The Organising Committee
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Conference
P O Box 95194
Grantpark
Johannesburg
2051
SOUTH AFRICA

Telephone (011) 728-4562

BELT CONVEYORS - AN EXPRESSION OF THE USERS VIEW POINT

W SPENCER and OTHERS
ANGLO AMERICAN CORPORATION
SOUTH AFRICA

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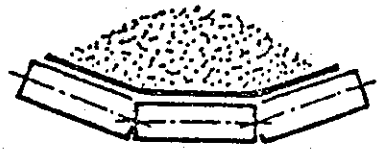

BELT CONVEYORS - DESIGN, OPERATION AND OPTIMIZATION

The Institute of Materials Handling — The Institution of Mechanical Engineers — The Materials Handling Research Group (University of the Witwatersrand)

BELT CONVEYORS
AN EXPRESSION OF THE USERS VIEWPOINT

R G Van Heysteen - ISCOR
L Zeederburg - ESCOM
W Spencer - AAC

Users Society for Engineering
Resources and Services (USERS)

SUMMARY

The paper briefly reviews belt conveyors relative to other forms of bulk material transportation from the users point of view.

Standardisation in conveyor componentary is reviewed and future plans are given. Product quality problems are examined. Some recommendations to suppliers are made in regard to standardisation and quality assurance.

1 INTRODUCTION

Over the past two decades bulk materials transportation has become a major feature of South African industry. There can be little doubt that bulk materials movement by conveyors has and is growing faster than other forms of transportation i.e. wheeled transport and pipelines. Conveyor projects of 10 to 20 million rand have become commonplace.

Despite the major problems of lack of redundancy with conveyor systems, especially true of long or elevating systems, there is a noticeable trend towards their use. This has led to the use of semi-mobile and mobile reduction units at the ore winning site, be it underground or on surface. Sometimes mining methods are designed to reduce the ore lump mass in order to facilitate belt transportation.

There is a trend towards longer single flights. An example on record is a single flight conveyor system some 16km in length with a total lift of 1 000m, a width of 1,3m, and a speed of 8 m/sec and a carrying capacity of 3 200 t/h.

The major user of conveyor equipment is the mining industry in which coal and ferrous metal mining are prominent. There is also a significant non-mining use by iron, steel, railway, petro-chemical and power generating industries. The conveyor industry competes with wheeled transport and pipelines, the latter of which is rapidly gaining ground in some areas. Users are carefully comparing the alternatives and it is in the strategic interests of conveyor manufacturers to reduce both initial and running costs of conveyor installations.

Some qualitative user requirements for bulk material transportation are:

- lowest life cycle cost per km.t transported
- maximum economically achievable reliability and availability of the installation
- minimum maintenance but maximum ease and speed of maintenance
- maximum safety

The selection from the three major transportation methods, (wheeled, pipeline or conveyor) involve an optimisation of the alternative selected and a further optimisation within the selected alternative. Both optimisations should be based on the principles of terotechnology, i.e. the total cost of ownership over the life cycle of an installation. This is a formidable task in the conveyor field with numerous variables, unknowns and a large measure of disagreement between experts on even basic parameters.

2 BELT CONVEYORS

Our concern here is the users' views on belt conveyors and other forms of conveyance will not be discussed further.

The two major user problems with conveyor equipment are undoubtedly standardisation and quality. Lack of standardisation has cost the user dearly in the past and is causing unnecessary expenditure today. Despite a large measure of reluctance and even open opposition from manufacturers at times, the last decade has seen a fair measure of standardisation motivated by large users. There is more to come as the standardisation needs of users have not yet been fulfilled. In the quality field progress has inevitably followed standardisation but quality in general requires much more attention and commitment. Users are currently giving full attention to quality.

Quality of design is also a user problem. Installation design inadequacies give rise to service problems. Most prudent users provide sufficient spares so that failure of critical elements does not involve long downtime. This is not economically practical in the case of belting for long single flight conveyors but some replacement belt lengths are normally kept in stock.

3 STANDARDISATION

Some ten years ago one major user decided that the fixing dimensions for idler sets were in rampant disparity. The consequence of this to users was that conveyor structures had to be purpose designed after the selection of the conveyor equipment. The user therefore developed and issued a specification which, among other things, specified this dimension. The specification also dealt with many other aspects such as design of conveyor installation for different materials conveyed, friction parameters, idler spacing, etc.

There was fierce resistance by manufacturers to the fixing dimension aspect as this was, presumably, seen as an attack on the manufacturers' captive markets. The manufacturer's modus operandi was to obtain the installation contract by competitive pricing and then enjoy replacement business without any great competition. This method of operation was, in fact, counter productive to the original manufacturer's interest as there emerged many small companies who could and did produce substitute parts at a greatly reduced cost and, sometimes of a lesser quality. This in turn forced the original manufacturers to meet this competition and consequently some original manufacturers reduced prices and quality.

The user suffered by either high replacement costs or by reduced quality from both original and alternative manufacturers. The sting in the tail was that the high replacement cost of original manufacturers equipment did not necessarily guarantee appropriate quality.

This situation was undoubtedly caused by lack of standards and a concerted effort has been made by users to correct the position. What has been achieved? Five national standards have been published as Section 3.1.

3.1 SOUTH AFRICAN NATIONAL SPECIFICATIONS

SABS SPECIFICATION NUMBER - DATE	TITLE
SABS 1173 - 1977	General purpose textile-reinforced conveyor belting
SABS 962 - 1978	Conveyor belt fasteners (heavy duty plate and bolt type)
SABS 971-1980	Fire resistant textile-reinforced conveyor belting (for use in fiery mines)
SABS 1313 - 1980	Dimensions and construction of conveyor belt idlers and rolls
SABS 1366 - 1982	Steel cord reinforced conveyor belting

The first of these standards (SABS 1173 - 1977) took an inordinately long time from initiation to publication as there was considerable difference of opinion at the SABS Technical Committee meetings between the user initiators of the specification and manufacturers.

