THE ALGERIA EAST-WEST HIGHWAY: AN INTERIM REPORT

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***ABSTRACT*:**
This paper is about how a consortium of five Japanese companies (COJAAL: Consortium Japonais Pour L'Autoroute Algerienne) is undertaking to build a 399 km, six-lane, limited-access highway across northern Algeria. The paper starts with the bidding process, the evaluation method and the structure of contracts that govern the construction of the project on a design-build basis. Since the contractor is allowed to alter, and therefore is responsible for, highway routing to a certain extent, the paper describes how this discretionary power was exercised to determine the final location of the highway. The paper then goes on to outline organizational setup, physical and design parameters, procurement and logistics, and construction execution plans. As of February 2009, the contractor is about 29 months into the project, whose duration was originally set at 40 months. The paper highlights events and/or issues that have had time impacts since its commencement in September 2006. Some sections of the project have faced major landslides. Other sections are being impacted by a shortfall of critical materials such as crushed gravels for pavement. The contractor also experienced complications from having to build a project to the French standard when natural conditions in Algeria do not necessarily lend themselves to the French standard. Sourcing and mobilizing labor from out-of-the-country markets in sufficient numbers and having them work efficiently on a stretch of construction sites extending over hundreds of kilometers have added to the task of coordination and control. As such, the paper represents an interim report on, and a case study of, managerial and technical challenges that an overseas project of this magnitude and scope can present to the contractor, as well as approaches that can be taken to meet such challenges.

KEYWORDS: highway construction, design-build management, construction standards

1. INTRODUCTION

In September 2006 a consortium of Japanese contractors (Cojaal: Consortium Japonais Pour L'Autoroute Algerienne) signed a ¥5.4 billion design-build contract for a 399 km eastern section of the Algeria East-West Highway, one of the largest civil construction projects ever to be undertaken by one entity in the history of the Japanese construction industry.

The award was a result of international biddings conducted by the Algeria Public Works Ministry in January 2006 to build out a contiguous 1,200 km East-West Highway from the Moroccan border to the Tunisian border. The Ministry divided up the Highway into three sections of approximately equal size, with Chinese contractors coming out as the winners of the western and central sections. Of the six bidders who competed for the eastern section, Cojaal bid the highest. Bid evaluation assigned 60 points to technical and 40 points to financial. Cojaal succeeded in tipping the scale largely on the strength of technical merits that it earned for a crash construction program utilizing global positioning systems, and contingency planning for the

earthquake hazard.

Figure 1.1 gives an outline of the Project, while Table 1.1 details the structure of contracts as well as how each contract defines contractor's design-build responsibilities. Of particular note is the contractor's right to propose alternative routes over large stretches of the Highway.

