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19th October, 1984

Anthony O. Inegbenebor
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Dear Sir,

1984 NSE CONFERENCE - KANO DECEMBER 1984

The Technical Committee of the Nigerian Society of Engineers has directed me to inform you that the "Call for Papers" for the above conference generated a very good response. It was therefore, impossible to get all the papers received presented at the conference because of the short time allocated to presentation of technical papers. Your paper happens to be one of those for which we could not find time in the programme. But you will be welcomed to present facts from your paper as a contribution during discussions of the papers presented at the plenary sessions.

We enclose herewith all copies of the paper.

Thank you very much for your usual cooperation and look forward to seeing you in KANO.

Yours faithfully,

ENGR. (PROF) C.O. ORANGUN, FNSE
Technical - Committee (Chairman).

THE NIGERIAN SOCIETY OF ENGINEERS

ANNUAL CONFERENCE AT KANO

DECEMBER 6 - 8 1984.

THEME: QUALITY, STRENGTH AND
STANDARD FOR NIGERIAN
STEEL AND PETROCHEMICAL
PRODUCTS.

By: A. O. Inegbenebor,
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July, 1984.

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ABSTRACT.

Without ^{depth} dwelling much into the details of the specialty of process of Steel Making, which is a function of the Steel Quality Strength and Standards for Nigerian Steel, a broad framework is used to analyse details of the steel produced so far at Aladja. Now that Nigeria had joined the club of nations of steel producers, the paramount aim now would be to set a standard for quality and strength for Nigerian Steel which would be comparable with any standard of steel produced in the world. This paper, is written on the tone of the importance of modern technology in producing (the quality, strength and standards) for Nigerian Steel. This paper compares the steels produced so far in the indigenous steel plant at Aladja Warri in Bendel State with the same products from West Germany, Steel Plant. The products from Aladja are based on the West Germany DIN, which is the standard being used in West Germany. The DIN which is 17100, is known as Constructional Steel. They are RST-37-2, ST-44-2, ST-50-2, ST-60-2, ST-60Mn, ST-70-2 and ST-52-3. With the creativeness of Nigerian Scientists at Aladja Steel Plant, Nigerian standard of steel have been produced in the label of NS-34-LC, which are equivalent to DIN 17100. To increase strength and toughness of our steel, Nigerian standard of NS-60Mn, which is equivalent to DIN 488, which is a reinforcement steel of BST 42/50 Ru and BST 42/50RK, have been produced at Aladja Steel Plant. Much cannot be written about the products of the Ajaokuta Steel Plant, because the backward integration plant is yet to produce steel. In the final analysis, the rolling mill products of Ajaokuta Steel Plant is included. The quality, strength and standards of Nigerian Steel can be said to rank amongst the best in the world, taking into consideration the fact that we are still very much young

in steel production. Since the topic goes with the Petrochemical Products, the Nigerian petrochemical industries are still under construction. Therefore, this paper includes the Economic Importance of the products of our petrochemical industries.

Introduction:

This conference is of tremendous significance because it is aimed at provoking programmed efforts in "Engineering Challenges for the future." It is more significant because steel and petrochemical are very important in any nation. As we all know they are the bed rock of a meaningful technological take-off of any country. The progress of a country in the modern world is often assessed by the per capita consumption of steel whereby countries like the United States of America, Japan, and the Soviet Union with per capita consumption of steel of about 600 kg., to 1,000 kg., are regarded as developed countries. The figure for developing countries is so much less. It is as little as 9 kg., to 20kg., per capita.

Most of these developing countries like Nigeria are however becoming more conscious of this deficiency and have stepped up the development of Steel.

The quality, strength and standard of steel are functions of technology of processes of steel. On a global scale, steel technology has tremendously improved since the days of Bessemer Converter of the nineteenth century. The wet quenching of coke in coke oven batteries is being replaced by dry, quenching techniques resulting in considerable improvement in the quality of metallurgical coke. Till late 1950's, the open hearth steel making process dominated steel making in the world, but 70% of world steel production is now through the basic oxygen converters. The productivity of this system

2.65

is about 10¹ times that of the open hearth system. About 20% of the world current steel production is through the electric arc furnace. The useful volume of blast furnace has increased from 1033m³ in the 1950's to 5000m³ to date. Rolling mills technology has also improved over the years. Today's Rolling Mills have become highly sophisticated with computerized controls and on-line televisions. The light section and wire rod mills have become high speed mills with very close rolling tolerances. The sloping flange beams are being gradually replaced by rolling of parallel and wide flange beams in medium and heavy section mills. These improvements in steel technology pose a great challenge to Quality, Strength and Standards of Steel to Nigeria. And also to the third world countries which are so richly endowed with human and material resources and yet for decades remain markets of European Steel Products. Today, there are five steel projects being executed in Nigeria. One of these is backward integrated steel plant and is located at Ajaokuta and another one is normal integrated steel plant and located at Aladja, while the other three are rolling mills. They are located at Katsina, Jos and Osogbo. The Delta Steel was designed to use the Midrex Direct Reduction Technology which is one of the latest and most acceptable steel technologies in the world.

