6.1 INTRODUCTION

Various ore haulage systems were examined to determine the most dependable and cost efficient means of transporting 1.7 million tonnes of ore per year from the Vangorda Plateau to the existing mill site; a distance of approximately 14 kilometres. In consideration of possible mill expansions, and the requirement to produce the entire mill ore supply from the Vangorda Plateau in the future, each of the systems investigated would be capable of providing increased haulage rates to meet projected requirements.

A preliminary engineering study was commenced in the fall of 1979 to evaluate a number of potentially feasible ore haulage systems which included:

a) Trucking utilizing off-highway equipment
b) Rail transportation
c) Conveyor by means of a conventional belt system
d) Trucking using smaller highway trucks
e) Conveying ore on a cable belt

The capital expenditures, operating costs and manpower requirements shown in Figure 6-1 were derived from preliminary data generated during the feasibility study of the haulage alternatives conducted by Swan Wooster Engineering Co. Ltd., February 1980.

6.2 TRANSPORTATION ALTERNATIVES

6.21 OFF-HIGHWAY TRUCKING

Off-highway trucking utilizes equipment which, by virtue of size and weight of the individual units, may not travel upon conventional highways. Conceptually this alternative required that off-highway trucks and or trailers be loaded at the respective ore face by a front end loader. The truck would then proceed directly to the existing primary crusher at the millsite, over a 30.5 metre wide haulage road to be built between the Vangorda Plateau and the millsite. Figure 6-2.

The 136 tonne Caterpillar tractor/rear dump trailer was found to be the most cost efficient off-highway unit, when compared to various rear dump, side dump and train configurations. This unit which is currently successfully used by Pine Point Mines Ltd. in the Northwest Territories offered the most attractive net payload/gross weight ratio and was demonstrably more fuel efficient than the other units considered. An analysis of the cycle times between the Grum deposit and the mill based on a maximum speed of 48 km/hr indicated that 7 trucks operating and 1 truck spare would be required to haul the planned tonnage on a one shift per day, 7 days per week basis.

