Mechnical, Shri G. P. Bhalla, dated 6-4-1966 was not significant in dictating the choice of the engine for this development. Keeping in view suitability of a diesel engine to match Suri transmission and feasibility of reverse governing, a necessary technical requirement of the Suri system, the choice of Maybach engine had been under consideration since 1959 itself. Even in the lower horse power range the Maybach reverse-governed engine had been used on the earlier prototype loco. For the development of the 5000 HP locomotive with Suri transmission for which tenders were invited in 1965, Maybach engine had been specified. The Technical Committee comprising GM/DLW, Director, Standards (Mechnical)/RDSO and Managing Director, National Industrial Development Corporation, in their report of December 1965, had recommended the use of Maybach engine with a 5000 HP locomotive and also for the alternative 2600 HP locomotive which they preferred.

* * * * *

At the time when the decision to use the Maybach MD-1080Z engine was taken, it was known that this engine had not been used for rail traction. The Technical Committee had, in their report taken note of this fact and nevertheless recommended its use in the larger interest of development of the Suri transmission. The MD series were standard engines on the German Federal Railways and at that time they had as many as 1000 engines of this series in service. The West German Railways had advised the Indian Railways regarding the satisfactory performance of the MD series on diesel locomotives.

* * * * *

The officer deputed (by the Railway Board to West Germany) met all the concerned manufacturers, the German Federal Railway Experts and the KFW. His comprehensive report on these discussions includes their views on the type of engines, the horse powers available and the axle arrangements (4 axled and six axled locomotives), recommended by them. This report was considered at length by the full Board at their meeting on 24-8-1966 and keeping in view also the earlier recommendations of the high powered Technical Committee, the Board decided that the choice will have to be Maybach MD 1080 engine of 2500 HP fitted on a 4-axle locomotive. The relevant extracts of the Board's minute is as under :

'This engine has already been cleared for application as a single unit on a locomotive of 2500 horse power or its two units on a 5000 horse power by the Technical Committee, appointed by the Board, to go into the question of procurement of 5000 HP locomotive. Board, therefore, agreed with the recommendation that the choice will have to be Maybach high speed engine MD1080'."

1.94. While justifying the selection of Maybach engine, a representative of the Ministry of Railways stated in evidence tendered before the Committee in March 1978, as under :

> "I only wish to bring to your notice that this fact (performance of the engine) was examined by the High Power Committee and it was accepted as the most suitable form of engine which can be adopted for development of this transmission. Therefore, the choice of the engine was limited by the fact that ALCO engine could not suit them—because the manufacturers were not willing to develop the transmission—and the axle load did not permit it to be used. The limitation of choice of Maybach engine was obvious."

SERVICE PERFORMANCE OF WDM-3 LOCOMOTIVES AND TYPE OF GUARANTEES OBTAINED

1.95. The contract for the supply of six locomotives fitted with Suri transmission and two locomotives with Mekydro transmission was executed with the firm on 23 June 1967. The firm had given a guarantee that the locomotives would be built fully in accordance with the specifications and would operate properly. It also guaranteed proper functioning of Suri transmission. The guarantee was to last for a period of 24 months from the dates of commissioning of the locomotives in India or 26 months from the dates of shipment from Germany or 3,00,000 Kms. run by each locomotive, whichever event should first occur. The eight locomotives arrived in India in the second half of 1970 and were commissioned between August 1970 and May 1971 at Gooty in Southern Railway. In July 1971 Southern Railway Administration reported to the Railway Board that the locomotives had developed defects in the transmission system and convertor turbine wheels leading to failures. On the recommendations of the manufacturers, certain modifications were carried out in torque convertor, turbine blades and mechanical clutches and thus the trouble in the system was overcome. However, the performance of these locomotives had not been satisfactory.

1.96. In regard to the performance of the imported locomotives, the Member Mechanical stated in evidence (August 1976) :

> "They worked for about three years—from 1970 to 1973. They are out of commission from 1974. The powerpacks of the locomotives have been damaged. These are beyond repairs. Very heavy investment is required to bring them to the working condition."

1.97. In reply to a question as to what will be the cost of repairs, the witness further stated (August 1976) :

> "1.15. million D.M. for three locomotives for putting them back to service. It comes to about Rs. 36 lakhs."

1.98. The Committee desired to know the terms and conditions of the agreement entered into with the West German firm for supply of the 8 locomotives and the extent to which these terms of the contract were fulfilled by the suppliers. The Ministry of Railways have in a note stated (1976) :

"The Warranty Clause as finally contracted for purchase of WDM-3 locomotives provided for a period of 24 months from the date of commissioning of the locomotives or 26 months from their date of shipment ex-West Germany or 3,00,000 kms., whichever event shall first occur.

This period of warranty was agreed to by the Railway Ministry after protracted negotiations with the firm. The warranty period originally tendered for in 1964, stipulated a warranty period of 60 months for the engine and transmission and 24 months for the locomotives from the date of its commissioning in India. The offers received against this tender, however, indicated a warranty period of only 12 months by M/s. MaK. After negotiations they agreed to extend the warranty period from 12 to 18 months only. The other firm M/s. Henschel (M. T. U.) offered guarantee of 12 months for the engine and transmission and 24 months for the vehicular portion. Subsequently the firm agreed to extend the warranty period for engine and transmission upto 18 months after commissioning or 24 months after despatch from the firm or 2,00,000 kms. whichever is earlier.

The matter was further negotiated with the firms and also referred to the Technical Committee who recommended the latest guarantee term offered by M/s. Henschel of 24 months for the complete locomotive with the stipulation that if the locomotives are out of commission on the contractors account the period of the guarantee will be extended accordingly.

Hence while issuing fresh tenders for 2500 HP locomotives the guarantee clause asked for was suitably modified and the guarantee clause as provided for in the final contract in 1967 was in accordance with the recommendations of the Technical Committee.

M/s. M. T. U., the suppliers of WDM3 locomotives have been regularly approached to rectify the various defects encountered on these locomotives in terms of the warranty clause as agreed to in the contract for the purchase of these locomotives.

The firm has been deputing its representatives to India from time to time to render necessary assistance in this regard. Their Service Engineers have spent 4592 mandays at Gooty shed during the last six years for rendering necessary services in this regard.

On an average the firm has kept 2.5 service engineers at the base diesel shed during the complete period of their service after commissioning till 1975.

The cost of material replaced under warranty by the supplier amounts to DM 6,29,460."

1.99. The Committee asked what action was taken when the firm failed to fulfil the provisions of the agreement. In a note, the Ministry of Railways have stated :

> "Ten major items of defects encountered on these locomotives were attended to by the suppliers out of which eight items were rectified and have worked satisfactorily, thereafter. The remaining two items have been nullified as the mechanical portion of the Suri transmission has been dummied as per the recommendations of the suppliers and as a result thereof these two items are no longer functional in the system.
>
> As a result of dummying of the Suri transmission as per the warranty clause the suppliers are required to attend to this transmission to make it comparable to Makydro K-252 transmission fitted on two out of the eight WDM3 locomotives. This modification was tried on one locomotive by the suppliers during June 1976. The trials with this modified transmission locomotives have not been successful and the suppliers have been now advised again to take necessary steps to carry out the modifications in terms of the warranty clause. The matter is being pursued with the firm."

1.100. The Committee desired to know whether the suppliers and had guaranteed that the Maybach MD1080 diesel engines would be trouble-free and in case it did not work, they would be responsible for it. The Member Mechanical stated (August 1976) :

> "It was not like that, it was only mentioned that if any part failed due to manufacturing defects, they would do the replacement."

1.101. The relevant extracts from the Warranty Clause are reproduced below :

> "Henschel guarantees that the locomotives shall be built fully in accordance with specifications and shall operate properly. In all cases, HENSCHEL guarantees that its designs shall strictly follow the 'as made' detailed drawings with such modifications as are notified in respect of each type. HENSCHEL further guarantees that the locomotives shall be free from faulty design defects in material and workmanship provided that their liability in this respect will be limited to the furnishing and installation of replacement parts free of charge or the repairs are attributable to or arise from faulty design or workmanship or material in the manufacture of the locomotives...
>
> As regards the K-253 transmission (supplied by Maybach), the essence of the guarantee is that HENSCHEL shall take all necessary action so that the transmission as proposed, supplied or modified shall be a satisfactory system with perforamnec not inferior to Maybach's type K-252 transmission. Considering that the transmission type K-253 is a new development of Maybach, HENSCHEL, therefore, reserve the right to carry out any modifications they consider necessary at their own cost to meet HENSCHEL's guarantee obligations."

1.102. It is seen from the Audit paragraph that in arriving at the decision to go in for 2500 HP BB 19 tonne axle load mixed service locomotives with Maybach MD 1080 diesel engine and fitted with 2500 horse-power Suri/ Mekydro transmission, the Railway Board, *inter alia,* took into account the following observations in the Report of the Railway Engineer, who had been deputed to West Germany for negotiations:

(i) the leading locomotive manufacturers of West Germany and the German Federal Railways indicated that a 2500 horse power diesel hydraulic locomotive could be built easily on four axles and that these locomotives would more or less perform what the six axle 2600 horse power WDM-2/WDM-4 diesel locomotives on the Indian Railways were performing ;

(ii) the capital cost of a four axle diesel hydraulic locomotive would be less than a six axle diesel electric locomotive when produced in series ; with Suri transmission a higher efficiency and also savings in fuel to the extent of 5 to 9 per cent were anticipated; from the maintenance angle also a four axle diesel hydraulic locomotive should, if at all, be cheaper than a six axle locomotive of the same power ;

(iii) M/s. Maybach who were developing Suri transmission, had no doubt about the proper functioning of either Suri transmission or their own transmission and they would not be interested in developing Suri transmission alone without matching it with their engine as they would not be able to guarantee performance with any other engine in the developmental stages ;

(iv) M/s. Maybach had stated that their modified 20 cylinder MD engine would be a good trouble-free engine ;

(v) the German Federal railways stated that they were quite satisfied with the performance of Maybach engines but they needed greater amount of attention and skill ; there were over 1000 Maybach engines of the MD series in use on the German Railways ; and

(vi) the German firm interested in developing Suri transmission system were of the view that it would be rather cumbersome to couple all the six axles together with Suri transmission.

1.103. During evidence in August 1976, the Committee enquired whether the assurances given by the West German manufacturers in regard to the performance of WDM-3 locomotives had proved to be correct. The Member Mechanical stated :

"It did not succeed."

1.104. In reply to further questions, the Member Mechanical conceded that even the other stipulations made by the West German manufacturers had not come true.

1.105. The Committee asked whether before going in for high powered engines, it would not have been better to have an improved version of

Maybach engines for trying Suri transmission as the Maybach engines already in use in India were giving trouble. To this the Member Mechanical replied (August 1975) :

"In retrospect, I share your views."

1.106. The Committee desired to know whether the Railway Engineer who went to West Germany got the terms and conditions from the firm in writing or was it all oral. The Member Mechanical stated (August 1976) :

"First, there were oral negotiations. After the oral negotiations, the actual tenders were invited."

1.107. The Committee asked as to why the high expectations raised about the performance of the Maybach engines and the Suri transmission were not incorporated in the agreement entered into with the suppliers. The Member Mechanical stated (August 1976) :

"We tried to get a guarantee for five years, but they would not agree and the maximum they would agree to was two years from the actual date of commencement of their operation or working. Normaly, guarantees are given for a maximum period of 24 months ; nobody generally gives for more than 24 months. The other firm has given it only for 18 months. They have also supplied a lot of material worth lakhs of rupees under warranty. In fact, even after the warranty period, they have supplied a large amount of components to make it a success and they are still trying to modify the transmission with a view to improving the performance."

1.108. In regard to the guarantee obtained from the West German manufacturers, the Chairman, Railway Board stated in evidence (August 1976) :

"Their guarantee, according to the agreement was worded in such a way as to mean that they were responsible only for metallurgical failures and manufacturing defects of the components but there was no performance guarantee included in the agreement. Therefore, it has become difficult to pinpoint them for any other deficiencies."

1.109. The Committee desired to know why no performance guarantee was included in the agreement. The Ministry of Railways have, in a note, stated (1976):

"Guarantee terms had been included in the contract with the suppliers. The performance guarantee in respect of K-253 transmission (Suri transmission) had been included in a special subclause in the contract which states that the manufacturer will ensure that the performance of K-253 transmission will at least be comparable to the performance of K-252 (Mekydro transmission) transmission fitted on 2 WDM-3 locomotives and if it is not so, the manufacturers will carry out necessary modifications to achieve this performance.

The guarantee terms also included any defects arising in service due to bad manufacture and design defects and these defects were required to be rectified at the cost of the locomotive builders provided these occurred within a period of 24 months from the time of commissioning the locomotive in India or 26 months after shipment or 3 lakh kms. per loco, whichever occurred earlier.

The locomotives were built as per specifications drawn out by RDSO, after considering the engine characteristics advised by the manufacturers, and as such it is not feasible to have an overall performance guarantee for the entire locomotive from the manufacturers for a trial locomotive being built at our instance to our specifications. Such a performance guarantee is not given by any diesel locomotive builder when the product is developed and manufactured as per users' specifications."

1.110. In a supplementary memorandum furnished to the Committee in February 1978, the Ministry of Railways have stated :

"Extensive guarantee terms had been included by the Board in the contract with the suppliers. The performance guarantee in respect of K-253 transmission has been covered in a special sub-clause in the contract. The guarantee terms included any defects arising in service due to bad manufacture and design defects and these defects were required to be rectified at the cost of the locomotive builders provided these occurred within a period of 24 months from the time of commissioning of the locos in India or 26 months after their shipment from West Germany or 3 lakh kms. per loco whichever occurred earlier. These guarantee terms were obtained after extensive negotiations and were comparatively better than the guarantee terms available in normal contracts which are generally for a period of 12 months. Even in the case of WDS-3 locomotives purchased earlier, the guarantee terms included a period of 24 months after commissioning of these locomotives in India. The Railway Board had originally envisaged to ask for a guarantee period of 5 years but the manufacturers were not willing to grant such unusual extensive guarantee. The matter was negotiated and the Tender Committee found the guarantee terms finally agreed to by the firm quite comprehensive. It is difficult to get better guarantee terms for a developmental trial locomotive where the developmental trial is being done as per the wishes and the needs of the buyer.

It is pertinent to point out that as far back as 1965 the high power Technical Committee had recommended as under in respect of earlier offers of 5000 HP locomotive :

'The Committee also recommend acceptance of the latest guarantee terms offered by Henschel Work covering a period of 24 months for the complete locomotive with the stipulation that if during the guarantee period the locomotives are out of commission on the contractor's account, the period of guarantee will be extended accordingly.'

1.111. The Audit paragraph bring out that after the various major defects in the WDM-3 locomotives transmissions and engines were brought to the notice of the manufacturers, they advised the Railway Board in November, 1973 that, as there has been engine damages on the locomotives equipped with Suri transmission, it would be necessary to operate these transmissions purely hydraulical. The Railway Board agree to the modifications being carried out. During evidence in August 1976, the Committee asked why no penal clause was included in the agreement under which the Railways could recover the additional expenditure incurred due to failure of the engine or the transmission system, the Member Mechanical stated :

> "As per the contract there was no recovery because the development of the transmission was from the railways side and what the warranty covered was change of parts due to manufacturing defects or design defects of the components which, as I mentioned, they have been changing. But there was no warranty included that in case it does not achieve the desired fuel consumption, then they will be liable to any penalty."

