CENTRAL DISPATCH STRATEGY TO OPTIMIZE DISPATCH AT TECK COAL

by

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Abstract

Teck Coal utilizes dispatch systems operated by site-based dispatchers to manage the equipment fleets at its operations. The dispatch function at each operation works independently but Teck Coal strives to standardize processes, operating practices and metrics used across the business unit. This paper identifies the issues with the site-based dispatch model utilized at the operations and examines whether a centralized dispatch model can address these issues and improve Teck Coal's dispatch function. The research shows that a centralized dispatch model can address the identified issues.

Dedication

I dedicate this paper to my loving wife, Lisa, and my two beautiful daughters, Abigail and Brianna. Without their support, patience and understanding over the course of the last five years, I could not have completed this journey.

Acknowledgements

I would like to thank Matt Cole and Mark Brown for supporting me through the MBA program. I want to extend thanks to Craig Yeliga for providing supporting information for this paper and Ross Wilson for his support as my supervisor through the GDBA portion of the program.

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Glossary

BCM	Banked Cubic Meter, which is the volume of material (waste/overburden or coal) in situ, prior to blasting or any other means of disturbance.
BCMTM	Banked Cubic Meter Total Material means the total volume of material, waste/overburden and waste combined.
$/BCMTM	Total mine site costs per volume of waste/overburden and coal mined in a period.
Clean Coal Strip Ratio	The volume of waste/overburden mined to produce one clean tonne of coal.

1: Introduction

Teck Resources Ltd. (Teck) is a diversified mining company with business units in coal, copper, zinc, and energy. The company does not hold the market share in these commodities so it strives to provide comparative value at a lower cost. To widen the gap between price and costs, Teck focuses on increasing operational effectiveness to achieve low operating costs.

A significant portion of the mine site operating costs is attributable to excavation and hauling of overburden (waste) and ore, which is achieved using the shovel and truck fleets. In 2014, the operating cost for these fleets was approximately 48% of the Cardinal River Operations (CRO) total mine site cost on a $/BCMTM basis. Efficient asset utilization is a focus at the sites and continuous improvement teams work with the mine operations departments to evaluate and implement opportunities for improvement. Initiatives such as reduced shift changes times and fuelling during lunch breaks are examples of some realized improvements. These initiatives are important to drive cost reduction and must continue to maintain a cost competitive position.

At Teck, the open pit operations manage the shovel and truck fleets using a common dispatch system, operated by site-based dispatchers. Many mine sites are not realizing the full value of dispatch because of high dispatcher turnover, inadequate training, dispatchers performing non-value added tasks, and lack of defined roles and responsibilities. Addressing these issues will improve the dispatch function and capture value through improvements in fleet management.

This paper investigates the issues with dispatch at Teck with a focus on the Teck Coal business unit. An overview of Teck and market conditions will illustrate the need to achieve operational effectiveness throughout the company. The paper will discuss the benefits of central dispatch and its application to Teck Coal as a means to address the issues with the existing site-based dispatch model. Recommendations for Teck Coal dispatch are presented and an effective change management strategy given.

2: Teck Resources Ltd.

This section gives an overview of Teck Resources Ltd., which includes the location of its operations through the Americas. It explains Teck's endeavour to standardize across the corporation and use internal benchmarking to identify gaps in performance. This section also discusses the market conditions driving the need to focus on cost reduction to maintain a cost competitive position and identifies the opportunity to improve the dispatch function in Teck Coal.

Teck Resources Ltd. is a diversified mining company with business units in steelmaking coal, copper, zinc and energy. Teck Coal is the second largest exporter of seabourne steel making coal in the world with six active operations and one development property. Teck Copper is one of the top ten copper producers in the Americas with five active operations and four development properties. Teck Zinc is the third largest producer of zinc in the world with three active operations. Teck Energy is developing in the Alberta oil sands with the Fort Hills and Frontier properties (http://www.teck.com/, 2014). Figure 1 shows the locations of active and development properties.

Figure 1Map of Teck Resources Ltd. Properties

Source: Teck 2014 Annual Report

Due to price volatility in commodities markets, Teck strives to be a low cost producer to remain competitive and maximize shareholder value. The company focuses on finding opportunities to share learnings within and across the business units. The corporate level endeavours to standardization policies and processes. The Teck senior management hierarchy structure is conducive to driving change throughout the corporation. All of the business unit vice presidents (VP) of operations report to the same executive VP and chief operating officer (COO). Sharing information, resources and standardization improves efficiencies through elimination of time wasted developing processes, systems or ideas that already exist in the company.