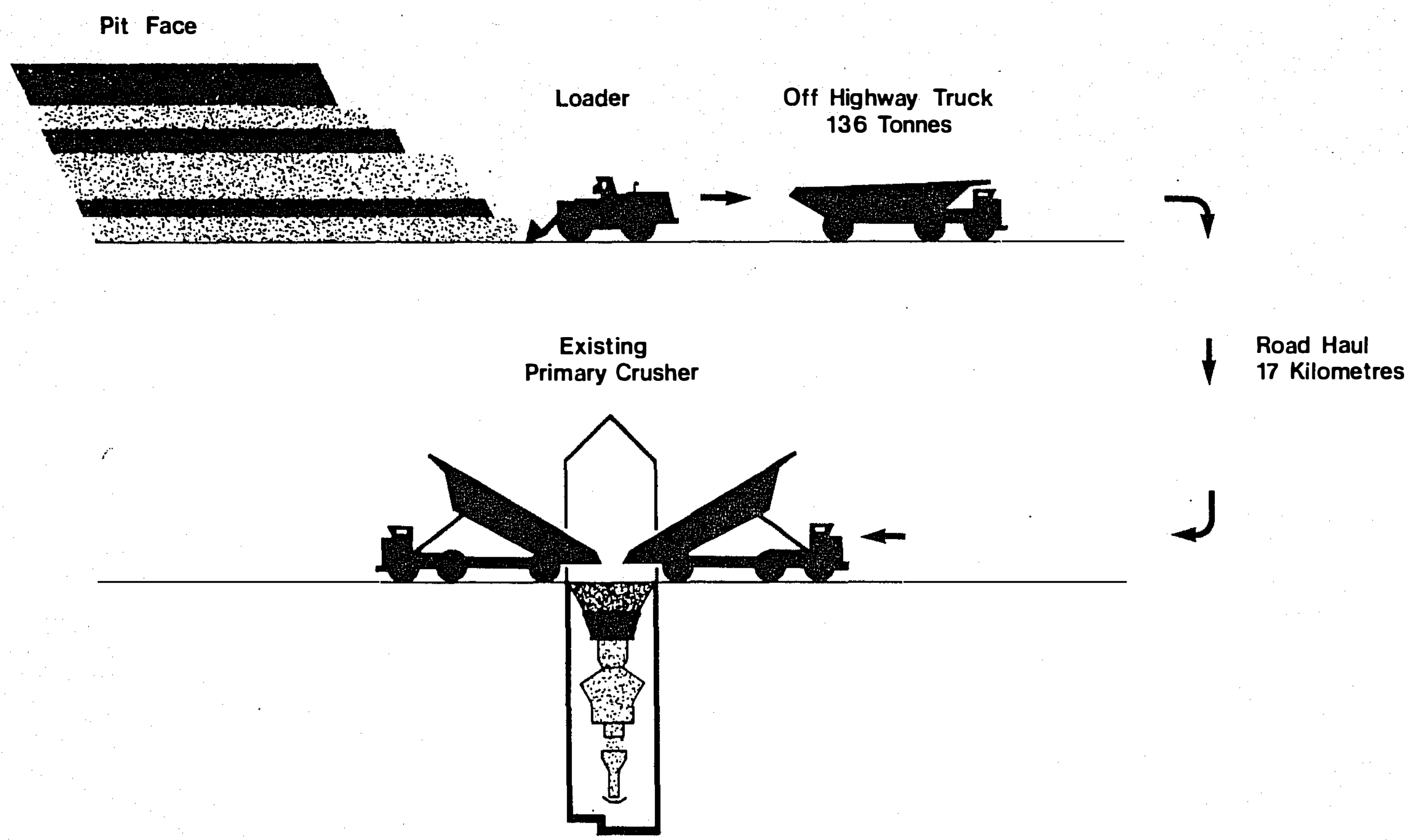

FIGURE 6-2 OFF HIGHWAY TRUCKING SYSTEM
THE DEVELOPMENT OF THE VANGORDA PLATEAU ORE DEPOSITS

That identical units were working successfully at similar latitudes was considered to be an advantage of this system. Scheduled daily ore commitments could be maintained despite temporary reductions in equipment availability by simply extending the operating times of the remaining vehicles.

The feature common to all alternatives considered, other than the off-highway system was the provision of an additional primary crusher and crushed ore storage facility at the Vangorda Plateau. Thus, while capital and operating costs compared most favourably with other alternatives, the off-highway arrangement did not reduce the risk of production loss that has resulted during shut-downs of the primary crusher. Such disruptions have occurred during scheduled major overhauls of the unit, and when handling wet or frozen ore.

Certain disadvantages were attributed to the system due to the fact that no such equipment is currently in use at the Faro pit. Thus additional operator training programs would be required and warehouse inventory values would increase. Pit ramp slopes would generally be designed at grades lower than those that could be efficiently handled by conventional haulage trucks to reflect the inferior climbing capabilities of the tractor/trailer configuration.