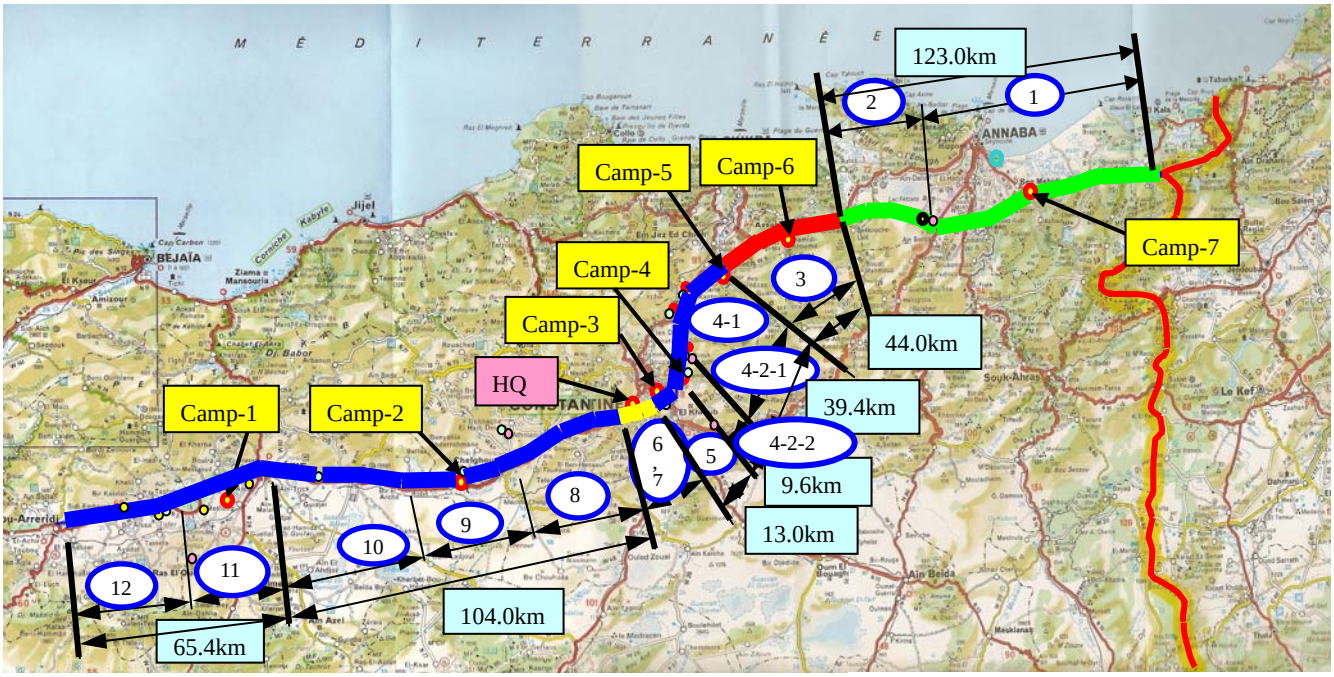

Figure 1.1 Project Outline

Table 1.1 Structure of Contracts

Lot #		12	11	10	9	8	7	6	5	4-2-2	4-2-1	4-1	3	2	1
Camp		1		2					3	4	5		6	7	
Distance (km)		37.8	27.6	46.9	30.0	27.1	17.0		13.0	9.6	3.1	36.3	44.0	39.0	84.0
Category #		I					in Service		I				II	III	III
Conceptual Design	APS	Completed					-	-	Completed					**1**	**1**
Preliminary Design	APD	Completed					-	-	Completed				by Emp	**1**	**1**
Modification of APD	APD	**1**	**1**	**1**	**1**	**1**	-	-	**1**	**1**	**1**	**1**	**2**	-	-
Leveling of Design	LVL	**1**	**1**	**1**	**1**	**1**	-	-	**1**	**1**	**1**	**1**	**2**	-	-
Execution Design	DEX	**1**	**1**	**1**	**1**	**1**	-	-	**1**	**1**	**1**	**1**	**2**	**3**	**3**
Construction		**1**	**1**	**1**	**1**	**1**	-	-	**1**	**1**	**1**	**1**	**2**	**3**	**3**

APS:	Apres Projet Sommaire
APD:	Apres Projet Detaille
DEX:	Dossier d'Execution
Contract #1	Initial Contract
Contract #2	Quotaion for Contract #2 is submitted after the completion of APD by the Employer, and then Contract
Contract #3	Quotaion for Contract #3 is submitted after the completion of APD included in Contract #1, and then Contract
	Numbers in grayed cells correspond to Contract numbers.

As of February 2009, Cojaal is approximately 29 months into the 40 month project. In what follows, the paper describes how Cojaal set itself up to handle this enormous undertaking, and what it encountered once the project got under way. As such, this is an interim report on managerial and technical challenges that an overseas project of this magnitude and scope can present to the contractor, as well as approaches that can be taken to meet such challenges.

2. HIGHWAY ROUTING

The ¥5.4 billion contract amount was introduced at the last stage of contract negotiations with the Employer as a cut-off point for the aggregate payments that Cojaal is entitled to receive in exchange of completing a yet-to-be-designed Highway whose routes are subject to change. The only exceptions are cost and time associated with variation orders, force majeure, and other causes attributable to the Employer.

Preliminary studies by Cojaal revealed that moving the Highway from its initial route through the coastal mountains to the edge of the coastal plains northward would eliminate tunnels as well as high bridges across ravines. These cost savings, however, needed to be weighed against impacting towns and villages along the alternative routes and having to spend time devising, negotiating and implementing mitigations.

In anticipation of this, Cojaal negotiated a special contract provision that compensated the contractor for time and cost arising out of extended delays in obtaining approvals.

When Cojaal accepted this “price ceiling,” it essentially took it upon itself the challenge to choose Highway routes and to develop subsequent design details such that, barring force majeure and other exceptions, the Highway can be executed on time and project cost can come in below the price ceiling.

3. PROJECT EXECUTION

This Chapter summarizes how the Project was initiated and managed at site, highlighting issues of time management as well as quality control.

The members of Cojaal recognized that key success factors in this regard are procurement and logistics (P/L) and design management (D/M).