Teck uses internal benchmarking to improve performance. As Ian McCarthy presented in the class notes for Bus 661 Operations Management, "Benchmarking is the process that enables companies to define the gaps in their performance and practices so they can compete (personal communication, March 7, 2013)." The corporation uses internal benchmarking metrics for safety, maintenance, processing and mine operations performance. One example is truck productivity metric benchmarking between Teck Coal sites and Highland Valley Copper (HVC). Figure 2 contains the internal benchmarking information for the non-travel time component of the haul cycle for two hundred and forty metric ton trucks hauling material at three Teck Coal sites. This benchmarking helps sites understand best in class productivities within the group and identifies gaps in performance. Compilation and review of truck productivity data occurs on a monthly basis.

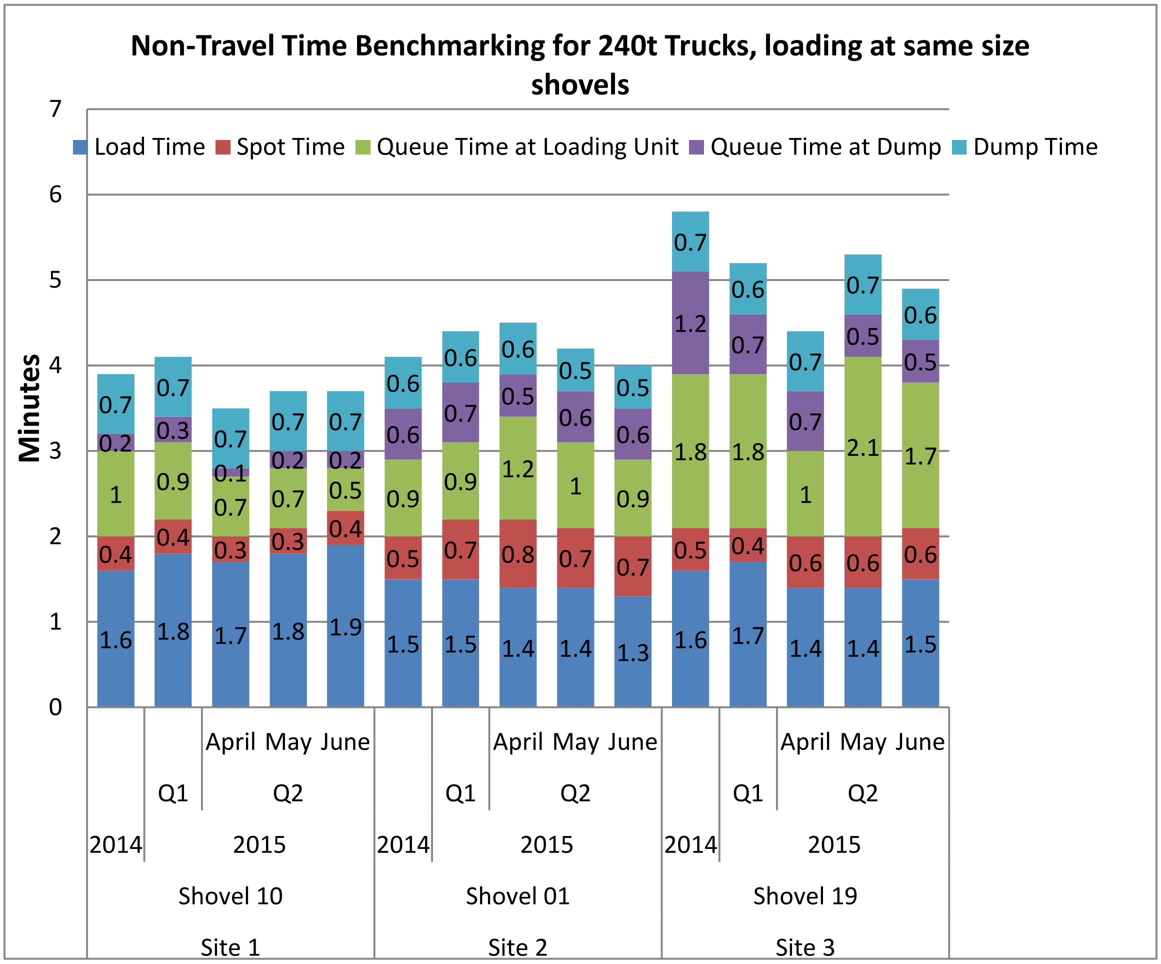

Figure 2Non-Travel Time Benchmarking for 240t Trucks

Source: Created by author using data from Teck Coal's June 2014 Haul Cycle Report