1.112. Arising out of the observations of the Member Mechanical, the Committee pointed out that it appeared as if sufficient care was not taken when the agreement was drawn up to safeguard the interest of the Railways. The Committee further pointed out that it also appeared that the German aid had something to do with our being compelled to go to the particular firm and that too with a warranty clause which did not ensure satisfactory performance of the engine.

1.113. On being asked whether there had been some collusion between the German firm and some Railway officers at the time of negotiating with the firm, the Member Mechanical has stated :

> "I cannot express.".

1.114. Asked further whether any of the officers of the Railway Board including a former Member of the Railway Board, who played a role when in service in regard to this transaction was representing the firm in question after retirement from service, the representative of the Railway Board stated that a former Member of the Railway Board was now representing the firm.

Performance of WDM3 locomotives

1.115. It is seen from the Audit Paragraph that the Railway Engineer who had been deputed to West Germany had *inter alia* observed in his report that the leading locomotive manufacturers of West Germany and the German Federal Railways had indicated that a 2500 H.P. diesel hydraulic locomotive could be built easily on four axles and that these locomotives would more or less perform what the axle 2600 H.P. WDM-2/WDM-4 diesel locomotives on the Indian Railways were performing. The actual performance of WDM3 locomotives has however not been comparable to the WDM-2 locomotives (manufactured in the country), as has been revealed by the appreciation report submitted by the Southern Railway Administration in May, 1973. This appreciation Report brings out that loco availability

in terms of hours per day per loco; horse power ; axle load; convertor efficiency; maintenance costs and incidence of failures in WDM-3 locomotives were not comparable to WDM-2 locomotives.

1.116. The Committee desired to know whether any systematic comparison between the performance of WDM-3 locomotives and WDM-2 locomotives was carried out with a view to assess the performance in respect of (i) engine (ii) transmission system (iii) radiators etc. while hauling freight and passenger trains or plain sections and on stiff gradients and what were the results of such a study. The Committee also asked what scientific conclusions had been drawn therefrom. In a note, the Railway Board have stated (1976) :

"Southern Railway in their report of May 1973 compared the performance of WDM3 and WDM2 locomotives in a comprehensive manner. This comparison was based on the service experience gained in actual operation and covered the performance in respect of the entire locomotive (including the engine and transmission) in freight as well as passenger services. This report of the Southern Railway was examined by the RDSO and their (RDSO) comments are included in Report No. 448-74 and may be summarised as under :

The conclusions of the comparative evaluation have been enumerated in para 7 of RDSO Report No. 448|74 issued in April 1974 and may be summarised as under :—

(i) WDM3 locomotives have not shown economies in fuel consumption compared to WDM2 locomotives.

(ii) Between Suri transmission and Mekydro transmission, there is no difference in fuel consumption in goods services. In express passenger services, locomotives with Suri transmission have a fuel consumption rate lower than with Mekydro transmission.

(iii) Problems have been experienced with Suri transmission calling for design changes. The mechanical clutch in the transmission has been disconnected by the manufacturers and it is now operating as pure hydraulic transmission.

(iv) Design changes introduced for ensuring proper change-over from first to second stage in direct drive have remained untested due to the isolation of mechanical clutch (the makers have subsequently advised to eliminate this change-over feature from the design on account of not being able to obtaining consistent and reliable performance.

(v) MD-1080 engines used on WDM3 locomotive have caused a number of problems in maintenance.

(vi) Mekydro transmission, the carden shaft and other drive components between the engine and wheel, have given satisfactory service requiring little maintenance.

1.117. The Committee desired to know what were the reasons for the comparatively poorer performance the WDM-3 locos as compared to WDM-2 locomotives in relation to various indices. In a note, the Railway Board, have stated :

"The reasons for comparatively poorer performance of WDM-3 locos as compared to WDM-2 locos for different indices were as under :—

(i) *Loco availability.*—The defects encountered on the equipment —both engine and transmission—resulted in the lower availability. Besides, WDM-3 locos being developmental locos in small number, required frequent attention for monitoring and modifications.

(ii) *Horsepower.*—The horsepower rating of WDM3 locos was known to be approximately the same as that of WDM2 locos upto an ambient temperature 40°C slightly lower at higher ambient temperatures. There has been no post performance than this in actual service.

(iii) *Axle load.*—There has been no proper performance in regard to axle-load. WDM2 (6 axle loco) has an axle-load of 18.8 tonnes and WDM3 (4 axle loco) has an axle load of 19 tonnes.

On account of the difference in the number of axles, the total adhesive weight of WDM3 locomotives is of the order of 76 tonnes (19×4) and that of WDM2 locomotives 112.8 tonnes (18.8×6). In case of WDM3, the power of 2500 H.P. could be provided within about 76 tonnes locomotive weight. Also, the firm which was developing Suri transmission did not consider it technically desirable to power 6 axles, with one Suri transmission.

(iv) *Convert efficiency.*—No comparison can be made between WDM2 and WDM3 locos in regard to convertor efficiency since a convertor is provided only on WDM3 locos and not on WDM2 locomotives. WDM2 loco has electrical transmission.

(v) *Maintenance costs.*—The maintenance costs of WDM3 locos are higher than those for WDM2 locos basically because :

(a) High incidence of defects on the equipment.

(b) The size of fleet of WDM3 locos (8 locos) is very small compared to that of WDM2 locos (nearly 1000).

(c) Most of the components required for WDM3 locos have been imported whereas substantial indigenisation has been achieved in WDM2 locos (about 85 per cent items).

(vi) *Failures.*—WDM3 locos failures have also been higher than those of WDM2 locos because the former are development locos and there were large number of defects whereas the latter are standardised series production of proven locos."

1.118. According to the Audit Paragraph various major defects in WDM-3 locomotives, transmissions and engines were brought to the notice of the manufacturers from time to time. The Committee desired to know what were the defects in Suri transmission as distinct from the defects in Maybach engines. The Ministry of Railways have in a note stated (1976):

"The following defects in Suri Transmission as distinct from those on Maybach engine were experienced on the WDM3 locos :

(i) Failure of turbine members.

(ii) Failure of clutch plates.

(iii) Failure of gear changing mechanism.

(iv) Defects in Oil Pumps in Control circuits.

(v) Failure of dog clutches.

There had been cases of damage to the crankshafts as a result ot slackening of counter-weight bolts and failure of bearings and crankshafts had also been experienced on locos fitted with Suri transmission. These were ascribed by the manufacturers to the mechanical clutch in the Suri transmission transmitting vibrations. To obviate these defects, the manufacturers advised dummying of the mechanical clutch in the Suri transmission. The actual experience after dummying the mechanical clutch, so far, in respect of these defects has been satisfactory."

1.119. It has been stated that in order to obviate the defects noticed in the Suri transmission, the manufacturers had advised dummying of the mechanical clutch in the Suri transmission. This in effect meant that the transmission has been converted into simple hydraulic Mekydro transmission. The Committee therefore asked as to what extent the performance of the WDM-3 locos in terms of engine availability, horse power, axle load, convertor efficiency, maintenance cost, and incidence of failures had improved after dummying Suri transmission. In a note, the Railway Board have stated (1976) :

"The performance of WDM3 locos in respect of the following aspects dummying mechanical clutch has been as under :—

Engine availability.—Although as a result of isolation of the mechanical clutch the performance in respect of crank-shaft and bearing failures has improved locos availability has not shown any improvement because of the various other defects on the engine and transmission. At present, 4 out of 8 WDM3 locos have been stabled for heavy damage and repairs, requiring inputs of imported material.

Axle load.—There has been no change in the axle load.

Horse Power.—Maximum output of diesel engine of WDM3 locos with Suri transmission is obtained at 1600 engine RPM. While

working in the mechanical stage of the Suri transmission, the seed of the engine is increased up to 1650 RPM, before the change-over to the next stage. Beyond 1600 RPM, there is actually a reduction in power. By dummying the mechanical clutch in Suri transmission maximum engine speed is now 1600 RPM. This has, therefore, not reduced the power output of the locos.

Convertor Efficiency.—The convertor portion of the transmission has not changed due to dummying of the mechanical clutch in Suri transmission and as such the 'Convertor Efficiency' has not changed. However, in the portion of the speed range where mechanical clutch was operative upto now, a hydraulic coupling is effective in the modified transmission. Efficiency of transmission in this range has therefore, been reduced slightly (about 5 per cent).

Maintenance cost .—There is no reduction in the maintenance cost.

Incidence of failures.—There has been no improvement.".

1.120. On the question of performance of WDM-3 locomotives and their comparative efficiency vis-a-vis. WDM-2 locomotives, the inventor of the Suri Transmission deposed before the Committee as follows :—

"Once these locomotives were delivered—this is a very important fact—in 1971, they had shown in a period of two years 1971-72-1973, which was a guarantee and warranty period, 21 hours a day availability, I should say that the comparison with the existing Alco WDM2 is not a correct comparison. Here it is one locomotive which is freshly developed, engine transmission, every bit new. It is available to you 21 hours in 24 hours.

In my opinion, this period of two years is significant, because I have analysed it. In these first two years, there was not too much noise that things are not working. They were only called teething troubles. The engineers often called on me and said 'It is going very well.' The impression was not at all that it was not going well. In 1973, as soon as the warranty period was over, the company, for the first time, though of blanking off the Suri transmission because by that time they had no other obligation contractually. They had lived through their obligations in a sense satisfactorily. I am saying 'in a sense' because you cannot expect better than 21 hours from a new locomotive.

There is an even more significant point. Round about that time, the RDSO of the Indian Railways had started talking that the only future in this country was for Diesel electric and there was no future for diesel hydraulic. When these people, once or twice or when they happened to meet me, used to say : 'Suri, if we pump more funds into developing it, what is the gain ? They will go ahead on the Indian Railways with diesel electric. Even if this locomotive is a success, what advantages are we going to gain? What is our gain ?

After a point, the commercial firm abroad will cut off from their side unless there is some enthusiasm on this side which was totally lacking. Indian Railways were already talking of diesel electric locomotives to be designed by the Henschel people instead of concentrating on this new development."

He further added :

"In a locomotive which has just come from Germany, you put it straightway into service and expect it to run day and night like any other ; you select the wrong section in which you put it ; it is an incorrect section to start with ; then suddenly you find it is not working too well and everyone just writes a report. What research did they do ? They only told a manufacturer this is not working all right. The manufacturer was quite convinced, out of this exercise, whether Suri transmission proves or not, let him at least prove his own transmission and leave it there. The problem is : who is motivated, who should correct it, at what stage, what action should be taken ? Was any officer there to correct the locomotives ? Reports have been made from running reports and statistical sheets ; they look it up and say that has done this and this has not done that. As soon as they came to know of passenger locomotives that they would save fuel, why did not the Railway Board immediately take suitable action on this knowledge ? Their locomotive was giving 21 hours service in 1971 and 1972, for two years. My point is that we cannot abdicate the role of ownership of this invention and our ultimate aim to develop."

1.121. In a supplementary memorandum furnished to the Committee in February, 1978, the Ministry of Railways have in relation to the service performance of the WDM3 locomotives submitted as under :

"It appears that the Audit have based their observations regarding performance on the basis of comparison of the performances of Indian Railways' standard WDM2 locomotives *vis-a-vis* prototype WDM3 locomotives in regard to locomotive availability and engine failures, maintenance costs, fuel consumption and trailing loads etc. These objections are based on Southern Railway's Report of the comparative performance of the WDM2 and WDM3 locomotives on the particular service.

Unfortunately, during earlier explanations and verbal discussions before the PAC it was not explained that in the year 1971 compared with 8 prototype WDM3 locomotive, the population of WDM2 locomotives on Indian Railways was over 600 and this class of locos had been in service for nearly 10 years. During this period, the teething troubles experienced on the WDM2 locomotives in the initial years had largely been overcome as a result of modifications carried out both by the RDSO and the manufacturers. As a result of the experience gained, the maintenance practices had undergone considerable modifications and were evolved by the Indian Railways to ensure periodic attention at

proper intervals for all components, leading to greater reliability and availability. By 1971, the WDM2 locomotives were in series production at Diesel Loco Works, Varanasi, with an indigenous content of 85 per cent and with firm availability of maintenance spares locally. Even the procurement of imported spares for this large fleet of WDM2 locomotives had been properly organised to ensure timely and regular availability of spares.

Against this, for WDM3 locomotives almost 100 per cent components were required to be imported, as even minor items for a limited fleet of 8 locomotives could not be procured from indigenous sources because of insufficient batch requirements. WDM3 was a prototype developmental locomotive and any comparison of reliability and availability between this proto-type and the standard WDM2 locomotive has to be viewed in its proper perspective. It will be pertinent to point out that in 1957-58 when the first 1000 Alco locomotives were imported, the Indian Railways experienced acute difficulties and availability and reliability of even this large first batch of locomotives was of the order of 60 per cent.

The performance of the locomotive so procured should be related to the requirements laid down in the particular Specification and the offer accepted. Southern Railway, in comparing this locomotive with WDM2 have obviously overlooked the glaring fact that WDM3 is powered with a 2500 HP engine with driving axles limited to four for reasons stated earlier, as against WDM2 with 2600 HP and 6 driving axles because of which the tractive efforts obtainable are not identical. Therefore, comparison of the permissible trailing load of a WDM2 cannot be made with that of a WDM3 particularly when steep gradients of 1 in 100 involving operation at low speeds are involved on this section. It is pointed out that on the Indian Railways, such heavily graded sections do not occur on the Broad Gauge trunk routes, except in some isolated cases. On most of the trunk routes e.g. Howrah-Madras, Howrah-Amritsar, Howrah-Delhi, Delhi-Bombay, the trailing load capability of the WDM3 would be more or less the same as that of a WDM2. WDM3 locomotives had been procured against a specific project, and were, therefore, confined to a heavily graded section with the attendant limitation of trailing loans and consistent near-maximum-output operating conditions..... This contributed to overstrain and frequent breakdowns due to overloading.

Comparison has sought to be made in the Southern Railway Report of fuel consumption figures between the WDM2 and WDM3 locos on the basis of litres per thousand gross tonne Kms. This index is only valid when the trailing loads are substantially similar. With the largely dissimilar trailing loads of WDM2 and WDM3 on this highly graded section, the per thousand TKM fuel consumption basis would not be relevant.

However, when the two locomotives did haul similar loads, as in the case of Vrindavan Express between Madras and Bangalore, where the speeds attained were higher, the WDM3 locos showed 4 per cent lower fuel consumption that the WDM2 locomotives. The use of the WDM3 locos on Passenger trains could not be continued because of the specific project under which they had been procured which limited their use for freight traffic. Later, when permission for use on Passenger services was obtained from KFW, the reliability of the locos had already been impaired on account of non-availability of imported spares.

The fact that the Maybach 1080 engine derates to 2090 HP on 55° Centigrade, as against an output of 2430 HP at the same ambient temperature of the Alco engine was known as the time of evaluation of tender of the 5000 HP locos. The high powered Committee which reviewed this tender had specifically referred to and accepted this derating in para 3.3.1 of their deliberations, which albit leads to a lower HP and therefore hauling capability in comparison with WDM2 loco under certain extreme ambient conditions.