3.1 Organizational Setup

Project organization adopted involves seven site offices, called “Camps,” each of which is to construct a section of the Highway that varies in length from 12.7 km to 123 km. The Headquarters (H/Q) coordinates, controls and integrates the activities of the Camps as shown in Figure 3.1. Each Camp internally replicates the functions that H/Q has, such as Contract Administration and Design Management.

Design within the scope of Cojaal is outsourced to internationally recognized design firms. The design process is managed by staff dispatched from the members of Cojaal.

3.2 Construction Execution

The Camps execute construction of the assigned work scopes independently, based on work budgets and programs that have been agreed upon at meetings presided by the H/Q.

With the exception of Camp 7, each Camp is operated by one member of Cojaal. For instance, Camps 2 and 4 are operated by Kajima Corporation

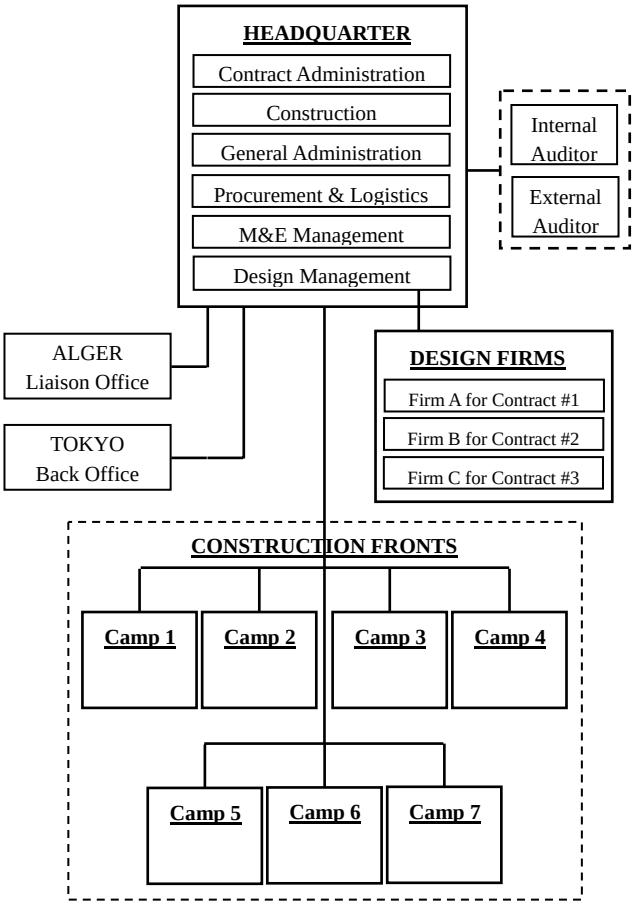

Figure 3.1 COJAAL's Organization

alone. This setup gives each member company managerial autonomy, allows aggressive application of proprietary technologies, and most importantly, provides a strong incentive to achieve good results for the company, contributing to Cojaal's overall success.

As Camp 7 was to commence last, it is operated by an internal joint venture where the members of Cojaal can pull together their experiences from their own Camps and expedite work progress.

3.3 Procurement and Logistics

Timely procurement of plant, equipment and major materials is a prerequisite to on-schedule work progress.

3.3.1 Plant and Equipment Procurement

Since aggregates, cement concrete, and asphalt mixtures shall be manufactured by Cojaal, all necessary plant and relevant equipment were globally procured early on. So were earthwork heavy equipment, passenger vehicles and other common equipment.

In order to meet a demanding time-schedule, huge volumes of cargo were rushed in the initial stage to the Port of Skikda, the closest and most convenient port of entry.

Table 3.1 exhibits a procurement schedule of such major plant and equipment which were purchase-ordered to vendors during the first seven months immediately after signing the contract. The countries of origin range from Japan, North America, Europe to South East Asia.

Table 3.1 Procurement Schedule of Major Plant & Equipment during the first Seven Months

Plant/Equipment	Q'ty	Countries of Origin
Batching Plant	10	Japan, China, Italy, Singapore
Crushing Plant (Fixed & Mobile)	14	Japan, Singapore, Malaysia, France
Asphalt Plant	3	Italy
Passenger Vehicle (Bus, Pickup, SUV)	307	Japan, Thailand, Morocco
Cement Lorry (Tanker)	17	Japan
Fuel Lorry (Tanker)	42	Japan
Agitator Truck	127	Japan
Dump & Cargo Truck	466	Japan, India, France, Sweden
Earthwork Equipment (Shovel, Bulldozer, Loader, Roller, etc)	400	Japan, USA, France, Germany,
200ton Wheel Crane	4	Japan, Germany
Concrete Pump on Truck	20	Japan, Singapore, Germany

The total volume of plant and equipment shipped to Algeria from various countries amounts to 110,000FT during this first seven months, out of 230,000FT during 28 months until December 2008. The value of the first seven-month procurement exceeds 20 billion Yen, or 220 million USD.