2.1 Maintaining a Cost Competitive Position

This section illustrates the need for Teck to be vigilant in maintaining a low cost position. Teck has minimal ability to influence the commodity price in the markets in which it competes and has limited ability to differentiate products to increase customers’ willingness to pay. As a result, the company endeavours to increase the gap between price and cost by focusing on cost reduction. The pressure to operate at the lowest possible cost is evident by the significant price drop observed in metallurgical coal between 2011 and 2014 as Figure 3 illustrates. Copper prices also experienced a drop between 2011 and 2012 plus another reduction from 2013 to 2014 as shown in Figure 4.

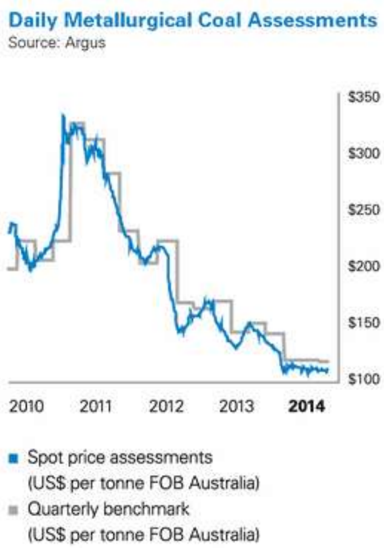

Figure 3Metallugical Coal Price

Source: Teck 2014 Annual Report

Figure 4Copper Price and LME Inventory

Source: Teck 2014 Annual Report

Given the impact of excavation and hauling on operating costs, it is critically important to achieve operational effectiveness in these functions. Operational effectiveness means performing similar activities better than rivals perform them (Porter, 1996, p.4). Teck has implemented continuous improvement teams at many operations to improve the efficiency of the mining processes. There have been improvements in equipment operating times through development of initiatives to decrease shift change times and elimination fuel delays by performing the activity by during lunch breaks.

There are still opportunities to increase equipment efficiencies by addressing the issues with Teck's dispatch function, which is the control system used to manage the mining equipment. In July 2014, at the Teck Coal Annual Five Year Planning Session, senior management along with other representatives from the mine sites recognized dispatch as one of five opportunities for improvement in the business unit. The executive vice president of Teck decided that each opportunity identified would have a team led by a Teck Coal general manager. This level of attention from the senior leaders reinforced the importance of dispatch in the business unit and highlighted the need to make improvements. The team created was the dispatch-working group.

3: Dispatch Overview

This section gives an overview of dispatch systems with a discussion on equipment fleet management, data collection and the importance of accurate data as it relates to different mine site departments. Following the overview, there is an explanation of dispatch at Teck Coal and an outline of the roles and responsibilities of dispatchers in the business unit.

Mining companies throughout the world, use dispatch systems to manage equipment fleets. Their primary purpose is to manage the production fleets to achieve production targets through efficient use of assets. In addition to fleet management, the dispatch system collects a tremendous amounts data such as equipment physical availabilities, operating efficiencies, utilizations and productivities. The dispatch system typically consists of hardware installed on mining equipment including global positioning systems and dispatch modules that receive and transmit data. Data exchanges between mining equipment and the central database through an extensive wireless network located at strategic points to cover the active mining area. Data displayed on computer monitors, gives the dispatcher visibility to the equipment fleets.

Dispatchers operate the dispatch systems from an office environment. The offices are typically set up with large computer monitors that display the dispatch data. The real time data gives the dispatcher visibility to the mining fleet, enabling decision making with accurate information. The monitors also display key operating metrics for the shift and fleets, which proves performance data to the dispatcher.

Data collected by the dispatch system is valuable to the mine site so accuracy is important. The mine maintenance and operations departments use the data to measure performance of the equipment and operators. One key performance indicator (KPI) for the maintenance department is equipment physical availability. The department strives to achieve specific physical availability targets so data accuracy is important to measure performance. Inaccurate data can result in mine sites taking actions that increase operating costs. For instance, erroneously over reporting operating hours could result in premature change out of components because it is common practice for maintenance groups to base equipment component change outs on operating hours.