This has also been commented upon specifically by RDSO (Paras 2.2 and 2.3 of their Misc. Report No. Diesel-448/74 of April 1974) while bringing out the lacunae in the comparison made by the Southern Railway. In fact, while ordering the prototype locos fitted with Suri transmission, the Board have concurrently ordered locos fitted with a similar Mekydro transmission for the sole purpose of comparison. The comparison made by the Southern Railway with WDM2 locos is, therefore, not relevant and suffers from serious limitations.

Diesel engine performance can only be compared on the basis of Test Bench results under controlled standard conditions of temperature and atmospheric pressure and International standards in this respect pre-fixed in order to ensure proper and purposeful comparison. Based on results obtained during such Bench Tests on MD-1080, it can be stated that fuel consumption of this engine under standard conditions was equivalent to the Alco engine. The actual performance of the engine under site conditions in relation to Test Bench results varies from design to design and RDSO's comment with regard to inferior performance under site condition has been made after practical experience had been gained and does not reflect on the basis on which the choice of the engine was made."

1.122. In his evidence before the Committee in March, 1978, a representative of the Railway Board deposed :

"The Audit para has arisen, in my opinion, largely as a result of the report of the Southern Railway in 1973 or so, in which a comparison has been made of the relative performance of WDM-3 with that of WDM-2 Alco locomotives already in use in this country.

I am not aware of the circumstances under which the comparison was made or it was possible.....this comparison was not relevant, not desirable and not necessary. We had been comparing something which was in use for 10 years with the one which was in service for 10 months. As we said earlier in the note, where there were comparative characteristics, full economies were achieved. Also, the initial performance for the first two years, when the locomotives were first installed before the spare parts problem arose, was perfectly satisfactory. We had reports that the locomotive was working well, as far as the expectation from them was concerned."

1.123. One of the main reasons for the development of the concept of Suri transmission was that with Suri Transmission a higher efficiency and also savings in fuel to the extent of 5 to 9 per cent were expected to be achieved. The Committee enquired whether these anticipations had been realised. The Member Mechanical stated in evidence (August, 1976) :

"As far as the economy in fuel is concerned, as per investigations, if the mechanical clutch in the transmission was going to be successful, there was bound to be economy. Actually, this locomotive was run on Vrindaban Express and we did find that fuel econony was there, but the engine was not reliable. We did not want to use it on important express trains. But when the engine was tried on a high speed train, economy in fuel, consumption was achieved, but unfortunately, the engine was unreliable."

1.124. The Audit para points out that the fuel consumption of WDM-3 locomotives (both with Suri and Mekydro transmissions) was approximately 20 per cent more than that of WDM-2 locomotives. In this connection it is noted that a representative of the manufacturer of WDM-3 locomotives had stated on 31st January, 1973 that the Maybach high speed engine fitted on WDM-3 locomotives was likely to consume 10 per cent more fuel than WDM-2 engine on account of precombustion chamber configuration. During evidence the Committee pointed out that it appeared that the excessive fuel consumed by the WDM-3 locomotives was attributed by the manufacturers to the unsatisfactory performance of the engine on account of the design characteristics. Asked to give their reaction to this assertion by the manufacturers, the Member Mechanical stated (August 1976) :

"They had pointed out that the mechanical clutch of the hydro-mechanical drive were responsible for the damage to the locomotives and they suggested that the mechanical clutch should be removed—*i.e.* the Suri transmission mechanical portion of the drive. This was done and the hydraulic drive has not given any trouble after the modification. But that meant that the fuel consumption would go up, because the mechanical portion has not been in operation."

1.125. The Committee enquired whether the design characteristic of the engine had not been noticed earlier and why were steps not taken to minimise

losses on account of operation of these locos, the Member Mechnical stated (August 1976) :—

> "The design, as we see it now, has not been good and once the performance of the engine is not satisfactory, all the other results are going to be below par."

1.126. The Committee asked as to how the Railway Board had come to the conclusion that there would be a saving of 4 to 5 per cent in fuel consumption if the Suri transmission was tried in high horse power engines. The Member Mechanical stated.

> "It was just a theoretical conclusion."

1.127. The Committee asked whether Suri transmission was tried on passenger services. The Member Mechanical stated (August) :

> "They were not able to do it for long length of time : but for a couple of months this was tried on Vrindaban Express. We did find fuel consumption was about 5 per cent less."

1.128. In this connection, it is to be noted that the inventor of the Suri transmission has, in a memorandum submitted to the Committee, made the following observations in regard to the Sections on which WDM-3 locomotives were used :

> "The second point of difference I have is that the heavily graded section chosen *viz.* Guntakal-Madras was incorrect for a light WDM-3 locomotive of 4 axles, expecting to replace the 6 axled ALCO locomotive of greater horse-power and greater weight. On this section the WDM-3 loco was literally thrashed to its limit on up gradients which is not good for any newly developed complex machine. Since WDM-3 were allotted against regular locomotive requirements the Southern Railway desired to get the same haulage as from ALCO locomotives and met with frustration.
>
> The WDM-3 locomotive speeds on these graded sections, because of lower power than Alco, were lower. Higher efficiency of WDM-3 at higher speeds could also not be exploited to save fuel.
>
> The diesel engine MD 1080 showed distress under strain of Guntakal-Madras operation, and engine troubles started getting bad to worse.
>
> The Board's decision was perhaps influenced by the fact that KFW had funded the purchase of these locos for iron ore movement on this particular section. Even when troubles were encountered, and fuel economies not obtained, these locomotives were not shifted from this "inappropriate" section which I feel could have been done."

1.129. It is seen from the Audit Paragraph that a slightly higher price (DM 67,500 per locomotive) quoted for the locomotive fitted with Suri transmission as compared to the locomotive fitted with Mekydro transmission was found more than justified considering the developmental expenses involved and expected savings in fuel due to higher efficiency of Suri transmission. The actual fuel consumption in both the locos (fitted with Suri & Mekydro transmission) was, however, of the same order being approximately 20 per cent more than that of WDM-2 locos. In this context the Committee wanted to know what the efficiency of Suri transmission was as compared to the Mekydro transmission. The Board have in a note stated (1976) :—

"On fast Vrindaban Express trains the specified fuel consumption of WDM-3—Suri transmission was 5.92 litres/1000 GTKM as compared to 6.47 litres/1000 GTKM for WDM-3 locomotives fitted with Mekydro transmission. This clearly indicates the better performance of Suri transmission over Mekydro transmission, in respect of efficiency. Extensive utilisation of the locomotives for such use has not been possible due to their unreliable performance. Also, the mechanical clutch has now been dummied and Suri transmission is now working as purely hydraulic transmission.

On freight service even prior to dummying of Suri transmission on these locomotives the performances of locomotives with Suri transmission and Mekydro transmission, in terms of specific fuel consumption, has been comparable. The reason for this is that when the train speed is low, the mechanical clutch in the Suri transmission is not operative."

1.130. As Suri transmission has been eliminated in all the six locomotives, the Committee asked whether the Ministry of Railways contemplated recovery of the additional price paid for locos fitted with Suri transmission from the suppliers as the same was justified on the basis of fuel economy it would achieve and the supplier had guaranteed its performance. The Ministry of Railways have stated (1976) :—

"The additional price paid for Suri transmission loco was due to the development of a new Suri Mokydro K-253 transmission, at Indian Railways' instance to enable experimentation with and develop Indian patent. The anticipated economy in HSD oil was according to expectation of Suri transmission and was not a part of the contract. Suri transmission was expected to give 5 to 9 per cent higher transmission efficiency (in the mechanical range).

The firm's guarantee for Suri transmission K-253 provided that they would take all necessary action so that the Suri transmission as proposed, supplied or modified shall be a satisfactory system with performance not inferior to Maybach K-252 transmission (fitted on two locos). In addition, it stipulated that considering that the transmission type K-253 is a new development of Maybach, Henschel, therefore, reserved the right to carry out any modification they considered necessary at their own cost

to meet Henschel's guarantee obligation. Keeping in view the guarantee clause of the contract, suppliers have lately modified one Suri transmission loco and trials are being conducted to judge the service performance. Bank Guarantee of the firm has not yet been released."

1.131. In the same context, the Member Mechanical stated in evidence (August 1976) :—

"The development of Suri transmission was done at the Railways request and there was no guarantee in the agreement that the money could be recovered. So, there is no chance of recovering the money as such. The only thing that they are doing is that they are trying to modify the design of the transmission. They have supplied a large quantity of spares and new components free of cost to keep the engines going while the experimentation is going on. But there is no possibility of recovering any money due to the failure of the mechanical portion of the Suri transmission."

Utilisation of West German credit and Research Programme

1.132. Referring to the poorer performance of the WDM-3 locomotives *vis-a-vis* the high expectations raised at the time of acquisition of the locomotives, the Ministry of Railways had stated that the locomotives represented a new development incorporating the first application of a newly developed transmission system; and therefore higher incidence of repairs and limited availability should be expected on such locomotives which were placed on line on trial basis as a Research Programme. The Audit paragraph, however, brings out that these WDM-3 locomotives were procured against West German Credit to haul heavy freight trains on graded sections.

1.133. The Committee desired to know whether the West German Credit authorities had been told that the locomotives were required for a research programme aimed at developing Suri transmission or that these were required for some commercial project. The Member Mechanical stated in evidence (August 1976):

"The West German bank authorities were told that this was going to be a part development project. But they were insisting at that time for the import of 7 5,000 HP locomotives or 14 2,500 HP locomotives."

1.134. When the Member Mechanical stated in evidence (August 1976) that the locomotives were purchased out of "credit facilities based on traffic needs", the Committee asked whether a research programme could be financed under the terms of the German Credit under which the locomotives were purchased. A representative of the Ministry of Finance then deposed :

"It was stated in the agreement that the proceeds of the loan were exclusively for the payment of foreign exchange costs of Indian Railways for modernisation and rationalisation and in particular for the purchase of 8 diesel hydraulic locomotive electrical equipment for the production of seventy WAG-4 locomotives, Components for 10 diesel NG locomotives and components for 24 650 HP shunting locomotives."

1.135. When the Committee pointed out that these were definitely purchase programmes, the Chairman Railway Board stated (August 1976) :

> "The purpose of these locomotives was definitely linked to the needs of traffic. Actually, it was linked to transporting iron-ore from Hospet to Madras and for certain other requirements. That is very clear. But what was done was by purchasing these locomotives, they tried to make use of these provisions to get these locomotives with the Suri transmission.

1.136. When the Committee, further pointed out that if it was a research programmes, it should have been pursued in a different way, the Additional Member Mechanical stated (August 1976).

> "The original purpose was that these locomotives would achieve a lower fuel consumption from 4 to 5 per cent. At that time, the decision-makers had in mind that this would really succeed because they were going to a firm which was well in the know of hydraulic and hydro-mechanical transmission system. If we had got 4 to 5 per cent saving in HSD, we would have saved some Rs. 4.6 crores per year. Even in retrospect, if the Suri transmission had been able to work well, then in the last five years, we would have more than recovered the cost of the locomotives and perhaps, a part of the cost of the maintenance of the locomotives. It was certainly done with the idea of commercial exploitation but we wanted to modernise our equipment in a way which was developed by our engineers."

1.137. In the supplementary memorandum furnished to the Committee in February 1978, the Railway Board have, *inter alia*, stated as under :

> "It had been decided that after development of Suri transmission, it would have to be tested under actual service conditions, which would only be achieved if a locomotive was engaged on commercial service since operational constraints do not permit field tests over a long period. In addition to this, such tests would have involved looking up of a large number of vehicles to form the trailing loads besides the huge costs involved. Accordingly the prototype locomotives were obtained for use on commercial service and the West Germany Loan credit justified accordingly. The total cost of the locomotive order to cover the projected KFE Loans did not figure in the consideration for the ultimate number of locomotives to be ordered and in fact, the total cost of the order eventually was about DM 12 million as against the original estimate of DM 20 million."

1.138. Further in the course of his evidence before the Committee tendered in March 1978, a representative of the Ministry of Railways stated :

> "Some of the confusion arose last year during discussions when the Public Accounts Comittee got the impression that since the purchase of these locomotives was against a commercial

loan it was, therefore for a commercial service. I would like to put the records clear that locomotives were for research and development effort and this was made known to the German Loaning authorities. The justification on which locomotives were actually procured was that locomotives would be used actually on a commercial service viz. the movement of iron ore between Hospet and Madras. We did not know of any other way by which we could justify the loan to enable us to procure the locomotives."

He further added :

"We knew it very well that any locomotive purchased has to be tried out on commercial service. We did not have the line capacity or the freight wagons to move them up and down the country for trials. We anticipated that we will procure the locomotives and use them for commercial service during the period of research and trial. Unfortunately this aspect of research and development was forgotten and the commercial aspect alone got highlighted during the discussions. I would place this point of view humbly before you. You may kindly consider to what extent your criticisms will stultify research and development in the Railways. I beg to submit that considerable fear has already been generated as a result of the criticisms that were levelled during the various correspondence we have had with Audit and this has considerably damped the morale of young engineers. They have the feeling that certain things with regard to research and development which do not become successful would be viewed very gravely."

1.139. The Committee pointed out that on the basis of evidence tendered before them and the information made available to them, an impression was created that the domineering aspect was the commercial characteristics and not the research and development characteristics. Moreover, since the German loan was utilised the presumption must be drawn that the deal was in accordance with the German loan, which was not contemplated to meet any research and development projects but only for commercial transactions. The Chairman, Railway Board then stated in evidence (March 1978) :

"As far as I could see, in the Railways this was originally started, right from the beginning, as a development project on 'transmission' under an Indian patent. For getting money for getting the development done, the project had to be initiated. At every stage of the project, this developmental aspect of the locomotive had to be considered. If it was a commercial project, we could have gone in for a German loan and got any standard German locomotive. They would have been too happy and we could have got one of the standard locomotives. But right from the beginning, "we have been insisting that this should be a development project, and whatever locomotive we buy under the German loan will be for development of Suri transmission. So, the whole thing was a developmental project, which we definitely used from the commercial angle, which the German loan needed. To that extent, I would submit that it is a R&D project mixed with a little comercial bias on it."

He added

"But whether the commercial bias was greater or the R&D effort was greater I leave it to the Committee to judge. But we feel that the R&D effort was basic. If it was purely commercial, it was not at all difficult to buy standard locomotives from the German manufacturers. The whole exercise for the two years was gone through purely because we wanted to develop this transmission. Otherwise, the German banks would have been too willing to give us the money to buy these locomotives from Germany. So, in the context of this, I would appeal to the Committee to look at it that way.

It was included in all our communications to the Finance Ministry and loan documents also, and even our specifications for buying the locomotives included the development of Suri transmission. To call it purely commercial will not be fair. Unfortunately, as I said, to call it purely R&D also would not be entirely correct. It was a mixture of both."

Number of Locomotives bought under Research Programme

1.140. The Committee asked if the locomotives to be bought against the German credit were meant for research and development programme why eight locomotives were ordered. The Member Mechanical stated (August 1976) :

"The bank officials were virtually saying that the minimum number should be 7 of 5000 HP or 14 of 2500 HP.

While that was the bank's attitude from our own point of view this was a project which had to be utilised in service also, and so we had to have a minimum and 6 of Suri transmission and two of the other was not considered a large number."