The P/L mission has been carried out with diligent preparations and particular care taken to:

1) Purchase-order to plural vendors a single item at a time to procure a large quantity in short period.
2) Manage delivery of the items to warehouses at original ports to effectively utilize deck spaces of cargo vessels
3) Call well in advance cargo vessels bound for or via Algeria, whose availability is quite limited.
4) Make up complete shipping/import documents to facilitate customs clearance.
5) Hire effective stevedores; experienced custom brokers; and inland forwarders to unload and transport the cargo out of the port in a timely manner.
6) Communicate well within the P/L team located both at H/Q, the consignee; and at Tokyo back office, the shipper.

3.3.2 Materials Procurement

An initial assumption that major materials such as aggregates, cement, reinforcing bars, concrete pipes, and bitumen, etc., can be procured easily from local sources turned out to be inaccurate:

1) Aggregate

   The planned Highway route provided distant views on both sides of a number of mountains being actively quarried, which led Cojaal to attempt to purchase from the operators of those quarries the necessary quality and quantity of aggregates. This effort was given up due to disagreement over the conditions offered by the operators.

   The second and adopted option was for Cojaal to operate crushing plants at quarries and produce the aggregates. However, some quarries turned out after some trials to produce limestone aggregates that did not meet the specifications in terms of Los Angeles Abrasion Test results.

   The engineers from the Camps and the P/L team collaboratively explored satisfactory quarries, and the last necessary quarry was identified only recently. This time-consuming quarry hunting has resulted, in part, in the procurement of a large number of crushing plants as shown in Table 3.1.

2) Cement

   Since Algerian mountains are constituted primarily of limestone, ERCE, a government agency, operates a number of cement factories. Although the quality is satisfactory, the quantity is not enough. As a result, cement lorries dispatched from the Camps routinely wait for cement loading for several hours in a line at the factories. Consequently, a cement lorry can make only one trip for cement transportation a day, leading to less stock in silos than was planned.

   This situation aggravates in summer time when production drops due to the “Vacance,” similar to what happens in Western Europe. Some busy Camps have responded by stockpiling cement in “Ton Bags” in well conditioned warehouses two months before summer vacation starts.

3) Reinforcing Bar

The specifications for the rebars are in accordance with the French standard, which is unfamiliar to non-European suppliers. Thus, the number of foreign suppliers that Cojaal can use is limited.

It was fortunate that an international steelmaker operates a steel mill in Algeria, and that rebars using the French standard were available locally through their official distributors.

The problem was the handling of the rebars at the distributors' warehouses. Poor inventory management has made it difficult to identify rebar specifications such as strengths and diameters.

Thus, the P/L team was forced to procure specified rebars from reliable Italian suppliers at the beginning.

Similarly, Cojaal has experienced problems with many other materials that were locally procured.

3.4 Design Time Management

Design time management is critical to the overall management of time for a design-build project. When design is not finalized and fixed on time, subsequent activities such as procurement and construction can not be carried out according to schedule. Benefits of fast track or phased construction often sought in the design-build scheme are thus predicated on successful time management of the design process.

3.4.1 Design Information Flow

Figure 3.1 also shows Cojaal's design organization. H/Q's design management team and Camps' design team collaborate with outside design firms.

The Employer also hires his own design consultants as "Technical Advisor" and "The Engineer." They are the counterpart of Cojaal's design management team.

Figure 3.2 exhibits the flow of design information exchange among the design-related organizations in case of LEVELING and DEX. The LEVELING is the matter of "Technical Advisor" and the DEX is of "The Engineer" in the Employer's organization. The design is finalized when the DEX is approved.

The DEX approval procedure is summarized in Figure 3.3. The DEX can be approved in a minimum of 15 days if the Engineer does not find in the submitted DEX draft any major deviations from the Employer's requirements in the Contract.