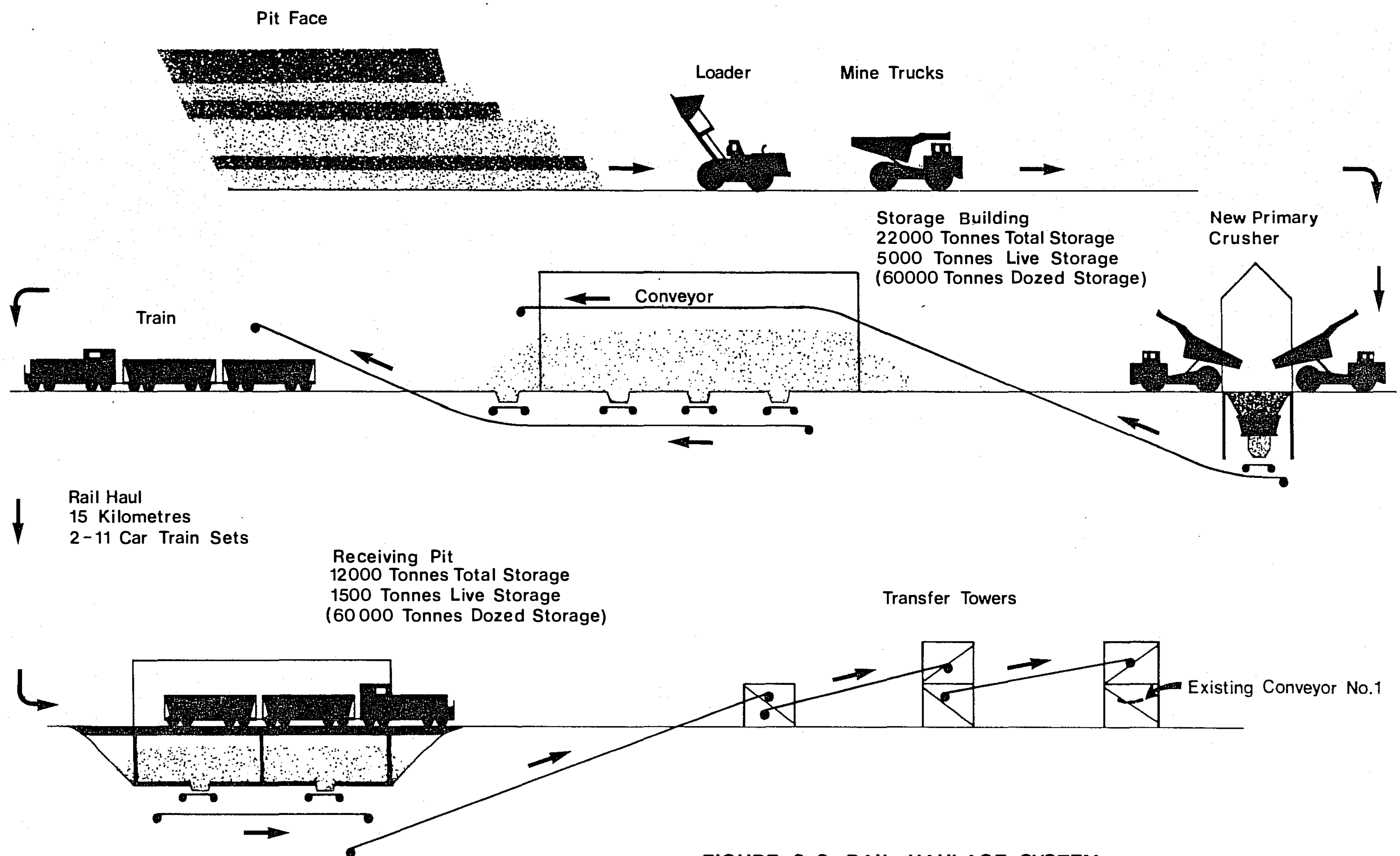

FIGURE 6-3 RAIL HAULAGE SYSTEM

THE DEVELOPMENT OF THE VANGORDA PLATEAU ORE DEPOSITS

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material would be drawn by a conveyor belt to load standard gauge, bottom dump rail cars of 80 tonne capacity. (Figure 6-3).

Since the proposed rolling stock included two 800 HP diesel electric locomotives, the system offered flexibility in the selection of train configurations. Thus it would be feasible for each locomotive to pull 11 cars constituting one train or alternatively both locomotives could be operated in tandem to haul one 22 car train. In either case adequate time would be available in one shift to haul the scheduled ore commitments.

The planned rail alignment consisted of a 14.4 kilometre track placed on a 7.3 metre wide rail bed. The line was of favourable grade over most of its length with the exception of a 1.0 km 1 percent adverse grade located at the West end of the line.

The rail cars discharge into a 2,000 tonne capacity stockpile at a trestle dumping station located to the Southwest of the concentrator from whence material was transported by conventional conveyor belt systems and introduced into the existing crusher circuits. The stockpiles were designed to facilitate the removal and replenishment of ore from the system to permit extra-ordinary storage of large volumes of crushed ore prior to major scheduled overhauls of a primary crusher.

additional training programs and warehouse inventories generated by implementing a new system. Further, the restraints imposed on railroad development by natural topography would almost certainly preclude the extension of the proposed system in an Easterly direction toward the DY and Swim deposits.

