LONG-TERM WARRANTY CONTRACTS
RISK OR REWARD?

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ABSTRACT

Many agencies across North America are looking for new and innovative ways to deliver transportation projects. These include design/build, public/private/partnerships and long-term warranty contracts. Increasingly, these projects include a transfer of risk for the quality of the final product from the owner to the contactor. This is a logical progression in the as the contractor is typically in the best position to manage this risk. Long-term warranties are usually structured so that the contractor is responsible for the quality of the construction for an extended period in the order of 5 to 10 years. This is a substantial change for contractors who have in the past been typically used to warranties of only 1 to 2 years.

There are many issues for a contractor to consider when evaluating the risks and rewards of bidding on these types of contracts. These issues include:

- Do I accurately understand how my performance will be evaluated against the contract requirements and key performance indicators?
- How does my past performance compare with the longer term warranty requirements?
- What do I need to do to ensure compliance with the warranty requirements?
- What are the bonding implications of pursuing these types of contracts?
- What are the financial risks for non-compliance with the warranty requirements?
- How do handle the potential warranty costs in my bid when compared to the competition?
- How can I mitigate the potential risks of a warranty contract?

Questions for an owner include:

- How do I transfer the responsibility for quality and performance to a contactor without increasing the cost of the project beyond what I would normally expect to pay for a design/bid/build type contact?
- How do I measure performance to ensure that the contract requirements are being met?
- What level of agency involvement is necessary to ensure compliance with the project specifications?

These types of questions must be answered to ensure that the bidding contractor ensures that they fully understand the risks and potential rewards of long-term warranty type contracts.

This paper examines the risks and rewards of long-term warranty contracts from both the contractor and owner perspectives and provides recommendations for both sides to ensure that the process results in a cost-effective, high quality facility final product.

INTRODUCTION

The infrastructure gap in Canada, defined as the backlog of deferred maintenance, rehabilitation, and replacement of pubic assets, in estimated to range from $25 billion to $125 billion [1]. The American Society of Civil Engineers estimated a $1.2 trillion investment over

the next 5 years would be required to address America's backlog of deteriorated transportation facilities [2]. The magnitude of these staggering sums has many agencies looking beyond the traditional public funding model and looking to innovative models/methods to manage the backlog and improve pavement performance.

In North America, a number of contract models have been used and reflect the varying degrees of risk transfer from the public sector to the private sector. These include construction management at risk, extended warranty contracts, design/build and various forms of privatization including public/private/partnerships. The degree of risk transfer by the owner to a constructor reduces as the contractor is held more and more responsible for the asset as shown in Figure 1.

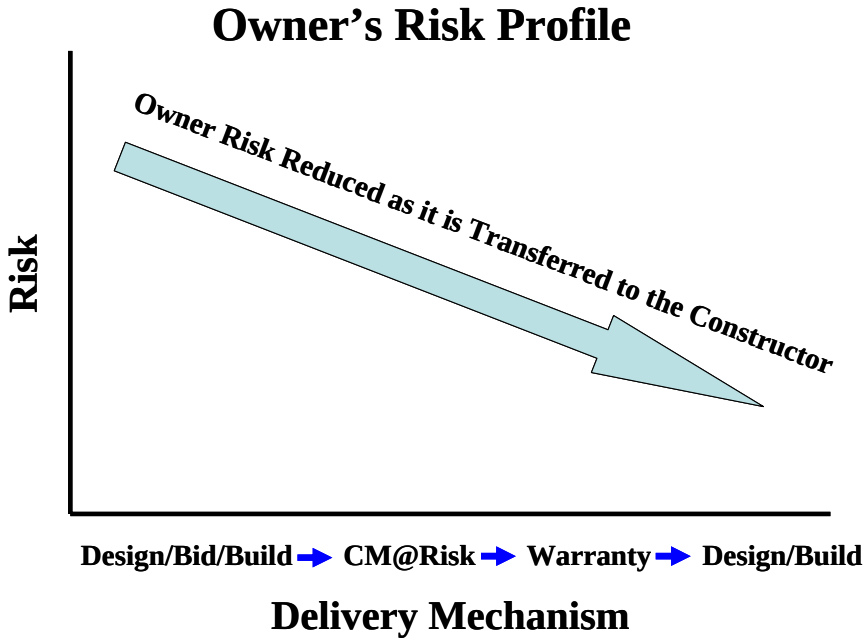


Figure 1. Owner Risk Profile based on Contract Delivery Mechanism.