1.141. The Committee enquired whether this large number of locomotives had to be acquired in order to utilise the German Credit then available. A representative of the Ministry of Finance clarified :

"From the records I cannot say that any indication was sent to the Railways that we had a problem in the Ministry of Finance of certain non-utilisation of German credits and therefore there was compulsion to persuade somebody to use them. Later on, I have been dealing with German credit from 1972 and my experience is that we have more projects which required funds from Germany than we have aid, and may have to be financed through other sources."

1.142. During evidence the Committee pointed out that since these locomotives were being acquired for the purpose of experimentation with the idea

of Suri transmission, only one or two locomotives should have been acquired. The Member Mechanical stated (August 1976) :

> "They said they would be interested in the scheme only if the minimum number was taken. In fact, they were asking for more than 8, and in the negotiations it was brought down."

1.143. In reply to another question whether for the purpose of successful experimentation a minimum of 8 locomotives was necessary, the Member Mechanical stated (August 1976) :

> "Actually there were six Suri and two Mekydro ones. I would regard this as a reasonable number."

He added :

> "This is my view. Just one or two locomotives would not have given the desired result, a proper assessment about the viability of locomotives."

1.144. In the same context, the Chairman, Railway Board stated in evidence (August 1976) :

> "On this subject itself, there have been varying views. One Member Mechanical had given his opinion that the reduced number locomotives with Suri transmission may be tried. On a long section like Hospect-Madras, for a scientific trial, perhaps, at least a pair of locomotives each way, would have been the minimum number required. So, I think perhaps four locomotives would have been the minimum number that was necessary."

1.145. In a note subsequently furnished to the Committee, the Ministry of Railways have stated (1976) :

> "The German authorities had not stipulated any minimum number of locomotives for purchase through the credit. Originally a sum of DM 20 million for 5000 HP Suri transmission locomotives had been earmarked for Project assistance from Germany. The draft agreement for DM 20 million loan, which was sanctioned earlier, was given by Dr. Rittler of KFW in February 1966 but this was not signed as the Railway Board was considering the question of 5000 HP diesel hydraulic locomotives earlier envisaged. Ultimately 8 WDM-3 2500 HP diesel hydraulic locomotives were ordered involving foreign exchange requirements of DM 12.8 million (inclusive of ocean freight and the requisite spares).
>
> During discussions with German Credit Loan Authorities by Jt. Director, Mechanical Engineering (Special) during his visit to West Germany, KFW had desired that order for fourteen 2500 HP locos should be considered. It was explained by JDME (Spl) that it was only a pilot project for development of Suri transmission and for ore movement, therefore, there was no sanctity for number 14. It was pointed out that even German Railway prototype ordering is usually for 6 to 12 locos. This was also discussed with M|s. Meybach, who indicated that they

were not prepared to consider any developmental order for less than 10 transmissions. They were requested to keep the number as 6 to 8 as these were prototype."

1.146. On the question of the number of prototype locomotives to be acquired for any R&D programme, the Ministry of Railways have, in their supplementary memorandum furnished to the Committee in February 1978, stated as under :

"The number of prototype locomotives to be ordered of any given series is determined by the following considerations :

(i) Optimum number for equitable distribution of development cost by the manufacturers and economic batch for production.

(ii) Desirability to acquire as wide-based an experience as possible in order to evaluate all relevant factors before series production is taken up.

(iii) Need for ensuring that the development is not vitiated by unforeseen hold-up to locomotives on account of sudden lay-offs because of accidents, failure of equipment, etc.

In this connection, it is pertinent to point out that even in the days of steam locomotive development, 15 prototype WP steam locomotives were imported and tried out in service prior to large scale import/manufacture. Again, at the time of development of low horse power Suri transmission, 7 prototype WDS-3 locomotives were ordered. Later, 10 ZDM-2 Narrow Gauge locomotives fitted with this transmission were ordered as prototypes for providing the locos and transmission application on Narrow Gauge sections. Even abroad the number of prototypes of Krauss-Maffei 4000 HP Diesel Hydraulic locos ordered by Southern-Pacific Railwys in the USA at a time when US Rail Roads were wanting to develop a high horse power locomotive was six.

In the case of 15 prototype WP steam locomotives, the boiler, entire valve gear, engine frame were completely of new design for the Indian Railways. In the case of the 7 prototype WDS-3 locomotives, the hydraulic transmission was new although the power pack had been in regular use elsewhere. In the case of the 10 ZDM-2 NG locomotives, although the power-pack was tested, the transmission and complete configuration of the NG locomotive was a new concept, providing for the most powerful locomotive for such a gauge in the world. In the case of the Krauss-Maffei diesel hydraulic locomotives ordered by the South Pacific Railways in the U.S., the engine transmission and final drive were completely new to the U.S. Rail Road system.

The Member Mechanical, Shri M. M. Khan, in his note of February 1966, had while suggesting use of Alco engine envisaged procurement of 8 locomotives with Suri transmission and 2 with a comparable Mekydro transmission. At the Board meeting of 9-6-1966 when the decision to develop the Suri

transmission on a 2600 HP loco instead of a 5000 HP loco earlier visualised, was taken, the number of locos envisaged was seven, 5 with Suri transmission and 2 with Mekydro transmission. The manufacturers who ultimately agreed for the development of the transmission, initially indicated the minimum number of locomotives as ten (10), this number was brought down to 6 with the new (Suri) transmission and 2 with comparable Mekeydro transmission as a result of negotiations. From the point of view of usage, for the specific services for which they were justified, a bare requirement for one ore train between Hospet and Madras was 4 locos and with repair allowance, five. Allowing for unforeseen set-outs due to accidents etc., the minimum number to be ordered could not be less than 6 with the Suri transmission."

1.147. In relation to the observations made by the then Chairman, Railway Board, in August 1976 at the time of tendering evidence before the Committee that 4 locomotives was a reasonable number for prototypes, a representative of the Ministry of Railways deposed in March 1978 as follows :

"The number that had been quoted in discussions last year as the minimum requirement was stated as anywhere between 2 and 4 or like that. The choice of the number of locomotives was guided by three principal factors. Firstly, the distribution of the development costs which were involved therein; secondly, to have as wide based an experience as possible, and thirdly, the development programme should continue unaffected in case some of the locomotives were laid off due to mishaps such as accidents, etc. The minimum requirement of locomotives for running one train per day on Madras Hospet section, having to run double headed, was 4. Allowing for one spare the minimum requirement was 5; therefore, procurement was restricted to 6 locomotives of the new design; two more locomotives were ordered with Mekeydro transmission as comparators. In this connection I would draw your attention to previous procurement of prototypes. As far back as 1952, when we purchased WDS-3 we procured 7; even earlier when we were in the steam age (WP locomotives from the United States), we procured 15. In the Southern Pacific Rail Road of the United States when they went in for high-up locomotive for traction, 6 prototypes were procured. So the number of locomotives we procured for this was governed by the factors I mentioned and the requirement of 6 plus 2 for comparison was not high."

Scrutiny exercised by the Ministry of Finance

1.148. The Committee desired to know what sort of scrutiny was made by the Ministry of Finance when requests from the Administrative Ministries for foreign assistance were received. The representative of the Ministry of Finance stated :

"In fact, this is the normal practice in our department that every year as we deal with a number of credits, and ahead of the year to

come we make enquiries from various administrative ministries about their possible needs to enable us to plan as to how we can go about it. We ask the ministries questions from the administrative and financial angles, namely, whether the project has been cleared by the Planning Commission, whether it is included in the Budget, whether investment decisions at the appropriate level have been taken, whether the import needs have been cleared by the DGTD and so on, but in the matter of an option of choice between two processes, you will appreciate we are not in a position to make any choice."

1.149. Asked as to who had taken initiative in the present case the Member Mechanical stated (August 1976) :

"We had approached the Ministry of Finance with this proposal that we wanted to get these locomotives from Germany and we did get clearance from them. As far as requirements of these locomotives are concerned, this was part of the scheme... these locomotives were going to be used for a particular purpose also. We wanted to try out these locomotives because we thought that it was going to be economical and we are also going to use them for a particular purpose."

1.150. Clarifying the position further the Chairman, Railway Board stated (August 1976) :

"....these locomotives were part of our project requirement primarily, and the Railway Ministry had approached the Finance Ministry for this credit. So, the requirement for these locomotives was against the specific programme of traffic movement. That is quite clear. The only thing was, while getting them, that opportunity was taken to get locomotives with the Suri transmission, and that was all taken up not in strict terms as development or research programme, because there was no programme like that. These locomotives were procured against the traffic requirement and the credit was also obtained for that. But while getting locomotives, an effort was made to get Suri transmission and make use of it for our purpose."

1.151. In a note, the Ministry of Railways have also stated (1978) :

"The WDM-3 locomotives had been procured against a specific project and were, therefore, initially confined to a heavily graded section, which resulted in continuous near-maximum output operation, which contributed to over-strain and frequent breakdowns. Keeping in view the limitations of trailing loads and strain on the power back on account of operation over these sections, the locos were subsequently used to haul the Bridaban Express between Madras and Bangalore where speeds attained were higher and the advantages of the transmission could show up better. On this service, the improved efficiencies were demonstratably realised in lower fuel consumption. The use of these locomotives on passenger trains

could not be continued, for, when permission for this change-over was obtained from the German Credit Bank, the reliability of the locomotives had already been seriously affected due to non-availability of imported spares."

1.152. The Committee drew attention to the following observations in the Audit paragraph :

"The desirability of developing Suri transmission with proven locomotives already in use viz., ALCO was not pursued because of the apprehension that utilisation of ALCO engines of American make with Suri transmission to be developed by M/s. Baybach of Germany might not be looked at with favour by the German Credit Loan authorities, even though the Railway Board was aware at that time that ALCO had collaboration with Mak of Germany for manufacture of diesel hydraulic locomotives and Mak held the licence for Suri transmission."

1.153. Referring to the above observations, the Committee asked about the basis of the apprehension that the utilisation of the German Credit implied that Railways had had to deal with a particular German firm. The representative of the Ministry of Finance stated :

"First, I would like to say that at that point of time German Credit was available only to purchase German goods and services. In other words, we could not have used German Credit for any other purchase, say from America..... We, at no point of time, were asked whether there would be any problem in getting ALCO locomotives from America to be matched to the Suri transmission by M/s. Maybach. And this proposition was never put to us, nor have we ever advised that there was any apprehension. If the Railway at that point of time wanted to try this locomotive—which is mentioned in para 8.22(b), that is, '(iii) 2600 horse power locomotives fitted with ALCO engine and Suri transmission'—which was the alternative which was ruled out—there would have been no problem from the foreign exchange angle. There had neither been a query from the Railways nor any advice from us that this was not possible because it would jeopardise the German credit. At that point of time adequate American credit was also available. There was no problem to find foreign exchange if a proposition of that kind had come."

The witness further added :

"There EXIM loans were arranged for DLW Varanasi. The locomotives were to be manufactured in collaboration with ALCO. Three US AID loans were also arranged for purchase of diesel electric locomotives. At that point of time, U.S. aid was of the order of Dollars 344 million in 1964, 292 million in 1965, 167 million in 1966 and 394 million in 1967 and so on. I am mentioning these figures to show that there was no difficulty in our arranging for the import of American locomotives if that was considered a necessary alternative."

1.154. Giving his reaction to the observations made by the representative of the Ministry of Finance, the Member Mechanical stated (August 1976) :

> "The development of the Suri transmission was to be matched with their power-pack and the ALCO people said that they were not interested to develop that unles they got readymade transmission available..... The diesel and electric locomotive manufacturers had nothing to do with the hydraulic system. In America, hydraulic system was not developed and so, they said that they were not in a position to manufacture the hydraulic system. But if somebody was ready to give the readymade system, they were ready to try it."

1.155. When the Committee pointed out that the possibility of Indian fabrication was there because of the collaboration with ALCO, the Member Mechanical stated (August 1976) :

> "The ALCO were not in a position to make transmission. The transmission was to be made in Germany. 12 years ago, the industrial base in our country was not sophisticated to be able to produce the transmission of 2500 HP. Of course, the picture is different today."

1.156. When the Committee pointed out that it appeared from the Audit para that the main reason for going over to the German firm was the facility of German loan, the Member Mechanical stated :

> "We went to them because they were the only manufacturers. Nobody else in the world at that time were there who could produce that transmission."

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1.157. Since it had been contended that WDM-3 locomotives were ordered as a pilot project for development of Suri transmission and for ore movement, the Committee desired to know whether any scientific trials were carried out with a view to evaluate the performance of those locomotives by any scientific tests in a systematic manner. In a note, the Ministry of Railways have stated :

> "On receipt of WDM-3 locomotives in India, riding stability and oscillation tests were conducted by RDSO on one locomotive to ascertain its behaviour on Indian track. These tests were carried out in December 1970/January 1971 upto a speed of 135 km/h on normal main line track. During these investigations, transverse force exchanged between the axle box and the bogie frame, vertical and transverse accelerations in the locomotive cab, wheel load variations and bogie rotation were monitored. These investigations indicated stable and comfortable riding quality of the locomotive upto the speed tested. The results of these tests are indicated in RDSO Report No. M-281.
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> In regard to the performance of these locomotives as regards power output rating, tractive effort and draw-bar pull characteristics and working of auxiliaries, controls etc., these have been assessed on the basis of their actual service performance. It has been

observed that although the power output and load haulage characteristics were according to the design expectations, a number of problems in regard to engine and transmission working cropped up from the very beginning. The transmission problems related to failures of converter turbine blades, mechanical clutch plates, circuit changeover controls and coupling system between the engine and transmission. On account of these problems, the locomotive ineffectiveness has been consistently high and a number of design modifications as desired by the makers have to be tried out from time to time. Ultimately, the designers of the transmission have advised that the mechanical clutch portion has to be isolated and the changeover from stage I to stage II in direct drive has to be kept inoperative since they are unable to solve the design problems associated with these and, therefore, cannot obtain consistent, reliable and trouble-free operation from them. The present position is that Suri transmission has to work like the conventional Mekydro hydraulic transmission with the mechanical clutch inoperative.

Prototype locomotives had also been tested by the makers before despatch from Germany in regard to their riding behaviour, output rating and other general performance parameters. In these tests, the performance of the locomotives in regard to riding stability and of powerpack in regard to output rating was found to be according to the design expectations. The following are extracts of the conclusions recorded in the Test Report compiled by Henschel to cover these tests :—

'In conclusion it can be said that the extensive tests have proved that the performance of the WDM3 locomotive is satisfactory.

The running behaviour of the locomotive is excellent, the torsional virbrations being negligible. A number of deficiencies could be detected and removed during testing, as was provided in the specification'.

It is thus seen that although the locomotives came up to the design expectations as far as performance output is concerned, the powerpack has not been able to maintain a satisfactory performance level consistently in actual service—both the transmission and the engine having been beset with a number of problems culminating in the isolation of the mechanical portion of the transmission and the changeover mechanism from stage I to stage II in the direct drive of the transmission."