6.23 THE CABLE BELT SYSTEM

The cable belt system was developed in England in the early 1950's to meet the need for higher conveyor horsepower than could be obtained with the then standard fabric belt-on-idler conveyors.

Since their introduction, cable belt conveyors have been installed in generally long-haul mining applications in many countries, including the United Kingdom, South Africa, Australia, Canada, Jamaica, Germany and Brazil.

The unique feature of this system is the separation of the driving (tension) medium from the material carrying medium. In conventional systems, the belt must be capable not only of carrying the material load, but also able to transmit the driving tension. In the cable belt system, the material is

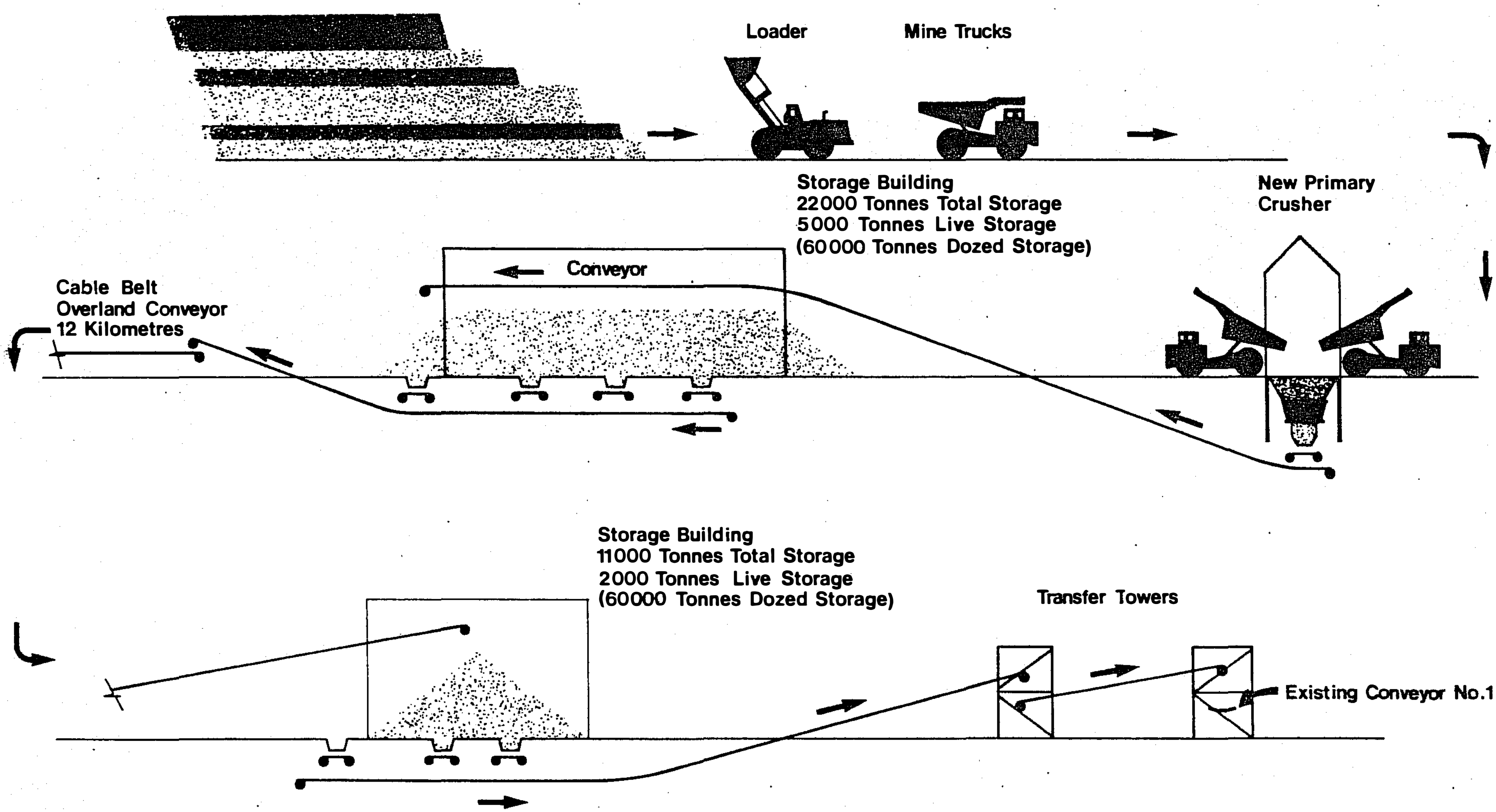

FIGURE 6-4 CABLE BELT HAULAGE SYSTEM
THE DEVELOPMENT OF THE VANGORDA PLATEAU ORE DEPOSITS

carried on a transversely stiffened but longitudinally flexible belt, riding on two endless loops of wire rope that transmit the driving tension. The ropes are supported at intervals by ball bearing pulleys. Molded rubber grooves on the belt grip the wire rope and prevent belt slippage. The wire ropes are driven by Koepe friction wheels at the drive unit, which incorporates a differential to allow for slight inequalities in rope movement. Because the ropes carry the driving tension, only enough tension to prevent folding is applied to the belt.

The mine haulage, crushing and stockpiling facilities included in this system were identical to those described in the rail haulage alternative. Thereafter, the 4,660 tonnes of ore per day would be carried by the 12.8 kilometre long, 76.2 centimetre wide conveyor to a 2,000 tonne covered surge pile. Two 800 HP electric motors would drive the belt at approximately 213 metres per minute.

The conveyor belt systems were found to be less labour intensive than the rail and off-highway alternatives. The relative high operating costs applied to the cable belt were based upon pessimistic estimates of rope life. It is probable that the detailed engineering studies proposed will result in a reduction of these operating costs to levels closer to those the system in sub-arctic climates. Despite the universal acceptance of the cable belt for moving bulk materials over long distances there is no known installation that experiences the cold temperatures that prevail in the Yukon winter. Although information to date would suggest that the system is capable of providing satisfactory service under all seasonal conditions, an extensive analysis of the system will be conducted to satisfy these concerns.

6.24 HIGHWAY TRUCKS

This alternative required that off-highway pit trucks be loaded at the face and discharge their loads into a primary crusher located to the South of the Grum deposit. The crushed ore would be delivered to a stockpile from which material would be drawn by a conveyor belt to load trucks, each of which would be capable of hauling 54 tonnes. The trucks would proceed along a 15.2 metre wide road bed to a dumping station located to the East of the concentrator. Ore would be reclaimed by conveyor and thus introduced into the existing crushing circuit. This haulage system would require 12 units operating to deliver the planned tonnage of ore. Figure 6-5.