All of these contract mechanisms have been used for the delivery of Canadian transportation projects over the past 20 years. In the U.S., the Federal Highway Administration (FHWA) limited the use of alternative contract delivery mechanisms due to their interpretation of U.S. Federal law prohibiting the use of federal money for routine maintenance costs. In the 1990s, FHWA began to approve, on a limited basis, some alternative contract delivery mechanisms including warranties under Special Experimental Project No 14 (SEP-14). For a typical long-term warranty contract, the contractor is held responsible for the maintenance work that may occur over the warranty period and is given a certain amount of freedom in selecting the materials and techniques that he or she considers best for the job as long as the owner's standards are met. These warranties guarantee the integrity of the product and the contractor's responsibility to repair or replace defects for a defined period.

WARRANTY CRITERIA

The development of specifications for long-term performance warranties is generally dependent on an agency's contracting procedures with the primary differences being the length of warranty and acceptance/penalty criteria. Sufficient investment on the agency's behalf in clear, well-defined specifications is crucial to the success of a project. Long-term warranty contracts are normally suitable only for larger reconstruction or rehabilitation projects, as the extra effort required to develop the project specifications needs to be in proportion to other administrative costs, not a majority cost.

When developing a warranty specification, the agency needs to consider several factors to establish key performance indicators and acceptance criteria. The factors should include the type of project being considered (i.e., resurfacing, new construction, rehabilitation, or preventive maintenance), the highway type (i.e., rural or urban, low or high volume, etc.), and the any associated criteria such as queue lengths during construction activities.

The specification development and tendering should be a fair process with defined timelines. It is also important that there is a commitment of personnel from the owner/agency to see the process through to completion, as well as the political will to ensure the project will proceed to award. Without the ability to develop a sense of teamwork and trust between the agency team and the contractor, the communication levels required to produce a high quality project will be significantly hampered. For example, flexibility during the bidding process can result in incorporation of changes that surface during the inquiry period that have minimal impact on the defined end product, but can result in substantial cost savings due to elimination of ambiguity in contract requirements.

Contractors or financial sponsors need to see the potential for a return commensurate with the level of risk taken. To be able to quantify the level of potential return requires realistic and achievable construction and maintenance expectations. Definition and exclusion of pre-existing conditions and capping upper limits for uncontrollable items such as traffic beyond the design level or weather events will also keep the risk level within reasonable limits for both sides.

For pavement warranty projects, the agency defines the design traffic levels for the pavement and typically the contractor is responsible for carrying out the pavement design to a specific design life or term, and then constructing or rehabilitating the subject pavement section. Pavement performance indicators are typically defined for both interim milestones and end of contract period performance, along with the desired level of QA/QC programme. Typical key performance indicators are smoothness, rutting, surface cracking, crossfall, frictional properties, and drainage functionality. More advanced warranties could include a pavement structural capacity requirement or as in the case of the Ministère des Transports Québec who specify both summer and winter maximum roughness requirements.

These pavement performance indicators are based on the assumption that the construction and maintenance operations are under the control of the contractor. The roles and responsibilities of both sides, the expectations for performance (including physical parameters like surface friction or performance measures such as lane rentals), remediation requirements and response

times, methods for measurement, reporting, dispute procedures, and financial payments must be also be clearly defined in the specifications for bidders to be able to assess the risk level.

When the operations are under the control of the contractor, the performance levels can be clearly defined and the potential for claims against the owner will be minimized as much as possible by allowing the contractor to choose the type and frequency of preventative and routine maintenance activities. Significantly more financial savings in contract price can be achieved when the contractor can incorporate innovative construction techniques and asset management practices. An overly prescriptive contract specification will normally inhibit innovation and result in a correspondingly conservative costing approach. As warranty specifications of five years duration and over can add 5 to 25 percent [3] to a contract value, savings due to innovation or efficiencies will offset the higher contract costs and allow the owner to utilize their budget more efficiently as well.

THRESHOLD LEVELS

Acceptance levels for warranty criteria should be based on historical data wherever possible and should be measured objectively using current technology to the maximum extent feasible. Establishing the thresholds for acceptance levels and required remediation activities should be reasonable and in general accordance with performance expectations for a similar road section built under conventional conditions. Incorporation of subjective acceptance criteria can increase the contractor's risk, and therefore the contract cost, unnecessarily.

In conjunction with the warranty criteria of performance indicators, the required repair and response time are also specified. The criteria can have several threshold values, including permanent emergency repairs, temporary emergency repairs and permanent remedial actions within a defined period of time.

At any specified milestones throughout the warranty period, and at the end of the warranty period, the properties of the pavement structure identified in the performance criteria are measured. If the performance threshold levels are specified correctly, compliance to the thresholds should ensure that the pavement structure will function as intended for the design life.

The contract should specify whether or not the owner or contractor or both perform the measurements. The reporting requirements will also be tied to the measurement and suitable time frames for submission of data. It is realistic to expect that a contractor will perform interim measurement even if not specified to ensure knowledge of pavement condition and to be able to react in a proactive manner if nearing any of the threshold values.