1.158. In a Memorandum submitted to the Committee, the inventor of the Suri transmission, who also gave evidence before the Committee, while referring to the Research and Development aspect of the work has stated as under :

"Personally I believe that over-confidence in the German engineering led to pressing these locomotives much too early into regular freight service. These locomotives were for Research and

Development and they should have first undergone total Dynamometer trials which would have established the performance (good or bad) of each of the elements, the diesel engine MD-1080, its fuel consumption under Indian conditions, the transmission and all other auxiliaries including radiator systems etc. We would then have established what performance improvements have been (or not) achieved and or what types of sections what fuel economies occur. The second stage of R&D programme would be to achieve reliability of all components and their trouble-free regular service. The first stage appears to have been jumped."

1.159. Commenting on Shri M. M. Suri ; observations the Ministry of Railways have, in a note furnished at the instance of the Committee *inter alia* stated :

"*Dynmometer Trials* : As per the practice of the Indian Railways, the RDSO is to take up evaluation trials on all new rolling stock received. In the case of locomotives, this consists of two portions, namely (i) Oscillation trials to assess the riding quality of the vehicular portion and (ii) Dynmometer Car trials to assess the power capability at various combinations of load and speeds.

In the case WDM3 locomotives also, evaluation trials were ordered on receipt of these locomotives. The first series of trials to evaluate the Oscilliational behaviour of the loco were carried out during December 1970/January 1971 *i.e.* within six months of the receipt of the first locomotive. The results of these tests have been published in RDSO's Report No. M. 281 (copies of which have been made available in reference to question No. 32, sent under Board's letter No. 76-BC-Genl./28 of 03-12-1976). Generally the trials exhibited exceptionally good riding characteristics at speeds upto 135 Kms./hr.

The Dynomometer Car trials could not, however, be programmed early due to pre-occupation of the Test Car housing the instrumentation. This delayed the programming of the trials and unfortunately, in the meantime, the locomotives had begun to show up defects, mainly in the diesel engine portion responsible for developing the engine power. Thereafter, the Railway could not certify availability of a power-back in good mechanical fettle to establish the rating and performance of the locomotives as a power unit under acceptable conditions could not be provided."

1.160. In the same note, the Ministry of Railways have further stated :

"The contribution of the RDSO to follow-up this Research and Development effort has been effected by non-availability of adequate testing facilities and attendant man-power back-up. This matter has been under the active consideration of the Ministry for some time and has been accorded a high priority recently. The Ministry have just now concluded an Agreement for World Bank Aid, which includes support for the setting up of a Diesel Engine

Development Organisation. This will progressively embrace the developmental activity in the field of transmission and controls. Within the present limitations, the Railway Board have ordered the setting up of a special R&O Team, which will monitor the developmental activity associated with "Suri Transmission". This team will also investigate and put up recommendations with regard to the possibilities of use of a diesel engine to replace the MD-1080, which has not performed satisfactorily on this locomotive. Due consideration will be given to the levels of reliability obtaining with alternate engines as also the possibility of their indigenous manufacture, in view of the increased industrial capability that has developed in the country in the intervening years."

1.161. Dealing with the procurement of WDM-3 locomotives as a purely R&D effort, a representative of the Ministry of Railways made the following submission before the Committee in March, 1978, when the representatives of the Ministry of Railways were allowed to appear before the Committee a second time :

"In so far as the Railway Board's intention of the procurement and development, I must submit that in the discussions which took place last year this particular aspect, namely, the research and development effort was not, in my opinion, sufficiently emphasised. I wish now to take the opportunity to correct the impression that might have been created. I will first of all read out to you an extract of the letter which we had written to the Ministry of Finance in which the Board have made it very amply clear that the entire process of obtaining foreign exchange for procurement of this locomotive was in pursuance of their effort to develop this hydro-mechanical transmission. The letter from the Joint Director (Finance), Railway Board and is dated 15th December, 1965. It is addressed to Mr. Subramaniam, Deputy Secretary, Ministry of Finance :

'It may be mentioned that the 5000 HP loco involves technological developments which are not yet fully tried out and it may be desirable to order a small number of locos initially, keeping also in view the need for a minimum order for economic production.'

Simultaneously we sent a memorandum to Finance Ministry for onward transmission to the German loan authorities from whom this loan was to come and in this memorandum also we made it quite clear that the purpose for which we are asking for a loan is for research and development effort for this transmission. I will again quote to you the relevant paragraph of the document prepared in justification of the loan :

'Since there is a large element of development of locomotives, *viz.* 2500 HP which is not in use for rail traction in the German Federal Railways for Suri transmission, if for any reason these locos become ineffective for any length of time,

particularly as the Indian Railways have to depend on imports for spares, the capital locked up in each 5000 HP loco will be much more than what would be the case in regard to 2500 HP loco. In the context of these two notes earlier the Railway Board had decided to purchase 5000 HP loco but later on they thought it was more productive to go in for 2500 HP loco with this transmission.'

Further in our advice to manufacturers, or to anybody who chose to tender according to our specifications when we called for tenders it has clearly been brought out that the locos were a developmental effort. I read it to you from the particular specification at the time of calling for tenders :

'The exact tractive effort characteristic curve will however be evolved subsequent to the development of the Suri/Mekydro transmission in consultation with RDSO, to take the maximum possible advantage of the installed power and adhesive weight.'

You will see from these three extracts— there are numerous other notings in this regard which I shall not burden you with— that the Railway Board made it clear to the Ministry of Finance to the German loan authorities and to the prospective tenderers that the sole purpose of procurement of these locomotives is for a research and development effort."

1.162. However, from the information made available to the Committee, the following facts emerge :

(i) In 1964, the procurement of these locomotives was indicated to the Ministry of Finance as part of Railways' development and modernisation programme in the Third Plan.

(ii) These locomotives were intended to cope with the heavy increase in traffic.

(iii) These locomotives were to be deployed for the export of ore of 'some million tons' through ports at Vizag and Madras.

(iv) These locomotives were to be deployed for handling additional traffic particularly coal, ore on high gradients and the procurement was justified on economic considerations.

(v) The use of the WDM-3 locos on passenger trains could not be continued because of the specific project under which they had been procured which limited their use for freight traffic.

(vi) The procurement of these locomotives was a part of the development programme of the Railways in the fourth and fifth years of the Third Five Year Plan, the finance for which was to be partly met out of German Credit.

(vii) In deciding to procure locomotive of 2500 HP one of the considerations was that the Railway Board would be able to obtain economic bids and locomotives of proven quality.

(viii) The loan agreement for the West German credit specifically stated that this was for modernisation and rationalisation of the railways' programme and that *inter alia* sound financial practices must be observed in the projects financed from the loan.

1.163. The Committee also understand that this particular project was appraised by the West German Credit authorities and this could be required for only in case of commercial loan investment and not in the case of R&D project.

1.164. The expenditure of about Rs. 3 crores on procurement of 8 WDM-3 diesel hydraulic locomotives from West Germany has been booked under DRF (Depreciation Reserve Fund) on replacement Accounts and not to Revenue to which normally Research and Development expenditure is allocable. It has been explained by the Railway Board that :

"the WDM-3 locomotives with Suri transmission were prototype locomotives in this horse power range to be put on line for the first time. Since the availability of funds was arranged from German Credit the development of these locomotives was linked with haulage of heavy trains of ore traffic and was shown as chargeable to Depreciation Reserve Fund."

GENERAL

1.165. The Committee desired to know the total loss suffered by the Railways on account of acquisition of 8 WDM-3 locomotives and how they were proposed to be used now. In a note, the Ministry of Railways have stated (1976) :—

"WDM-3 locomotives were ordered to develop application of Suri transmission in mainline locomotives. As such, they were experimental units. It is inherent in any R&D activity that all experiments may not be successful and that there will always be some failures. In hindsight it may be possible to find fault in a large number of design and research projects because of the constant accumulation and progress of knowledge that keeps on taking place. It has, however, to be appreciated that this advance in knowledge and technology is gained as much through R&D successes as through failures. As a matter of fact, many times it may be more important to find out what does not function rather than what does function.

The cost incurred in R&D activity, even if it does not culminate in success, cannot be classified as loss or infructuous expenditure. It is necessary for any technical organisation, including the Railways, to keep on trying new ideas and designs even though many of them may not come up to expectations and may have to be abondoned. The history of all technical progress is lined with a large number of unsuccessful ventures.

Procurement of WDM-3 locomotives has to be viewed in this light. As such, it should not be taken that the money spent on this experimentation is a loss incurred by the Railways. The gain has been in the shape of technological knowledge that a transmission system of the type tried out, even though holding potential from the efficiency point of view may not be able to reach levels of reliability and ruggedness required in railways operation where its application on main line higher power traction units is involved.

At present 4 out of 8 locos are stabled, requiring imported material for commissioning the same."

1.166. One of the reasons given by the Ministry of Railways for procuring WDM-3 locomotives from West Germany was that at that time (1966) there was no other diesel engine available in the market which could be used with Suri transmission. The Committee asked whether diesel engines are available today which are efficient and could be used with Suri transmission and if so, whether the Ministry now propose to develop Suri transmission in conjunction with a diesel engine of suitable type with a view to obtain the economies of fuel expected from the use of Suri transmission. The Ministry have stated :

"It is seen from records that MD-1080 diesel engine was selected for WDM-3 locomotive as—

1. the firm M/s. Maybach (now M/s. MTU) who were to undertake development of Suri Transmission were prepared to do so only if their own engine, i.e. MD-1080 was used in conjunction with the same.

2. from weight, space and power rating aspects, other engines of equivalent rating within the same size and weight were not available for being used in this particular application.

Diesel engines of other makes of rating equivalent to MD-1080 and having similar weight and space configuration may be available now. However, it has not been ascertained whether their makers will agree to their application and matching with the Suri transmission. Further, even if the engine and transmission can be matched and accommodated within the configuration of the WDM-3 locomotives, the question of having a Suri transmission in which the mechanical clutch operates with reliability will still arise. The designers (M/s MTU)) of the Suri transmission used on WDM-3 locomotives have indicated that mechanical clutch portion of the transmission has to be isolated as it is not able to perform satisfactorily. The transmission, therefore, operates as a pure hydraulic transmission. Fuel consumption of the locomotive with this will thus be like that with any other equivalent type of hydraulic transmission.

In view of our experience with Suri transmission and electric transmission already having been indigenously developed and giving satisfactory service, Railway Board do not propose for any further development of Suri transmission for high horse power locos."

1.167. During evidence before the Committee in March 1978, however, the Chairman, Railway Board stated :

"Some locomotives are still working. We would like to develop them. Because of the reservation that came in, it had more or less stopped the effort any further development. A fear psychosis overtook it. This is what we would like to avoid in R&D effort."

1.168. The Committee desired to know whether there was any proposal to recommission the stabled locomotives and if so, how and what will be the estimated total expenditure thereon. In a note, the Ministry of Railways stated (1978) :

"There is a proposal to review the commissioning of the 4 stabled locos after organising inputs for improving the position of four WDM-3 locos which are presently in use and watching the performance for some time. For these four locos presently in use initial inputs for the first year to the tune of approximately Rs. 60 lakhs will have to be made followed by annual recurring expenditure for maintenance spares of the order of Rs. 16 lakhs. Expenditure for commissioning the four stabled locos is likely to be higher and this will be estimated at the time of review."

1.169. The Committee desired to know whether the Railways ever consulted the inventor of Suri transmission in regard to the working of Suri transmission in the WDM-3 locomotives more particularly before they decided to dummy the Suri transmission and if not, the reasons therefor. The Ministry of Railways have, in a note, stated :

"Suri transmission used on WDM-3 locomotives has been designed, engineered and manufactured by M/s. Maybach (now M/s. MTU) who are also the designers of the diesel engine used on these locomotives. The entire power-pack supplied by MTU has been fitted into the design of WDM-3 locomotives by M/s. Henschel who are the prime contractors for development, manufacture and supply of these units to Indian Railways. In the contract with the firm there is a stipulation in regard to the Suri transmission which reads as under :—

'As regards the K-253 transmission (supplied by Maybach) the essence of the guarantee is that HENSCHEL shall take all necessary action so that the transmission as proposed, supplied or modified shall be a satisfactory system with performance not inferior to Maybach's type K-252 transmission. Considering that the transmission type K-253 is a new development of Maybach, HENSCHEL, therefore, reserve the right to carry out any modifications they consider necessary at their own cost to meet HENSCHEL's guarantee obligations'.

In pursuance of the right of the firm to effect any modifications considered necessary by them in the transmission, it has been conveyed by both HENSCHEL and MTU that the mechanical portion of the transmission is to be isolated and that the changeover from stage I to stage II in the direct drive is to be kept inoperative. It is learnt that they have decided on these modifications as it has not been possible for them to ensure consistent reliability in the system for a proper changeover from Stage I to stage II in direct drive and because of their experience having indicated that with the use of direct mechanical drive, the performance of the power pack is problematic.

The changes as suggested above by the firm have been effected as per the stipulations of the contract. However, the firm has been asked to advise how the performance of the modified Suri transmission is to be brought on par with that of the Mekydro transmission in accordance with the requirements of the contract. The firm has not yet been able to give a final advice on this and the matter is still current with them.

The matter is being pursued with the firms as per contractual stipulations. Shri M. M. Suri is the inventor of the 'idea' of hydromechanical transmission and actual development and detailed design were entrusted to M/s HENSCHEL and MTU. Shri Suri after leaving Government service and starting his private business has not taken interest in the development of Suri transmission."

1.170. The Committee desired to know whether Suri transmission had been tried on any other locomotive in some other countries. The inventor of the Suri transmission stated in this connection :

"No other country will take on this locomotive development from one country unless it has been run and proved in that country.

Germany bought it. But when they went to Poland and Turkey to sell the locomotives, they came across the commercial hurdle that the Indian Railways were not going ahead with it."

1.171. The Committee enquired from the inventor of the Suri transmission as to what were his practical suggestions to make the Suri transmission operative on the WDM-3 locomotive. The witness stated :

"The Railways must decide to form a group development team. That might be under a leader whose capability the Railways themselves are confident about. If I may be permitted to say something I should say that the railways can have two or three people who are motivated and are trained with this transmission, who know the transmission, who know the design and so on. In this case, all those people who have been dealing with the locomotives in the Southern Railway have no knowledge about their design.

The second thing is that if we are not successful with one engine, we should make a serious attempt to get another engine. But even if we fail in this regard, the experiment should go on with the full knowledge, that if this engine fails or breaks down, if this diesel engine is found to consume more fuel then it should be ultimately scrapped and we should go in for another engine. The performance of this engine should not meanwhile cloud your judgment in assessing how the rest of the parts of the locomotive are working."

He added :

"Now it is the diesel engine of the locomotive which had been giving a lot of trouble on both Suri and Mekydro. It is on record that the diesel engine consumes ten per cent more fuel. If you want a reliable locomotive, efficient locomotive, you change the diesel engine; that is the first conclusion that anyone would take."

1.172. In reply to a question whether it was a fact that the Suri transmission had not been given a proper trial, the witness stated :

"It has not been given the nursing that any development needs. It has not been given a chance to be tried by people who might matter. I can name a number of people in the Indian Railways who are capable of analysing it."