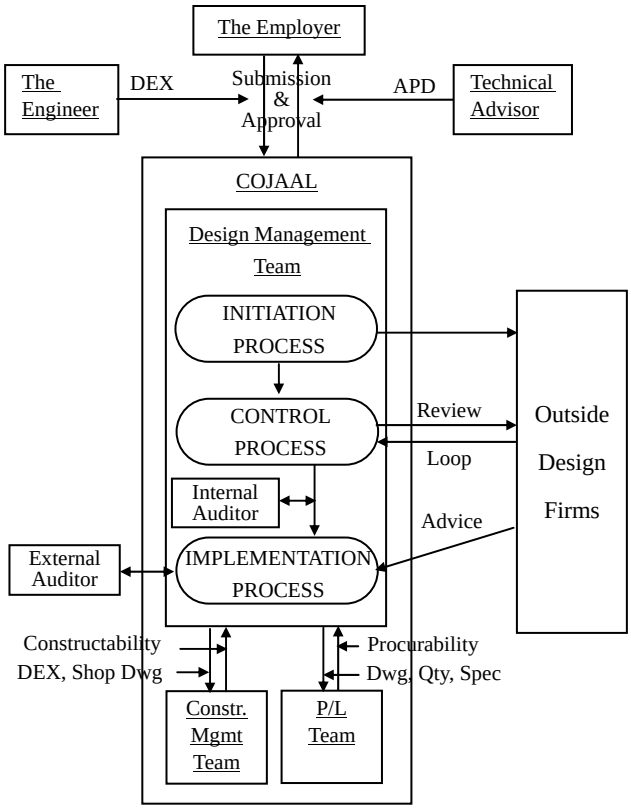

Figure 3.2 Flow Diagram of Design Information for LEVELING (APD) and DEX

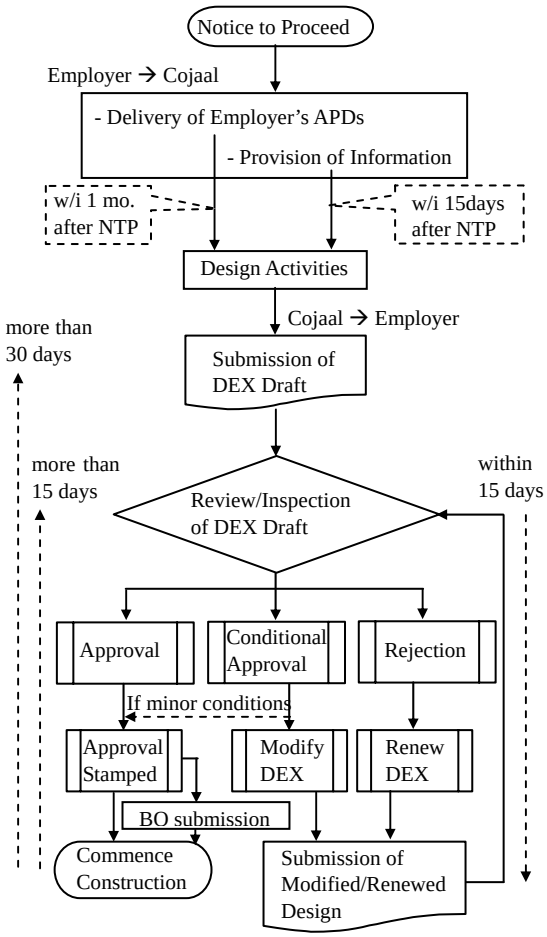

Figure 3.3 Flow Diagram of Approval Procedure for DEX

3.4.2 Difficulties in Design Time Management

Cojaal has found it difficult to manage design time in this Project. Uncontrollable and/or unexpected events and circumstances have affected the design process, in more ways than Cojaal ever expected. Approvals of the designs presented to the Employer (the Engineer and Technical Advisor) were anything but timely or forthcoming.

The difficulties which Cojaal has faced include:

1) Limited availability of original APSs & APDs,
2) Sparsely located original bore-hole logs,
3) Environmental restrictions unknown to the Bidder (prospective Design/Builder),
4) Technical Specifications particular to this Project,
5) Unfamiliar standards (the French standard) frequently referred to in the Specifications,
6) Inconsistency time-to-time in the Design requirements and preferences,
7) Lack of prompt Employer responses to the Contractor's submission,
8) Magnitude of the Project
9) Design Firms located outside Algeria
10) Disagreements with the international design firms
11) Reconciling construction requirements with design requirements
12) Pursuit of cost effectiveness in the design phase under the price ceiling
13) Scarcity of experienced in-house design managers
14) Ruling French language

3.4.3 Design/Build scheme : from the Contractor's View

Textbook arguments for and against the D/B scheme typically look like the following:

1) The Contractor can incorporate its innovative technologies and constructability in the design, leading to reductions in cost & time,
2) Overall project time can be reduced to the extent that "Fast Track" or "Phased Construction" is possible,
3) "Checks and balances" does not work well between the designer and the contractor because both functions are integrated in one entity,
4) The Employer needs to take strong control of project expenditures so as not to allow the cost to exceed the budget,

and so forth.