While it might be considered that the larger number of trucks

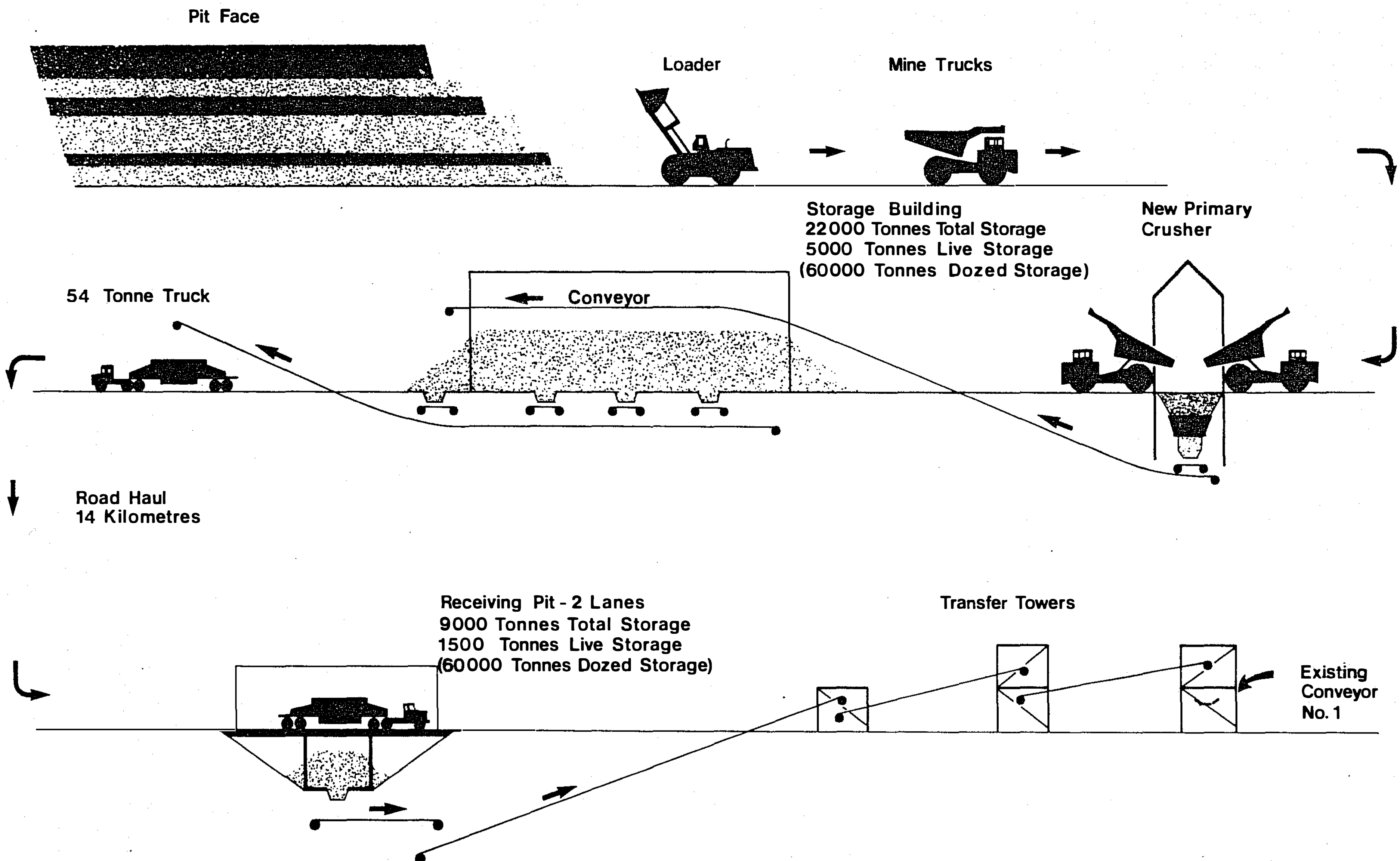

FIGURE 6-5 HIGHWAY TRUCKING SYSTEM

THE DEVELOPMENT OF THE VANGORDA PLATEAU ORE DEPOSITS offered improved system flexibility, it should be noted that under no circumstances could these units be deployed in the Faro pit to be loaded directly from the face. Further the problems discussed previously relating to supervisory control, road maintenance, fuel and tire costs, were also disadvantages of this scheme.

6.25 THE CONVENTIONAL CONVEYOR

As was the case when considering the cable belt and highway trucking, the conventional conveyor system required that pit run ore be hauled to the crusher located at the Grum minesite. Subsequent to crushing and stockpiling, the ore would be delivered to the conventional conveyor. Due to the distance involved, the haulage would be achieved by utilizing two conveyors in series, each of which would be 6.4 kilometres long. The final belt would discharge onto the covered surge pile from which ore would be drawn to be introduced into the existing crushing circuit. Figure 6-6.

The high risk involved in operating conventional conveyor systems over long distances in cold weather negated further consideration of this alternative.