1.173. The Committee pointed out that several reasons had been given for the failure of Suri transmission. Among them one was that a new transmission was tried on a new engine and the locomotives had been tried on freight trains which were run on a high gradient section and not on passenger trains where the locomotives recorded better performance. The Committee asked whether the Ministry of Railways had made a deliberate mistake in trying it out the wrong way or was there any inherent defect in the design because of which the results were not upto expectations. The inventor of the Suri transmission stated during evidence :

"After their trial, the German engineers were very happy that the things were going very nicely. When the trouble started, they should have analysed same of the things which I am saying It was recorded on the file that 5000 HP locomotive was meant for fast passenger trains or freight trains on level sections, but it was tried on the wrong section. I have no intention of saying that the Board were taking deliberately wrong decisions at that time. I am only saying that the Germans even went on record saying that this would pull as much weight as ALCO's but it was not correct because ALCO had got more power. This loco was literally thrashed to its limit on up gradients in the heavy gradients section. Even at that time they could have diverted it to the passenger trains and if they could have discovered something good, they could have fortified it in that direction. It was tried on the passenger trains and it was proved that it would save fuel. There is no reason why it should consume so much fuel on the freight trains. I would suggest that these locomotives

should be tried on Howrah-Madras section and then the fuel consumption seen. It is rather meant for plain section for freight. But if it had given some trouble on the high gradients section, normal corrective actions should have been taken. In the 1971-73 period, the Germans were saying that every-thing was all right; it had teething trouble which would be over soon. It is only when the warranty period was over that the actual trouble started and they came with the suggestion of blanking off."

The witness further stated :

"There is only one thing with the German manufacturers, that they lost interest in it because they saw no commercial future in this here. But diesel electric lobby is very strong so much so that the diesel hydraulic is almost being thrown aside."

He further added :

"German did try to make a number of proposals to get into the diesel electrics but they could not. Now BHEL is having its own electrical equipment. So, it is also one more point that if diesel electrics are to be developed, we can get equipment from the BHEL.

The biggest threat of this particular locomotive is to the diesel electric of the same horse power i.e., ALCO which is already under collaboration here. Once a collaborator is already here, he is all the time trying to show that anything else being developed is wrong especially if it leads to replacement. And on the hydraulic side, R&D facilities were not created to test hydraulic transmission."

1.174. The Committee find that eight WDM-3 locomotives were procured by the Railways from a West German firm with the objective of developing Suri transmission for high speed traction with a view to obtaining operational efficiency and fuel economy. The total expenditure booked upto August 1975 towards the cost of these locomotives was Rs. 3.37 crores. Out of the eight locomotives, six had been equipped with Suri transmission and two with Mekydro transmission. Four out the six WDM-3 locomotives equipped with Suri transmission had to be stabled within a very short time of acquisition. Apart from the four locomotives having to be stabled, the Suri transmission had been blanked off by the manufacturers on the ground that the transmission system was responsible for the poor performance of the locomotives. Thus the objectives of purchasing 2500 horse power locos (WDM-3), namely, development of Suri transmission for high speed traction with a view to obtaining operational efficiency and fuel economy have not been realised. The circumstances leading to this purchase of eight WDM-3 locomotives are discussed in the subsequent paragraphs.

1.175. The Committee find that Suri transmission was first used in seven 650 horse power diesel shunting-cum-shuttle service locomotives which were developed and manufactured by M/s. Mak of West Germany.

These locomotives placed in service during 1961-62 were not giving good performance. The Committee were informed by the Chairman, Railway Board in August 1976 that trials had been going with 650 horse power locomotives when a decision was taken that "they should go in for a higher horse power engine as Suri transmission was more beneficial at higher speeds." According to the Member Mechanical who deposed (August 1976) before the Committee, the conclusion that 5-9 per cent savings in fuel consumption, if Suri transmission was used in higher horse power locomotives was "just a theoretical conclusion", although in a very general manner he added that "initially with every new unit one does experience trouble, e.g., with all our steam locomotives and the diesel ones, we always had some trouble or the other". However, in their supplementary memorandum furnished in February 1978 the Railway Board stated that consequent to the "successful trials" with Suri transmission in low horse power locomotives it was proposed to develop this transmission for higher horse power range for main line applications. The Railway Board could not furnish a precise evaluation, as asked for by the Committee, of the benefits derived by installation of Suri transmission in low horse power low speed diesel shunting locomotives to prove that higher efficiency and fuel savings in the use of Suri transmission had been successfully established before it was decided to go in for development of this transmission in higher horse power locomotives. In fact the result of the trials of Suri transmission on low H.P. engines were not available when the decision to go in for higher H.P. engines with Suri transmission was taken.

1.176. Between 1962 and 1964 the Railway Board considered the question of the procurement and development of Suri transmission in 5,000 horse power locomotives or alternatively in 2500 or 2600 horse power locomotives. In September 1964, the Railway Board issued tender enquiries to some West German firms for procuring 5,000 horse power locomotives because efforts were then being made to procure West German credit. The offers of the two West German firms received in response to these tender enquiries were examined by a Technical Committee appointed in June 1965. That Committee on various considerations came to the conclusion that no economic benefits of capital and maintenance costs could be expected of 5,000 horse power locomotives as compared to those of dual coupled 2600 horse power diesel locomotives of ALCO design. In June 1966, the Railway Board decided that taking all factors into consideration, procurement of 5,000 horse power locomotives for developing Suri transmission could not be justified and since the standard B.G. locomotive on Indian Railways was of 2600 horse power, the Board felt that it should be possible to design and fit 2600 horse power Suri transmission in a diesel locomotive of equivalent horse power. It was accordingly decided that it would be more prudent to go in for 2600 horse power locomotives rather than for 5,000 horse power locomotives. The Railway Board then decided to procure six or eight number of 2600 horse power Co Co type locomotives fitted with medium speed engines and Suri transmission and for this purpose a senior Mechanical Engineer of the Railways was deputed West Germany to have informal talks with the representatives of the firms concerned and the German Credit Loan Authorities for obtaining their reaction to the proposal of procuring 2600 horse power locomotives instead of 5000 horse power locomotives. In the light of the

report of the Mechanical Engineer of Railways deputed to West Germany, the Railway Board decided in August 1966 to procure 2500 horse power 8B 19 tonne axle load mixed service locomotives with high speed Maybach MD 1080 diesel engines and fitted with 2500 horse power Suri/ Mekydro transmission.

1.177. In this connection, the Committee, however observe that the report of Railway Engineer deputed to West Germany was nothing but a record of the discussions he had with the representatives of various firms, the German Federal Railways and the German Credit loan authorities. Obviously what the Railway Engineer had done was that he had recorded what he had been told by the German firms in regard to the "ease of manufacture and maintenance of 4 axle BB type locomotives, lower cost of BB type of locomotives compared to the Co Co type", unsuitability of a six axle locomotive such as ALCO for the development of Suri transmission, the high expectations about the performance of 20 cylinder MD engine proposed to be used in the locomotives. There is no evidence to show whether the assertions made by the West German firms about the performance of their locomotives/diesel engines were subjected to any critical scrutiny either by the Engineer deputed to West Germany for negotiations with the firm or by the Railway Board or by any competent technical body with a view to arrive at some rational conclusions.

1.178. The Committee find that the Railway Board's main argument in support of their decision to go in for 2500 horse power BB type locomotives for development of Suri transmission had been that as the hydraulic transmission had been developed only in West Germany, the development of Suri transmission could be done by one of the leading hydraulic transmission manufacturers in the West Germany. Further, the only established firm in West Germany who offered to develop this transmission was M/s. Maybach and this firm was agreeable to develop the transmission only if their own Maybach engine was used. The choice of the manufacturer was thus restricted to only one firm and the choice of the diesel engine to be used in conjunction with the Suri transmission also go restricted because the firm made it a precondition that they "would not be interested in developing Suri transmission alone without matching it with their engine as they would not be able to guarantee performance with any other engine in the developmental stages."

1.179. The Committee note from the evidence and subsequent written information submitted in 1976 by the Railway Board as follows :

(i) The Member Mechanical in August 1964 had indicated that 2500 HP high speed Maybach engines which were still under developmental stage would introduce additional element of trial on the same locomotive. However, the Railway Board ruled out the ALCO locomotives, for the time being, for the development of Suri transmission, as M/s. ALCO were unable to develop the transmission themselves and were prepared to undertake this only after the Suri transmission had been fully developed.

(ii) One of the members of Technical Committee constituted by the Railway Board in July 1965 pointed out that building of 2500 HP locomotive with Suri or any other hydraulic transmission should present no problems, as 2600 HP locomotive (ALCO) was already being manufactured in the country. This suggestion had also been accepted by the then Member Mechanical.

(iii) Again in February 1966 the then Member Mechanical opined that the best and the safest course would be to go in for prototype locomotives both with ALCO and Maybach engines for development of Suri transmission which incidentally would provide an adequate means of comparison with 2600 HP ALCO locomotives already in use with the Indian Railways. Thus the Member Mechanical on three different occasions considered trial of Suri transmission with ALCO engine as technically feasible.

(iv) The above proposal (February 1966) of the Member Mechnical was not favoured by the subsequent Member (April 1966) on the ground that this would involve a de novo examination of the matter and would thus cause delay in the finalisation of the proposal being negotiated with the German firm. In other words the Member Mechanical on April 1966 ruled out trials of Suri transmission with ALCO engine on consideration other than technical

(v) The final decision was based on the Railway Engineer's visit to West Germany (July-August 1966) who pointed out that M/s. Maybach was the only firm in West Germany who offered to develop Suri transmission provided their own Maybach engine was used.

(vi) Another important reason for procurement of diesel locomotives from West German firm is that the procurement was to be financed by West German Credit and that the West German credit loan authorities would not approve of procurement of locos from sources other than West Germany. On this point the representatives of the Ministry of Finance had however clarified in evidence that "there would have been no problem from the foreign exchange angle" if the Railways decided to go in for 26000 HP locomotives fitted with ALCO engine.

1.180. In their supplementary memorandum and during fresh evidence (February-March 1978), the representative of the Railway Board stated :

(1) The selection of West German locomotive WDM-3 became inevitable as the ALCO did not give a positive response to the suggestion of undertaking development of the Suri transmission.

(2) The choice of locomotives for development of Suri transmission was restricted to West Germany as there was virtually no other country in the world where diesel hydraulic transmission had been developed.

(3) The ALCO locomotives with 6 axles and heavier 2600 HP ALCO engine were technically unsuitable for the development of Suri transmission. Within the limited permissible axle load, the use of the heavier 2600 HP ALCO engine necessitates use of 6-axles divided into two 3-axle bogies. With hydraulic transmission, the transfer of power to the axles is made through a cardon shaft and gear boxes, and development of an arrangement for distributing power from a single transmission to two 3-axle bogies presented serious technical problems. The Committee, however, must record that the then Member Mechanical on four different occasions (1964, 1965, February 1966 and April 1966) dealt with this matter and did not consider trials of Suri transmission with ALCO engine as technically unsuitable. Again this was not the ground on which the final decision to procure the Maybach engine was taken in August 1966.

(4) The question regarding selection of Maybach engine for use in conjunction with Suri transmission had been examined by the High Power Committee and it was accepted as the most suitable form of engine which could be adopted for development of Suri transmission.

1.181. The Committee find that while keeping in view the West German firm's advice against 6-axle loco with single Suri transmission and insistence of M|s. Maybach for use of their engine as brought out in the Railway Engineer's report, the Railway Board took the decision in regard to use of Maybach MD 1080 diesel engines disregarding the following points :

(a) The Maybach MD 1080 diesel engine had not till then been installed in any locomotive and had undergone bench tests only.

(b) Prototypes of this engine had not undergone trials under Indian conditions nor had this engine been tried in Germany or anywhere else.

(c) The past experience of the Indian Railways in regard to the performance of Maybach engines on WDS-3 and ZDM-2 locomotives was not satisfactory.

(d) The Technical Committee appointed by the Railway Board in 1965 to examine the offers of 5000 HP locomotives and the 20 Cylinder Maybach MD 1080 series engine had given only qualified approval by saying that there would not be "undue risk" in going in for these engines.

(e) In the Railway Engineer's report of 1966 there was no positive statement in regard to the performance of these engines. It had only been mentioned that "M/s. Maybach had stated that their modified 20 cylinder MD engine would be a good trouble-free engine" and that "the German Federal Railways stated that they were quite satisfied with the performance of Maybach engines but they needed greater amount of attention and skill".

1.182. The Committee also find there were some other features in the agreements entered into with the West German firm, which were not completely free from criticism. One such matter related to performance guarantee. It is seen from the Audit paragraph that in 1964 itself the Railway Board had indicated that adequate guarantees on the performance of the Locomotives, engines and transmission should be forthcoming. In regard to the guarantee actually obtained the Chairman, Railway Board stated in evidence (August 1976) that "Their guarantee, according to the agreement, was worded in such a way as to mean that they were responsible only for metallurgical failures and manufacturing defects of the components, but there was no performance guarantee included in the agreement. Therefore, it has become difficult to pinpoint them for any other deficiencies." However, the Railway Board in their supplementary memorandum of February 1978 have maintained that "Extensive guarantee terms had been included in the contract with the suppliers."

1.183. It is not clear to the Committee as to what extensive guarantees were obtained if these did not cover the performance of the locos, the engine and the transmission system and were confined to material, manufacturing and design defects of components. In regard to Suri transmission (Hydro-mechanical) the guarantee obtained from the manufacturers provided that its performance would not be inferior to the Maybach type K 252 transmission, i.e., Mekydro (hydraulic). The manufacturers have not been able to ensure even this part of the guarantee, in that the performance of the locomotives even after Suri transmission was modified to make it comparable to Mekydro transmission (hydraulic) have not shown any improvement. The performance expected for the Maybach engine and Suri transmission in terms of fuel saving and their availability was not incorporated in the agreement. Inspite of the uncertainties and misgivings about the performance of these locomotives, why performance guarantee for the locomotive as a whole including the untried engine and transmission system was not obtained from the manufacturers is a matter which mystifies the Committee.

1.184. It has been argued by the Ministry of Railways that since the locomotives were built as per specifications drawn out by RDSO, after considering the engine characteristics advised by the manufacturers, it was not feasible to have an overall performance guarantee for the entire locomotive from the manufacturers for a trial locomotive being built at our instance and to our specifications. It is to be noted in this connection that what was under trial in these locomotives was the transmission system and not the Maybach diesel engine, whose performance could and should have been covered by adequte guarantees enforceable at the instance of the Railway Board.

1.185. The Committee further find that no penal clause had been included in the agreement with the West German firm under which the Railways could recover the additional expenditure incurred due to failure of the engine or the transmission system. In the absence of such a penal clause the Railways cannot claim any compensation for the additional expenditure incurred due to inadequate performance of either the engine or the trans-

mission system although so far as manufacturing defects or design defects are concerned, M/s. Mak have been removing these defects without charging to the Railways.