The experiences by Cojaal, however, suggest that benefits of design-build can vary greatly depending on the following circumstances:

1) The design/builder proposing to utilize its innovative technologies for time/cost reductions often meets with resistance from outside design firms because the latter are afraid of liabilities that may arise from adopting such innovative technologies.
2) Design time management is a complicated task, often leading to delays in design progress. In such cases, the benefits of fast track or phased construction are elusive.
3) The Employer has the ultimate right to approve design and construction, meaning that the Employer's review and/or approval rights affect all activities of the design/builder. The degree to which this relationship can work to slow or expedite project progress may exceed contractor expectations.

4. CURRENT ISSUES IMPACTING TIME

Of the events that impacted on-site work progress since construction commenced, two things stand out: landslides and a shortage of aggregates.

4.1 Landslides

Part of the Highway traverses an extended terrain characterized by limestone-marl formations. Cojaal did not anticipate the degree to which partially-weathered marl in this area is susceptible to landslides. After excavation started on the tunnels in this section of the Highway, construction stalled in the face of extensive landslides around tunnel entrances and where hillsides were cut for the project.

Mitigation measures included moving the location of tunnel entrances, constructing embankments or driving long piles that can hold the weight of marly formations on the slopes above, and installing drainage channels through the marl.

4.2 Shortage of Aggregates

Production of aggregates suffered not only from difficulty of finding suitable quarries but also from restricted supplies of explosives. The latter was due to strict controls on the distribution of explosives for security reasons: regulations require that any transportation of explosives from the only source available near the western section of the Highway to the quarries be attended by armed official guards, and all explosives be used up while the guards are in attendance at the quarry.

This places severe constraints on the production of concrete and crashed gravels for pavement, and limits the amount of blasting for tunnel excavation. Cojaal is applying for a special permit to build explosives stockpiles. The location of such storage facilities is still being negotiated.

4.3 Construction Standards and Specifications

The Employer has adopted construction standards and specifications (CCTP) that are conceived along the French standard. CCTP not only requires testing methods and performance measures that are unfamiliar to Cojaal, but also imposes restrictions that are often at odds with local conditions in Algeria.

As a case in point, CCTP discourages the use of limestone aggregates in the surface course asphalt mixtures when in fact the only aggregates locally available in large enough quantities are of limestone. The issue is insufficient hardness of local limestone. As a result, a solution being proposed by Cojaal is to mix blast furnace slag or hard sandstone with limestone aggregates to improve the abrasion/corrosion resistance.

Cojaal continues to encounter situations where it finds CCTP impractical or uneconomical, given local conditions. Cojaal's approach has been to devise alternative means or methods that Cojaal deems to be "equivalent," and to attempt to convince the Engineer to adopt them. Cojaal is assisted in this effort by a committee of experts formed in Tokyo that regularly convenes and advises on technical solutions.

4.4 Labor Management

Cojaal found that the Employer often had issues with the qualifications of subcontractors that Cojaal had chosen to bring in from foreign countries. It was also time-consuming to obtain visas for imported labor.

Supervising groups of labor that are positioned far apart along the Highway has proven to be demanding especially when the distance involved can be 50 km or more. Workers who are rushed to move between work locations using two-lane local highways or partially completed roads are prone to engage in unsafe driving practices, which have led to some fatal accidents.

The task of on-site labor management is often compounded by an apparent lack of sufficient supervisory capacity on the part of the Employer. On-site progress suffers and confusion ensues when the Employer does not dispatch someone to either attend the testing or approve construction work that is ready for inspection.

5. CONCLUSION

Cojaal signed on the ¥5.4 billion contract for the Algeria East-West Highway with a full realization that it was a crash construction program on an unprecedented scale. While it may not have been typical for a design/builder to commit to a fixed sum when the design was so incomplete, Cojaal regarded the design-build features – including contractor's discretionary right to alter the Highway routes – as a lever with which to make the Project work as a business proposition. It was a judgment call based on much analysis at the time and strong commitments from its members.

Working with a foreign government Employer on a design-build project based on unfamiliar construction standards and specifications has so far been more than challenging; yet the members of Cojaal are bringing all their expertise and resources to bear on the Project in order to succeed.