DUTIES

The warranty specifications need to clearly state the roles and the responsibilities of both the contractor and the agency regarding maintenance responsibilities. The contractor is generally responsible for the performance of the pavement for the warranty period but not the entire project. The specifications should address normal routine maintenance responsibilities during the warranty period such as snow plowing, drainage maintenance, repairs to safety

appurtenances, pavement markings, mowing, and sign maintenance. The responsible party for these activities must be clearly stated, including any handover responsibilities or indemnification for pre-existing conditions at the beginning and end of the construction period.

BONDING

Bonding is necessary to assure the remediation of any noted deficiencies during the warranty period. The project elements and depreciation over the length of the warranty are typically defined in the project specifications. Bonding requirements for long-term warranties are more complicated than for a short term project, but similar to the need for defined roles and responsibilities for maintenance activities, there will be a corresponding definition of elements included in the warranty, and the remainder of the roadway elements which are not included. Bonding is a significant component of any long-term warranty project as the guarantee of deficiency remediation is key to the warranty. On the other hand, contracts which require large bonds to remain in place during the warranty period may 'use up' a contractor's bonding capacity making it difficult to bid on new work. Typically, this issue is resolved by the owner replacing the construction related bonding with a smaller bond covering the warranty obligations of the contractor after project substantial completion.

BENEFITS

For agencies that utilize performance-related (or end result) specifications, the concept of reviewing the process rather than directing the process is much easier to embrace. For this type of owner, the long-term warranty contracts can require a lesser level of design and/or contract administration. Additionally, transferring the majority of the risk to the contractor may result in cost savings from avoiding overruns as well.

There is often an increase in the level of service as the contractor takes ownership of the road and there is continuity between the construction and maintenance. Innovative construction and maintenance techniques can improve the quality of the road, or increase the level of service to the user through shorter road use restrictions or delays. Many agencies have found that the contractor provides a higher level of service during the initial construction phase to reduce the risk they have assumed as much as possible. In many cases, this level of service is higher than the level of service provided by the agency as it is now being measured on a regular basis and that was not the case with the agencies own forces.

Fully integrated asset management services can result in improved asset management and easier budgeting as the condition monitoring is captured as part of the performance monitoring, and does not need to be repeated for a separate asset management application.

When partnering occurs with local contractors and subcontractors, warranty contracts can actually strengthen the contractors involved as they become more skilled over time.

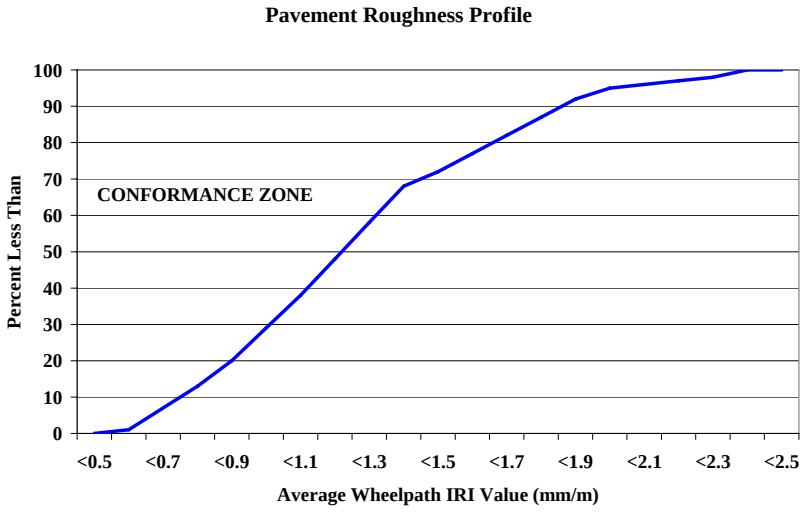
Results from all of these advantages have seen reduced cost to the agency when the contract has been designed and implemented properly.

RISKS

The two primary types of warranties included in transportation projects include express warranties and implied warranties. Express warranties are typically included by an owner and require the contractor to repair or replace any work that does not conform to the contract requirements during the specifically identified period of performance. Owners have typically relied on express warranties to ensure that any defects that were not identified during the construction process are rectified. Implied warranties could be a serious concern to a contractor in that an implied warranty may be interpreted to be a defect related to any item that could affect the intended purpose of the infrastructure and could be subject to legal statues with periods of expiration of more than 10 years. For this reason, contractors should seek warranty limitations that restrict their responsibility to express warranties, only.

The development of the contract package for warranty contracts can be more time consuming and more expensive than a comparable time and materials type contract. With the importance of developing appropriate contract specifications, considerably more time is spent on the pre-contract phase. While owners/agencies typically maintain performance data on their infrastructure, if sufficient historical data is not available, it will be more difficult to establish reasonable performance thresholds, and accompanying remedial measures. An unattainable threshold can result in unacceptably high costs or costly claims during the performance of the warranty.