1.186. The Committee learn that out of the eight locos 4 have been stabled requiring imported material for commissioning the same. The Ministry of Railways have stated that for improving the position of four locos presently in use initial inputs for the first year to the tune of approximately Rs. 60 lakhs will have to be made followed by annual recurring expenditure for maintenance spares of the order of Rs. 16 lakhs and the expenditure for commissioning the four stabled locos was likely to be higher. It is thus to be seen that besides the initial investment of about Rs. 3 crores on the acquisition of these locomotives, the Railway Board will have to incur huge expenditure to bring these locos in proper order and keep them fit for operations. But what distresses the Committee is that Mr. Suri himself pointed out that it is the fault of the Railways in putting these locomotives straightway in use without making any research. Mr. Suri had further observed that "the heavily graded section chosen viz., Guntakal-Madras was incorrect for a light WDM-3 locomotive of 4 axles, expecting to replace the 6 axled ALCO locomotive of greater horse-power and greater weight. On this section the WDM-3 loco was literally thrashed to it limit on up gradients which is not good for any newly developed complex machine. Since WDM-3 were allotted against regular locomotive requirements the Southern Railway desired to get the same haulage as from ALCO locomotives and met with frustration." Explaining the reasons why the WDH-3 locomotives were used on heavily graded sections, the Railway Board have stated that these locomotives had been procured against a specific project and were therefore initially confined to a heavily graded section. For use of these locomotives on passenger trains the permission of the German Credit Bank was required and by the time permission for this change over was obtained, the reliability of the locomotives had already been seriously affected due to non-availability of imported spares.

1.187. In the light of the above the Committee were distressed to learn from the Railway Board in 1976 that in view of their experience of Suri transmission they did not propose any further development of Suri transmission for high horse power locos, as electric transmission has been indigenously developed and giving satisfactory service.

1.188. The Railway Board have stated that the WDH-3 locomotives had been procured under a Research and Development Programme for the exploitation of the concept of Suri transmission and that the infructuous expenditure should be viewed in this background. In this context it is to be noted that the then Chairman, Railway Board, while giving evidence before the Committee in August 1976 made a categorical statement to the effect that there was no R&D programme but the locomotives were procured against the specific programme of traffic movement and the credit was also obtained for that. The only thing was that while getting them opportunity was also taken to get locomotives fitted with Suri transmission. As to whether a research programme could be financed under the terms of the German Credit under which the locomotives were purchased, the representative of the Ministry of Finance deposed before the Committee

(1976) that 'the proceeds of the loans were exclusively for the payment of foreign exchange cost of Indian Railways for modernisation and rationalisation' Inspite of the Railway Board Chairman's categoried statement of 1976 to the effect that there was no R&D programme, the Railway Board, in 1978, attempted to clarify it further by stating that the whole thing was a development project which was used from the commercial angle as the German loan conditions required it and to that extent it was a R&D project with a little commercial bias. The Railway Board have also stated that they would like to develop these locomotives and there was a proposal to review the commissioning of the 4 stabled locomotives after organising inputs for improving the position of 4 WDM-3 locomotives which are presently in use and watching their performance for some time. The Committee, however, are not able to understand why the proposed review for commissioning of the 4 stabled locomotives was not undertaken earlier as these locomotives had been stabled since 1975-76. The Committee would like that responsibility for this lapse may be fixed.

1.189. From the information made available to the Committee the following significant facts clearly emerge :

(i) In 1964, the procurement of these locomotives was indicated to the Ministry of Finance as part of Railways' development and modernisation programme in the Third Plan.

(ii) These locomotives were intended to cope with the heavy increase in tariffic.

(iii) These locomotives were to be deployed for the export of ore of 'some million tons' through ports at Vizag and Madras.

(iv) These locomotives were to be deployed for handling additional traffic particularly coal, ore on high gradients and procurement was justified on economic considerations.

(v) The use of the WDH-3 locos on passenger trains could not be continued because of the specific project under which they had been procured which limited their use for freight traffic. For use on the passenger trains permission of the German Credit Bank was required. There could not be any such limitations on the use of locomotives if they were for R&D project.

The Committee are also unable to reconcile the statement of the Railway Board that the locomotives were for a research and development programme with their inability to deploy them on passenger trains for research and development.

(vi) The procurement of these locomotives was a part of the development programme of the Railways in the fourth and fifth years of the Third Five Year Plan, the finance for which was to be partly met out of German Credit.

(vii) In deciding to procure locomotive of 2500 HP one of the considerations was that the Railway Board would be able to obtain economic bids and locomotives of proven quality.

(viii) The loan agreement for the West German credit specifically stated that this was for modernisation and rationalisation of the railways' programme and that inter-alia sound financial practices must be observed in the projects financed from the loan.

(ix) This particular project was appraised by the West German Credit authorities and this could be required for only in case of commercial loan investment and not in the case of R&D project.

(x) The expenditure of about Rs. 3 crores on procurement of 8 WDM-3 locomotives has been booked under Depreciation Reserve Fund on replacement Account and not to Revenue to which normally Research and Development expenditure is allocable.

(xi) These locos were not put to rigorous and comprehensive tests which locos developed under an experimental research programme have to go through. In fact there were no research test facilities established by the Railways which were an essential prerequisite to the research development programme.

It appears that none of the above considerations could be relevant in a R&D programme but only for a commercial project. The Committee feel that it was primarily a commercial project for the Indian Railways and a research and development programme for the Germans. In fact, it appears that the German manufacturers in return for a loan to the Indian Railways, in effect were experimenting on a new loco and a new engine and a new transmission system at the expense of the Indian Railways.

1.190. Another exceptionable feature of the arrangement entered into with the West German firm was that the manufacturers imposed a condition that they would be interested in the supply of locomotives fitted with Suri transmission only if a minimum number of locomotives were ordered and in the process they were able to foist 8 locomotives fitted with their own untried engines on the Indian Railways. This was facilitated through the offer of an easy West German credit. The Committee further note that during evidence (1976) the Chaiman, Railway Board stated that "Perhaps 4 locomotives would have been the minimum number that was necessary". In their supplementary memorandum of February 1978 the Railway Board stated that the minimum number required was not less than six locomotives with the Suri transmission for the specific service in Madras-Hospet sections. The Committee is unable to understand that if the locos were for a research and development project, then how the number of locomotives required for manning a specific commercial service was relevant. Again the Committee feel that if two locomotives with Mekydro transmission were sufficient as comparators, only an equal number of locos with Suri transmission would have been enough for evaluation of performance.

1.191. The Committee find that an important consideration in the procurement of WDM-3 2500 HP (BB design) locos was that they would more or less perform what the WDM-2 2600 HP (Co Co design) locos, manufactured in this country, were performing and that with Suri transmission would give a higher efficiency and savings in fuel to the extent of 5 to 9 per cent. Actually the performance of the WDM-3 locos had been poor and were consuming 20 per cent more fuel as against the anticipated saving of 5 to 9 per cent. The Railway Board submitted (1978) that the actual performance of the WDM-3 engine under site conditions in relation to test bench results would vary from design to design and RDSO's comments with regard to inferior performance of WDM-3 under site conditions does not reflect the basis on which the choice of the engine was made. The Railway Board also stated that comparing something which was in use for 10 years with one in use for 10 months was not relevant, not desirable and not necessary. The Railway Board further stated that the two locomotives (WDM-3 and WDM-2) were tried in Brindavan Express between Madras and Bangalore, where the speeds attained were higher, and the WDM-3 locos showed 4 per cent lower fuel consumption than the WDM-2 locos. However, the use of WDM-3 locos on passenger trains could not be continued because of the specific project commitment which limited their use for freight traffic between Madras and Hospet. This fits in ill with the claim of the Railway Board in Supplementary evidence that this was a design and development effort. When permission for use on passenger services was obtained from the Geran Bank authorities, the reliability of the locos had impaired on account of non-availability of spares.

1.192. The Committee are unable to appreciate the reason for not comparing the WDM-2 locos with WDM-3 locos as submitted by the Railway Board in the Supplementary memorandum, when the locos had been procured on the understanding received from the manufacturer that the WDM-3 locos' performance would not be inferior to that of WDM-2 locos. The Committee note that the manufacturers have attributed the non-realisation of fuel saving to the configuration of the combustion chamber of the engine which resulted in the consumption of 10 per cent more fuel and that any possible advantage gained in transmission efficiency was likely to be offset, in fact over shadowed, by the lower engine efficiency. Again, the poor performance of WDM-3 locos had been ascribed to Suri transmission system but it did not show any improvement even after the Suri transmission had been blanked off in these locos. Even the performance of the locos equipped with Mekydro (hydraulic) transmission has been no better than that of the locos equipped with Suri transmission (hydromechanical) establishing thereby that the transmission system alone was not responsible for the failure or for the poor performance of the locomofives. In the context of the equally poor performance of the WDM-3 locomotives fitted with Sur transmission and the one fitted with the Mekydro, it is not unreasonable to infer that the main cause of trouble was the improper functioning of the untried diesel engine. Actually, the former Chairman of Railway Board admitted (1976) that when the Railway went for an altogether untried engine for 16 to 20 cylinders, perhaps some performance tests would have been held so that it did not run into difficulties.

1.193. The Committee, therefore, desire that an independent high powered Technical Committee be constituted with a view :

(i) to ascertain whether in the circumstances then prevailing selection of WDM-3 locomotives with Meybach engine was the correct choice ;

(ii) whether the assertions made by the West German firms about the performance of their locomotives/diesel engines were subjected to any critical scrutiny either by the Engineer deputed to West Germany for negotiations with the firm or by the Railway Board or any comptent technical body ;

(iii) whether there was any lapse in obtaining full guarantee terms from German suppliers; and

(iv) whether a fair trial has been given to these locomotives to prove their efficiency.

NEW DELHI;
April 17, 1979.
Chaitra 27, 1901 (*S*)

P. V. NARASIMHA RAO,
Chairman,
Public Accounts Committee.

APPENDIX

Conclusions and Recommendations

S. No.	Para No.	Ministry Concerned	Recommendation
1	2	3	4
1	1.174	Railway	The Committee find that eight WDM-3 locomotives were procured by the Railways from a West German firm with the objective of developing Suri transmission for high speed traction with a view to obtaining operational efficiency and fuel economy. The total expenditure booked upto August 1975 towards the cost of these locomotives was Rs. 3.37 crores. Out of the eight locomotives, six had been equipped with Suri transmission and two with Mekdro transmission. Four out of the six WDM-3 locomotives equipped with Suri transmission had to be stabled within a very short time of acquisition. Apart from the four locomotives having to be stabled, the Suri transmission had been blanked off by the manufacturers on the ground that the transmission system was responsible for the poor performance of the locomotives. Thus the objectives of purchasing 2500 horse power locos (WDM-3), namely, development of Suri transmission for high speed traction with a view to obtaining operational efficiency and fuel economy have not been realised. The circumstances leading to this purchase of eight WDM-3 locomotives are discussed in the subsequent paragraphs.
2	1.175	—Do—	The Committee find that Suri transmission was first used in seven 650 horse power diesel shunting-cum-shuttle service locomotives which were developed and manuafctured by M/s. Mak of West Germany. These locomotives placed in service during 1961-62 were not giving good performance. The Committee were informed by the Chairman, Railway Board in August 1976 that trials had been going with 650 horse power locomotives when a decision was taken that "they should go in for a higher horse power engine as Suri transmission was more beneficial at higher speeds." According to the Member Mechanical who deposed (August 1976) before the Committee, the conclusion that 5-9 per cent sarvings in fuel consumption, if Suri transmission was used in higher horse power locomotives was "just a theoritical conclusion", although in a very general manner he added that "initially with every new unit one does experience trouble, e.g., with all our steam locomotives and the diesel ones, we always had some trouble or the other". However, in their supplementary memo-

randum furnished in February 1978 the Railway Board stated that consequent to the "successful trials" with Suri transmission in low horse power locomotives it was proposed to develop this transmision for higher horse power range for main line applications. The Railway Board could not furnish a precise evaluation, as asked for by the Committee, of the benefits derived by installation of Suri transmission in low horse power low speed diesel shunting locomotives to prove that higher efficiency and fuel savings in the use of Suri transmission had been successfully established before it was decided to go in for development of this transmission in higher horse power locomotives. In fact the results of the trials of Suri transmission on low H.P. engines were not available when the decision to go in for higher H.P. engines with Suri transmission was taken.

3 1.176 Railways

Between 1962 and 1964 the Railway Board considered the question of the procurement and development of Suri transmission in 5,000 horse power locomotives or alternatively in 250 0 or 2600 horse power locomotives. In September 1964, the Railway Board issued tender enquiries to some West German firms for procuring 5,000 horse power locomotives because efforts were then being made to procure West German credit. The offers of the two West German firms received in response to these tender enquiries were examined by a Technical Committee appointed in June 1965. That Committee on various considerations came to the conclusion that no economic benefits of capital and maintenance costs could be expected of 5,000 horse power locomotives as compared to those of dual coupled 2600 horse power diesel locomotives of ALCO design. In June 1966, the Railway Board decided that taking all factors into consideration, procurement of 5,000 horse power locomotives for developing Suri transmission could not be justified and since the standard B.G. locomotive on Indian Railways was of 2600 horse power, the Board felt that it should be possible to design and fit 2600 horse power Suri transmission in a diesel locomotive of equivalent horse power. It was accordingly decided that it would be more prudent to go infor 2600 horse power locomotives rather than for 5,000 horse power locomotives. The Railway Board then decided to procure six or eight number of 2600 horse power *Co Co* type locomotives fitted with medium speed engines and Suri transmission and for this purpose a senior Mechanical Engineer of the Railways was deputed to West Germany to have informed talks with the representatives of the firms concerned and the German Credit Loan Authorities for obtaining their reaction to the proposal of procuring 2600 horse power locomotives instead of 5000 horse power locomotives. In the light of the report of the Mechanical Engineer of Railways deputed to West Germany, the Railway Board decided in August 1966 to procure 2500 horse power *BB* 19 tonne axle load mixed

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			service locomotives with high speed Maybach MD 1080 diesel engines and fitted with 2500 horse power Suri/Mekydro transmission.
4	1.177	Railways	In this connection, the Committee however, observe that the report of Railway Engineer deputed to West Germany was nothing but a record of the discussions he had with the representatives of various firms, the German Federal Railways and the German Credit loan authorities. Obviously what the Railway Engineer had done was that he had recorded what he had been told by the German firms in regard to the "ease of manufacture and maintenance of 4 axle BB type locomotives, lower cost of BB type of locomotives compared to the Co-Co type", unsuitability of a six axle locomotive such as ALCO for the development of Suri transmission, the high expectations about the performance of 20 cylinder MD engine proposed to be used in the locomotives. There is no evidence to show whether the assertions made by the West German firms about the performance of their locomotives/ diesel engines were subjected to any critical scrutiny either by the Engineer deputed to West Germany for negotiations with the firm or by the Railway Board or by any competent technical body with a view to arrive at some rational conclusions.
5	1.178	—Do—	The Committee find that the Railway Board's main argument in support of their decision to go in for 2500 horse power BB type locomotives for development of Suri transmission had been that as the hydraulic transmission had been developed only in West Germany, the development of Suri transmission could be done by one of the leading hydraulic transmission manufacturers in the West Germany. Further, the only established firm in West Germany who offered to develop this transmission was M/s. Maybach and this firm was agreeable to develop the transmission only if their own Maybach engnie was used. The choice of the manufacturer was thus restricted to only one firm and the choice of the diesel engine to be used in conjuction with the Suri transmission also got restricted because the firm made it a precondition that they "would not be interested in developing Suri transmission alone without matching it with their engine as they would not be able to guarantee performance with any other engine in the development stages."