In this route of steel production, steel is produced by smelting directly reduced pellets along with the scrap through electric arc furnace. The conventional route of steel production was adopted for the Ajaokuta Steel Plant because a lot of improvement has been made on the blast furnace technology and local materials could be utilised. The three inland rolling mills are designed to use most modern technologies. At present, all the rolling mills depend on Aladja for supply of billets. The quality, strength and standards of Nigerian steel can be assessed from the products from Aladja. Since Ajaokuta has not produced steel from the oxygen converter. In fact, electric arc furnaces are recorded to produce high quality steel.

THE FUNDAMENTAL REASONS WHICH CAN IMPAIR QUALITY, STRENGTH AND STANDARDS OF NIGERIAN STEELS.

The quality strength and standards of Nigerian steels, depend on the steel produced in the steel making shop and mostly at the continuous casting section at Aladja Steel Plant.

The continuous casting is based on a system of instrumentation which records the fundamental casting parameters and allows through modern computer technology. A continuous and individual supervision of the major casting parameters that influence the quality of each strand. Any deviation from the specified casting condition is recorded automatically as an irregularity which could impair the quality, strength and standard of steels to be produced at the rolling mills. The fundamental casting parameters that affect quality such as casting temperature, casting speed, shrouding of the pouring stream, bath level movement, the addition of casting powder, cooling in the mould and on the strand. The Rolling Mills, the rolling temperature, the cooling system and skilled of the workers. The quality of the products of the Rolling Mills at the first instance depend on the quality of the billets from Aladja and on the process of rolling.

8.0 THE PRODUCTS FROM THE ROLLING MILLS.

All the rolling mills, including Osogbo Steel Rolling Mill, produce merchant bars from 12mm to 40mm, (Round 12 - 40mm or reinforcement bar 12 - 25mm). Wire coil from 6mm - 12mm. This can be plain 6mm - 12mm or reinforcement wire 8mm - 12mm. They can be straightened in cold work. The Aladja Rolling Mill produces, Re-inforcement Rod, merchant bars. The Ajaokuta Rolling Mill, produces wire rod (coils) 5.5mm - 12mm, Re-inforcement Rod 6mm - 12mm, Rounds 10mm - 30mm, Angles 25 x 25mm - 50 x 50mm, Re-inforcement Bars 10mm - 30mm T-Beams 30mm - 60mm, Channels 15mm - 30mm, Hexagons 10mm - 25mm and strips (16 - 12) x (12 - 70mm). These products are low-alloy steels and are

used mostly for constructional purpose. They could also be used for making nails, bolts, nuts, rivets, wire mesh, machine parts, shafts, connecting - rods, automobile component, binding wire, telegraphic wire, barbed wire, chainlink and for other purposes.

THE COMPARISON OF THE NIGERIAN STEEL BASED ON THE DIN 17100 AND 488 AND NIGERIAN STANDARD.

The billets produced and sent to the rolling mills from Aladja are in the different qualities: RST-37-2, ST-44-2, ST-60Mn, ST-50-2, ST-60-2, ST-70-2. They are all constructional steel based on German Standard, of DIN 17100. For example RST-37-2, means minimum tensile strength of 370 N/mm², R - means oxidised steel, 2 - means 27 Joules/20° + notch per impact strength. The Nigerian Standard Steel produced at Aladja are NS-60Mn, NS-34=LC which are equivalent to DIN 488 and DIN 17100. Steel is steel any where in the world and the chemical composition must conform with the international standard. The nomenclature can only change, Nigerian has their own nomenclature steel which is known as "Nigerian Standard." It is on label NS-60-Mn and NS-34-LC. Which means Nigerian Steel minimum tensile strength of 600 N/mm² of manganese steel, Nigerian Steel of minimum tensile strength of 340 N/mm of Low Carbon. The steel NS-60-Mn is based on the DIN 488, and is equivalent to re-inforcement steel BST-42/50 RU and BST-42/50RK. So far the chemical composition of these steel produced in the country are in lined with other steel of the same standard in the world. The strength of these steel are the same with other steel of the standard in the world. Below is the table of analysis of steel produced in Nigeria and steel produced in West Germany.