For example, some agencies in Canada have established performance requirements for long-term contracts that include an overall distribution of roughness similar to that shown in the Figure 2 [4].



In these situations, the primary criteria require that any 50 m length of pavement where the International Roughness Index (IRI) exceeds 2.5 mm/m be repaired to improve the ride quality. The second criteria requires that the distribution of roughness values for the total population of 50 m sections fall into the conformance zone as indicated above.

Bidders on these projects have had significantly difficulty assessing the risk associated with maintaining the pavement infrastructure to standards as outlined above. The agency acceptance for construction is based on a lot size of one day of paving with sublots of 100 m lengths. The IRI of each sublot is averaged before being decisioned in accordance with Table 1.

Table 1. Lot Assessment and Payment Adjustment for Smoothness

Lot IRI (m/km)	Payment Adjustment
<0.81	+$2,000
0.81 to 0.90	+$1,000
0.91 to 1.00	+$500
1.01 to 1.10	+$200
1.11 to 1.20	0
1.21 to 1.30	-$100
1.31 to 1.40	-$250
1.41 to 1.50	-$600
1.51 to 1.60	-$1,400
1.61 to 1.70	-$2,000
1.71 to 1.80	-$3,000
>1.80	Remove and Replace

The payment adjustment is based on a sliding scale providing a bonus of $2,000 for a lot with an average IRI of less than or equal to 0.8 m/km and rejection if the lot average IRI exceeds 1.8 m/km. Full pay is obtained for an average Lot IRI of 1.11 to 1.20 m/km.

Based on the requirements outlined in Table 1, the contractor can achieve a full pay status for an average daily IRI of up to 1.20 m/km. If however, the contractor paves all of the roadway sections to an IRI of 1.20 m/km, then applying the cumulative distribution curve in Figure 1 would make about 50 percent of the pavement sections out of specifications. In order to comply with the cumulative distribution specifications, at least 10 percent of the sublots would have to be paved with an IRI of less than 0.80 m/km. The apparent disconnect between the construction specifications and the performance requirements could result in significant risk to the contractor accepting these performance specifications.

When specifying the performance criteria, another risk is that the performance required is not adequately identified, with a lower level of service received than intended. The loss of control does not allow the owner to dictate a specific remedy, only the contract provisions can be enforced. Any desired changes mid-term in the contract must be negotiated, typically as an extra, so forethought and planning is extremely important.

One of the other concerns is that the role change for the owner usually leads to a loss of technical knowledge through a need for monitoring the process rather than leading the process.

If the contractor forfeits while the contract is partially complete, the owner may no longer be in a position to administer a conventional contract because of resultant downsizing.

The long-term warranty contracts tend to require larger contractors to carry out the work, and may reduce the competitiveness of the market through the removal of the contract work from the market for the local contractors if an out of town contractor is the successful bidder. This can also present problems if the contractor defaults during the term of the contract, as there may not be the capacity to absorb the work in the local market.

The effects of contract failure are potentially greater than with a traditional contract, depending on the performance bond and degree of performance failure. If the contractor was proceeding with the minimal effort philosophy and then forfeits, it may require major rehabilitation to ensure the long-term service life of the pavement structure.

When moving to the longer term contracts, some projects have not gone forward with a mid-range warranty of 5 to 7 years as the local contractors were still working out risk levels and submitting very conservative bids. Longer term warranty contracts are more likely to take advantage of economies of scale as the contractor is able to gear up to handle additional capacity with well trained staff.

SUMMARY AND CONCLUSIONS

The most significant potential benefit of a performance contract is increased value for money. The performance aspect of the specification allows the contractor to utilize their knowledge more efficiently with the ability to manage their own risk. The freedom to use innovative technology is another key benefit that can be translated onto more projects where successes have been proven.

The preparation of appropriate and thorough project specifications can make the difference between a well defined and achievable performance level with good potential for partnership, and a substandard level of service with contentious relations and numerous costly claims.

The decreased level of supervision does not necessarily mean loss of control, it is more of a redirection of efforts to monitoring and tracking performance criteria to ensure levels of service remain appropriate. Appropriate bonding requirements also assure that even in the case of contractor default, the owner remains protected.

The longer the term of the contract, the more ownership the contractor takes for the road. The significant benefit to this is that the contractor will manage the road based on technical choices to maximize the benefit from any preventative or remedial activities without having the political and budgetary restraints the owner or agency are limited by.

Finally, many contractors bidding on long-term warranty contracts have very quickly learned that by carefully controlling their construction practices and materials selection, they are able to build high quality, long-lasting pavements that regularly meet the performance criteria. In turn, they are able to reduce allowances for warranty repairs and therefore reduce their bidding costs which make them more competitive.

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