6 1.179 Railways 1.179. The Committee note from the evidence and subsequent written information submitted in 1976 by the Railway Board as follows :

(i) The Member Mechanical in August 1964 had indicated that 2500 HP high speed Maybach engines which were still under developmental stage would introduce additional element of trial on the same locomotive. However, the Railway Board ruled out the ALCO locomotives, for the time being, for the development of Suri transmission, as M/s. ALCO were unable to develop the transmission themselves and were prepared to undertake this only after the Suri transmission had been fully developed.

(ii) One of the members of Technical Committee constituted by the Railway Board in July 1965 pointed out that building of 2500 HP locomotive with Suri or any other hydraulic transmission should present no problems, as 2600 HP locomotive (ALCO) was already being manufactured in the country. This suggestion had also been accepted by the then Member Mechanical.

(iii) Again in February 1966 the then Member Mechanical opined that the best and the safest course would be to go in for prototype locomotives both with ALCO and Maybach engines for development of Suri transmission which incidentally would provide an adequate means of comparison with 2600 HP ALCO locomotives already in use with the Indian Railways. Thus the Member Mechanical on three different occasions considered trial of Suri transmission with ALCO engine as technically feasible.

(iv) The above proposal (February 1966) the Member Mechanical was not favoured by the subsequent Member (April 1966) on the ground that this would involved *a dc novo* examination of the matter and would thus cause delay in the finalisation of the proposal being negotiated with the German firm. In other words the Member Mechanical on April 1966 ruled out trials of Suri transmission with ALCO engine on consideration other than technical.

(v) The final decision was based on the Railway Engineer's visit to West Germany (July-August 1966) who pointed out that M/s. Maybach was the only firm in West Germany who offered to develop Suri transmission provided their own Maybach engine was used.

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7	1.180	Railways	In their supplementary memorandum and during fresh evidence (February-March 1978), the representative of the Railway Board stated : (1) The selection of West German locomotive WDM-3 became inevitable as the ALCO did not give a positive response to the suggestion of undertaking development of the Suri transmission. (2) The choice of locomotives for development of Suri transmission was restricted to West Germany as there was virtually no other country in the world where diesel hydraulic transmission had been developed. (3) The ALCO locomotives with 6 axles and heavier 2600 HP ALCO engine were technically unsuitable for the development of Suri transmission. Within the limited permissible axle load, the use of the heavier 2600 HP ALCO engine necessitates use of 6-axles divided into two 3-axle bogies. With hydraulic transmission, the transfer of power to the axles is made through a cardon shaft and gear boxes, and development of an arrangement for distributing power from a single transmission to two 3-axle bogies presented serious technical problems. The Committee, however must record that the then Member Mechanical on four different occasions (1964, 1965, February 1966 and April 1966) dealt with this matter and did not consider trials of Suri transmission with ALCO engine as technically unsuitable. Again this was not the ground on which the final decision to procure the Maybach engine was taken in August 1966.

(4) The question regarding selection of Maybach engine for use in conjunction with Suri transmission had been examined by the High Power Committee and it was accepted as the most suitable form of engine which could be adopted for development of Suri transmission.

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(a) The Maybach MD 1080 diesel engine had not till then been installed in any locomotive and had undergone bench tests only.

(b) Prototype of this engine had not undergone trials under Indian conditions nor had this engine been tried in Germany or anywhere else.

(c) The past experience of the Indian Railways in regard to the performance of Maybach engines on WDS-3 and ZDM-2 locomotives was not satisfactory.

(d) The Technical Committee appointed by the Railway Board in 1965 to examine the offers of 5000 HP locomotives and the 20 Cylinder Maybach MD 1080 series engine had given only qualified approval by saying that there would not be "undue risk" in going in for these engines.

(e) In the Railway Engineer's report of 1966 there was no positive statement in regard to the performance of these engines. It had only been mentioned that "M/s. Maybach had stated that their modified 20 cylinder MD engine would be a good trouble-free engine" and that "the German Federal Railways stated that they were quite satisfied with the performance of Maybach engines but they needed greater amount of attention and skill".

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10	1.183	Railways	It is not clear to the Commitee as to what extensive guarantees were obtained if these did not cover the performance of the locos, the engine and the transmission system and were confined to material, manufacturing and design defects of components. In regard to Suri transmission (Hydro-mechanical) the guarantee obtained from the manufacturers provided that its performance would not be inferior to the Maybach type K 252 transmission, i.e., Mekydro (hydraulic). The manufacturers have not been able to ensure even this part of the guarantee, in that the performance of the locomotives even after Suri transmission was modified to make it comparable to Mekydro transmission (hydraulic) have not shown any improvement. The performance expected for the Maybach engine and Suri transmission in terms of fuel saving and their availability was not incorporated in the agreement. Inspite of the uncertainties and misgivings about the performance of these locomotives, why performance guarantee for the locomotive as a whole including the untried engine and transmission system was not obtained from the manufacturers is a matter which mystifies the Committee.
11	1.184	—Do—	It has been argued by the Ministry of Railways that since the locomotives were built as per specifications drawn out by RDSO, after considering the engine characteristics advised by the manufacturers, it was not feasible to have an overall performance guarantee for the entire locomotives from the manufactures for a trial locomotive being built at our instance and to our specifications. It is to be noted in this connection that what was under trial in these locomotives was the transmission system and not the Maybach diesel engine, whose performance could and should have been covered by adequate guarantees enforceable at the instance of the Railway Board.

12	1.185	Railways	The Committee further find that no penal clause had been included in the agreement with West German firm under which the Railways could recover the additional expenditure incurred due to failure of the engine or the transmission system. In the absence of such a penal clause the Railways cannot claim any compensation for the additional expenditure incurred due to inadequate performance of either the engine or the transmission system although so far as manufacturing defects or design defects are concerned, M/s. Mak have been removing these defects without charging to the Railways.
13	1.186	—Do—	The Committee learn that out of the eight locos 4 have been stabled requiring imported material for commissioning the same. The Ministry of Railways have stated that for improving the position of four locos presently in use initial inputs for the year to the tune of approximately Rs. 60 lakhs will have to be made followed by annual recurring expenditure for maintenance spares of the order of Rs. 16 lakhs and the expenditure for commissioning the four stabled locos was likely to be higher. It is thus to be seen that besides the initial investment of about Rs. 3 crores on the acquisition of these locomotives, the Railway Board will have to incur huge expenditure to bring these locos in proper order and keep them fit for operations. But what distresses the Committee is that Mr. Suri himself pointed out that it is the fault of the Railways in putting these locomotives straightaway in use without making any research. Mr. Suri had further observed that "the heavily graded section chosen viz., Guntakal-Madras was incorrect for a light WDM-3 locomotive of 4 axles, expecting to replace the 6 axled ALCO locomotive of greater horse-power and greater weight. On this section the WDM-3 loco was literally thrashed to its limit on up gradients which is not good for any newly developed complex machine. Since WDM-3 were allotted against regular locomotive requirements the Southern Railway desired to get the same haulage as from ALCO locomotives and met with frustration." Explaining the reasons why the WDM-3 locomotives were used on heavily graded sections, the Railway Board have stated that these locomotives had been procured against a specific project and were therefore initially confined to a heavily graded section. For use of these locomotives on passenger trains the permission of the German credit Bank was required and by the time permission for this change over was obtained, the reliability of the locomotives had already been seriously affected due to non-availability of imported spares.
14	1.187	—Do—	In the light of the above the Committee were distressed to learn from the Railway Board in 1976 that in view of their experience of Suri transmission they did not propose any further development of Suri transmission for high horse power locos, as electric transmission has been indigenously developed and giving satisfactory service.

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15	1.188	Railways	The Railway Board have stated that the WDM-3 locomotives had been procured under a Research and Development Programme for the exploitation of the concept of Suri transmission and that the infructuous expenditure should be viewed in this background. In this context it is to be noted that the then Chairman, Railway Board while giving evidence before the Committee in August 1976 made a categorical statement to the effect that there was no R&D programme but the locomotives were procured against the specific programme of traffic movement and the credit was also obtained for that. The only thing was that while getting them opportunity was also taken to get locomotives fitted with Suri transmission. As to whether a research programme could be financed under the terms of the German Credit under which the locomotives were purchased, the representative of the Ministry of Finance deposed before the Committee (1976) that 'the proceeds of the loans were exclusively for the payment of foreign exchange cost of Indian Railways for modernisation and rationalisation. Inspite of the Railway Board Chairman's categorical statement of 1976 to the effect that there was no R&D programme, the Railway Board, in 1978, attempted to clarify it further by stating that the whole thing was a development project which was used from the commercial angle as the German loan conditions required it and to that extent it was a R&D project with a little commercial bias. The Railway Board have also stated that they would like to develop these locomotives and there was a proposal to review the commissioning of the 4 stabled locomotives after organising inputs for improving the position of 4 WDM-3 locomotives which are presently in use and watching their performance for some time. The Committee, however, are not able to understand why the proposed review for commissioning of the 4 stabled locomotives was not undertaken earlier as these locomotives had been stabled since 1975-76. The Committee would like that responsibility for this lapse may be fixed.
16	1.189	—Do—	From the information made available to the Committee the following significant facts clearly emerge : (i) In 1964, the procurement of these locomotives was indicated to the Ministry of Finance as part of Railways' development and modernisation programme in the Third Plan. (ii) These locomotives were intended to cope with the heavy increase in traffic. (iii) These locomotives were to be deployed for the export of ore of 'some million tons' through ports at Vizag and Madras.

(iv) These locomotives were to be deployed for handling additional traffic particularly coal, ore on high gradients and the procurement was justified on economic considerations.

(v) The use of the WDM-3 locos on passenger trains could not be continued because of the specific project under which they had been procured which limited their use for freight traffic. For use on the passenger trains permission of the German Credit Bank was required. There could not be any such limitations on the use of locomotives if they were for R & D project.

The Committee are also unable to reconcile the statement of the Railway Board that the locomotives were for a research and development programme with their inability to deploy them on passenger trains for research and development.

(vi) The procurement of these locomotives was a part of the development programme of the Railways in the fourth and fifth years of the Third Five Year Plan, the finance for which was to be partly met out of German Credit.

(vii) In deciding to procure locomotive of 2500 HP one of the considerations was that the Railway Board would be able to obtain economic bids and locomotives of proven quality.

(viii) The loan agreement for the West German credit specifically stated that this was for modernisation and rationalisation of the railways' programme and that *inter-alia* sound financial practices must be observed in the projects financed from the loan.

(ix) This particular project was appraised by the West German Credit authorities and this could be required for only in case of commercial loan investment and not in the case of R & D project.

(x) The expenditure of about Rs. 3 crores on procurement of 8 WDM-3 locomotives has been booked under Depreciation Reserve Fund on Replacement Account and not to Revenue to which normally Research and Development expenditure is allocable.

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			(xi) These locos were not put to rigorous and comprehensive tests which locos developed under an experimental research programme have to go through. In fact there were no research test facilities established by the Railways which were an essential prerequisite to the research development programme. It appears that none of the above considerations could be relevant in a R & D programme but only for a commercial project. The Committee feel that it was primarily a commercial project for the Indian Railways and a research and development programme for the Germans. In fact, it appears that the German manufacturers, in return for a loan to the Indian Railways, in effect were experimenting on a new loco and a new engine and a new transmission system at the expense of the Indian Railways.
17	1.190	Railways	Another exceptionable feature of the arrangement entered into with the West German firm was that the manufacturers imposed a condition that they would be interested in the supply of locomotives fitted with Suri transmission only if a minimum number of locomotives were ordered and in the process they were able to foist 8 locomotives fitted with their own untried engines on the Indian Railways. This was facilitated through the offer of an easy West German credit. The Committee further note that during evidence (1976) the Chairman, Railway Board stated that "Perhaps 4 locomotives would have been the minimum number that was necessary". In their supplementary memorandum of February, 1978 the Railway Board stated that the minimum number required was not less than six locomotives with the Suri transmission for the specific service in Madras-Hospet sections. The Committee is unable to understand that if the locos were for a research and development project, then how the number of locomotives required for manning a specific commercial service was relevant. Again the Committee feel that if two locomotives with Mekydro transmission were sufficient as comparators, only an equal number of locos with Suri transmission would have been enough for evaluation of performance.
18	1.191	—Do—	The Committee find that an important consideration in the procurement of WDM-3 2500 HP (BB design) locos was that they would more or less perform what the WDM-2 2600 HP (Co Co design) locos, manufactured in this country, were performing and that

with Suri transmission would give a higher efficiency and savings in full to the extent of 5 to 9 per cent. Actually the performance of the WDM-3 locos had been poor and were consuming 20 per cent more fuel as against the anticipated saving of 5 to 9 per cent. The Railway Board submitted (1978) that the actual performance of the WDM-3 engine under site conditions in relation to test bench results would vary from design to design and RDSO's comments with regard to inferior performance of WDM-3 under site conditions does not reflect the basis on which the choice of the engine was made. The Railway Board also stated that comparing something which was in use for 10 years with one in use for 10 months was not relevant, not desirable and not necessary. The Railway Board further stated that the two locomotives (WDM-3 and WDM-2) were tried in Brindavan Express between Madras and Bangalore, where the speeds attained were higher, and the WDM-3 locos showed 4 per cent lower fuel consumption than the WDM-2 locos. However, the use of WDM-3 locos on passenger trains could not be continued because of the specific project commitment which limited their use for freight traffic between Madras and Hospet. This fits in ill with the claim of the Railway Board in Supplementary evidence that this was a design and development effort. When permission for use on passenger services was obtained from the German Bank authorities, the reliability of the locos had impaired on account of non-availability of spares.

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The Committee are unable to appreciate the reason for not comparing the WDM-2 locos with WDM-3 locos as submitted by the Railway Board in the Supplementary memorandum, when the locos had been procured on the understanding received from the manufacturer that the WDM-3 locos' performance would not be inferior to that of WDM-2 locos The Committee note that the manufacturers have attributed the non-realisation of fuel saving to the configuration of the combustion chamber of the engine which resulted in the consumption of 10 per cent more fuel and that any possible advantage gained in transmission efficiency was likely to be offset, in fact over shadowed, by the lower engine efficiency. Again, the poor performance of WDM-3 locos had been ascribed to Suri transmission system but it did not show any improvement even after the Suri transmission had been blanked off in these locos. Even the performance of the locos equipped with Mekydro (hydraulic) transmission has been no better than that of the locos equipped with Suri transmission (hydro-mechanical) establishing thereby that the transmission system alone was not responsible for the failure or for the poor performance of the locomotives. In the context of the equally poor performance of the WDM-3 locomotives fitted with Suri

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transmission and the ones fitted with the Mekydro, it is not unreasonable to infer that the main cause of trouble was the improper functioning of the untried diesel engine. Actually, the former Chairman of Railway Board admitted (1976) that when the Railways went for an altogether untried engine for 16 to 20 cylinders, perhaps some performance tests could have been held so that it did not run into difficulties.

The Committee, therefore, desire that an independent high powered Technical Committee be constituted with a view :

(i) to ascertain whether in the circumstances then prevailing selection of WDM-3 locomotives with Meybach engine was the correct choice ;

(ii) whether the assertions made by the West German firms about the performance of their locomotives/diesel engines were subjected to any critical scrutiny either by the Engineer deputed to West Germany for negotiations with the firm or by the Railway Board or any competent technical body ;

(iii) whether there was any lapse in obtaining full guarantee terms from German suppliers ; and

(iv) whether a fair trial has been given to these locomotives to prove their efficiency.

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