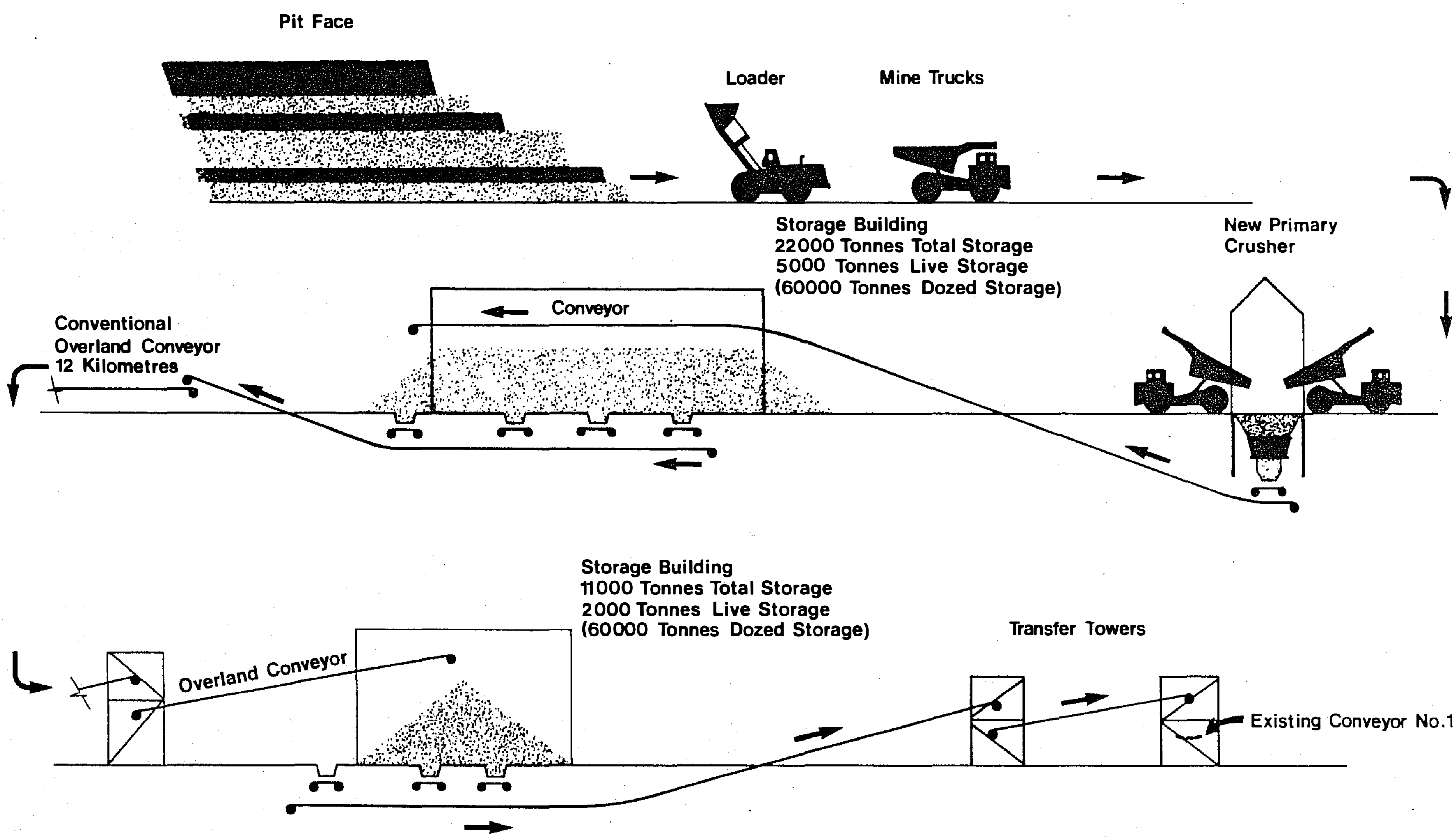

FIGURE 6-6 CONVENTIONAL CONVEYOR HAULAGE SYSTEM
THE DEVELOPMENT OF THE VANGORDA PLATEAU ORE DEPOSITS

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6.3 THE SELECTION OF THE ORE HAULAGE SYSTEM

Detailed engineering studies are now in progress to evaluate the off-highway, rail and cable belt conveyor systems. Based upon the results of this work, the input from operating personnel at the minesite and appropriate plant visits, a comprehensive decision analysis will be conducted by mid 1980 to select the transportation system that will haul ore from the Vangorda Plateau to the Mill.