What is still to be done?

3.2 CONVEYOR PULLEYS

Large users experienced a spate of costly failures about seven years ago. As a consequence one large user investigated the status of local and international design capabilities. It transpired that the commercial design techniques then used were inadequate and this large user decided that their own designs were not in accord with their needs.

A design programme was undertaken by this user for small and medium pulleys and specifications were developed and issued. The reactions of manufacturers was considered uncooperative.

Whether these user specifications influenced the issue or not there has been a significant upgrading of commercial pulley design. There are still problems of dimensional standardisation, materials selection and quality of manufacturer, but the general situation perceived by the authors is more healthy.

It is now being considered by users that the SABS should be approached to develop a conveyor pulley specification. This may well happen relatively soon.

3.3 IDLER/ROLLS

We have the position where the dimensions of these are specified in SABS 1313 - 1980.

Large users attempted to have performance and critical design factors included into this standard, but a lack of general acceptance on the SABS Committee prevented this.

History is now repeating itself and one large user is developing a specification to supplement SABS 1313. This private specification will determine performance and certain design requirements for idlers and rolls.

3.4 PULLEY BEARINGS

A situation has developed similar to idler fixing detailed above i.e. the two major suppliers have different dimensions and geometry. Further, current designs are not in accordance with the needs of the user since the current bearing design necessitates wide bearing centres and this creates costly overall conveyor installation designs.

Active consideration is being given to a user specification to eliminate this problem until there are standards to specify these bearings.

3.5 FUTURE STANDARDS

There is a need to review design standards for conveyor installations. A number of useful supplier and user standards already exist but there are major differences between them, even on basic factors which could be established by experimentation. There is a critical need for the industry to rationalise this situation.

At considerable expense one large user has embarked on the sophistication of their current conveyor design and application specification. This old standard contained over thirty friction factors gleaned from suppliers' published technical data. In the new version there is but one factor - 0,22 - which is very close to the ISO recommendation. An important addition are the masses of revolving parts, an element which suppliers refused to divulge in times past.

It is believed that when this document is available it could well be adopted as a basis for a national standard.

A further need is attention to a definition of various standards for corrosion control to suit different environments.

A developing feature now in strong evidence are non-metallic rolls. These have considerable technical advantages in some applications and indications from environmental experiments are that they could be much more effective in normal applications on a cost/benefit basis than traditional wrought or cast metal rolls. Consideration is necessary for the production of standards in this area.

4 QUALITY

This subject has received attention for a long time but has recently assumed new dimensions in this country and internationally. There are some basic misconceptions about quality and quality assurance which are proving counter-productive to suppliers and users.

Quality assurance is not a slight of hand device by which purchasers obtain more value for less payment. Nor should it cost the manufacturer vast sums of money to implement. Astute manufacturers have used quality assurance to increase their profitability by increasing productivity. There are many instances on record both in this country and abroad of such achievements and manufacturers must make a conscientious and concerted effort to gain the financial benefits available from the concept.

The definition of quality seems to cause difficulties. Quality is not perfection and certainly not perfection at any price. Quality is manifest when the user's needs, which are not necessarily his desires, have been satisfied. Quality is the satisfaction of a purchaser's needs at an optimum cost.

It is an established fact that correctly applied quality assurance reduces manufacturers' costs, increases productivity and improves profitability. This closed loop effect does not appear to be understood or believed by many despite ample evidence to the contrary. Manufacturers faced with the front end costs of quality assurance should not immediately attempt to transfer these to the nearest current contract.

It is obvious that purchasers hope to gain from improved quality and this is the reason for their insistence that suppliers apply themselves to the principle of quality assurance. This gain is, however, that which is their due and is not at the expense of the well managed supplier.

Since quality is the satisfaction of the user's needs it must be the user's duty to state these in clear terms in a specification. Users are currently attempting to do this as detailed in the above section on Standards.

There is confusion between quality assurance and quality control. The latter is but one element of the former. It is apparently not understood that shop floor operators have but a small part to play in the attainment of quality. Management has a far larger influence on the subject. It has been estimated that more than two thirds of all product 'non-conformances' are directly traceable to lack of management control.

The areas which require much further management attention are:

- Quality of design
- Planning for quality
- Monitoring of quality during manufacture and 'non-conformance' procedures

In quality of design, matching designs to users needs require continuous market surveys and the changing of design details and material selection to fulfil these needs.

Planning for quality involves, among other things, the production of a unique quality plan for each item produced. This plan should list all major events of production together with inspections, verification and tests together with accept/reject criteria necessary to produce the desired end result.

Monitoring of quality during manufacture against the quality plan is obvious, but the need for non-conformance procedures is not so obvious. The shop floor operators reaction to non-conformance is, however, crucial to the ultimate quality and this reaction should be governed by management ruling.

Users are now auditing suppliers for the competency in the above and other related quality aspects.

Although these comments on quality assurance are of a general nature, they do apply also specifically to the local conveyor industry.

5 CONCLUSIONS

Standards are of critical importance to the belt conveyor industry. They are the means by which the industry can effectively compete with other forms of bulk material transportation. It is in the interests of the industry to actively seek standardisation and co-operate with users in the production and implementation of belt conveyor standards.

Quality now occupies centre stage of the user interest. Active participation and full commitment to quality assurance is required of manufacturers in the pursuit of the progress of product quality.