The Nigerian Steel Based on DIN 17100.

RST 37-2	Tensile Strength 340 - 470N/mm ²	C 0.16-0,17	Si 0.11-0.12	Mn 0,57	P 0.041	S 0.033
St44-2	410-540 N/mm ²	0.18-0,19	0.18-0.20	0.65- 0.69	0.40	0.039
ST 60-2	500 - 710N/mm ²	0.49	0.24	0,50	0.035	0.026

The German Steel Based on DIN 17100

RST 37-2	Tensile Strength 340 - 470N/mm ²	C C23 - CO,19	Si No Limit	Mn No Limit	P 0,060	S 0,060
ST 44-2	410-540N/mm ²	C024- CO,25	No Limit	No Limit	0,060	0,060
ST60-2	570-710N/mm ²	0,40	0,30	0,50	0,060	0,060

The Nigerian Standard Steel NS34-LC which is based on DIN 17100, has the same strength as the RST37-2 produced in Nigeria and also in Germany. The carbon content of NS-34-LC is low^{er} than RST.37-2, from the metallurgical point of view, this NS-34-LC is more ductile than RST-37-2, and it can be drawn into lesser diameter. The Laboratory test of Nigerian Standard Steel of NS-60-Mn which is equivalent to BST 42/50 Ru and BST 42/50 RK which is based on DIN 488, showed that Tensile Strength is 640 - 750 N/mm². But the manganese content of the NS60Mn is higher than BST 42/50RU and BST 42/50RK

11.0 OTHER IMPORTANT USES OF THE NIGERIAN STANDARD STEEL.

The chemical analysis of our steel, showed that silicon and manganese constituted the main alloy elements. These elements add strength and toughness to steel. It is therefore left to Manufacturers Association of Nigeria (MAN), to start making use of these products to manufacture simple Agricultural Implements. The Manganese steel, for example NS-60Mn can be conveniently used to manufacture shovel

teeth, rock crusher jaws, dredge buckets, tractor jaw, and other Agricultural implements. Nigeria at present, can now produce silicon steel, which is used mostly in electrical Engineering. This can save us little foreign exchange to import HEPA Spare Parts especially for transformer. Without producing flat steel at present, we can still manufacture the bulk of our spare parts from our present steel products

THE ECONOMIC IMPORTANCE OF THE PRODUCTS OF OUR
PETROCHEMICAL INDUSTRIES.

Petrochemicals industry entails an immense if not awesome, accumulation of benefits. And this industrial multiplier cuts deep into sectors as wide and far reaching as the pharmaceutical where petrochemical derivatives are used in the synthetics of drugs, production of tablet containers and disposable syringes. The building sector benefits by floor and ceiling tiles, electrical insulating equipments, pipes conduits and paints. The agricultural sector where fertiliser production is enhanced with the aid of petrochemical bases. Whilst the manufacturers of tyres, upholstery, battery casing and even soles of boots, tennis shoes, tennis bats rackets. Others are the ganis of automobile industries and physical recreational settings respectively. Of course, we do know that the benefits as to textiles are break taking and for detergents and its associates the list is unnecessary. Of course, with all these benefits from the products of petrochemical and steel products of which quality, strength and standard are not questionable compared with other products of the same in the world market. Thus the seeming paradise which promise to dawn on any nation that effectively utilises these benefits in terms of cut in foreign exchange, provisions of near excellent health care, productive education and employment opportunities plus accessories as pipe borne water, well tarred roads and other social services is all too scenic, too enticing to brush off.

14. CONCLUSION.

In this paper, efforts have been made to examine the Quality Strength and Standards for Nigerian Steel and Economic importance of the products of our petrochemical industries and the uses of our steel products. Without gainsaying, the quality, strength and standards of Nigerian Steel rank amongst the best in the world. All said and done, the government should set up Research and Development machinery in all the steel plants and petrochemical industry to monitor these quality, strength and standards for Nigerian Steel and Petrochemical Products and also to improve on them. The Nigerian Society of Engineers should also set up monitoring unit, to liaise with the steel plant and petrochemical industry to up-date these quality, strength and standards for Nigerian Steel and Petrochemical products.

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