Mine operations departments use dispatch data to measure performance of the equipment operators, crews, supervisors and equipment. The data is available in real time to indicate how the operating is running; it can help to identify problems or bottlenecks in the production cycle.

The historical data is very important for benchmarking performance to identify opportunities for improvement.

Data quality is very important for mine engineering departments because it is the basis for development of mine plans. The mine engineering departments use equipment productivities to determine future production rates and equipment requirements. Poor data could lead to inaccurate economic assessments. For example, under reported truck productivities could result in a mine plan that erroneously requires capital spending for the acquisition of additional trucks. This decision will negatively affect economics and could lead to the decision to reduce the strip ratio, resulting in reduced mine life.

Dispatch systems are valuable tools utilized globally in the mining industry. The systems provide real time data that enable dispatchers to optimize mining equipment fleets from an office-based environment. The data collected by the dispatch system is important for performance monitoring and internal benchmarking for identifying opportunities to improve performance. The operation of the dispatch system is a function of the competency levels of the dispatchers. It is very important to ensure that these individuals have the appropriate skills and training to optimize the system.

3.1 Dispatch at Teck Coal

Teck has over twenty years of experience using dispatch systems. In the past ten years, Teck has transitioned to a standard dispatch system at its open pit operations. Standardizing the system helps to build system knowledge and expertise. One realized benefit of standardization was the development of a dispatch user group, which has proven to be an important network for transferring knowledge, standardizing codes and addressing technical issues.

Teck Coal utilizes the standard dispatch system to manage the eighteen shovels and one hundred and ninety-nine trucks across the six active mine sites. The fleet size ranges from seven shovels and sixty-three trucks at the largest mine, Fording River Operations (FRO), to two shovels and ten trucks at the smallest mine, Coal Mountain Operations (CMO). All mine sites operate twenty-four hours per day, and seven days per week. The mine operations department at each site is responsible for operating and managing the mining equipment. These departments have four operating crews that work a four by four schedule, meaning they work four days and take four off.

Every mine operations crew has a site-based dispatcher who operates the dispatch systems, except for Cardinal River Operations (CRO) located near Hinton, Alberta (AB). CRO has dispatch service provided remotely from CMO, located near Sparwood, British Columbia (BC). Elkview Operations (EVO), Line Creek Operations (LCO), Greenhills Operations and FRO have full time or permanent dispatchers who are intended to only perform the dispatch role. CMO does not have full time dispatchers; they rotate pit supervisors from the field into the dispatch role.

3.1.1 Dispatcher Roles and Responsibilities

All dispatchers at Teck Coal are part of the mine operations organizational structure. Most mine sites have the dispatchers reporting to the senior pit supervisor, except FRO where dispatchers report to a dispatch supervisor. The roles and responsibilities of the dispatchers vary between sites but are consistent with regard to the requirement to manage the equipment fleets, ensure accuracy data inputs and coordinate activities with other departments such as engineering, processing and maintenance.

Management of the shovel and truck fleets is an important dispatcher responsibility. Effective utilization of these assets is necessary to achieve the mine plan production targets. If there are productivity losses due to delays in the truck loading and dumping/unloading cycle, the dispatcher must reallocate the equipment to improve productivities or contact the pit supervisor to investigate the cause. The dispatcher is also responsible for correcting equipment operator substandard performance, specifically pertaining to improper use of the dispatch system on the mining equipment. The dispatcher is also responsible for monitoring and achieving specific KPIs targets such as shift productivity, shovel productivity, truck productivity, truck-waiting time at the shovel and dump, shovel-waiting time and haulage route accuracy. The dispatcher’s ability to achieve the KPI targets provides a means to evaluate the individual’s performance.

Data accuracy is vital for the dispatch system to function properly. The dispatcher is responsible for accurately inputting data that is required for the dispatch system for function properly. This data includes but not limited to locations for the shovels, assigning proper dumping locations for the trucks, ensuring assignment of proper material types (waste or ore) to the production equipment and it is very important to ensure that the road networks are correct. The road accuracy is particularly important for operating in automatic dispatch mode. The automatic mode is a fleet optimization tool utilizes system inputs received and verified from the dispatcher to optimize the equipment fleet.

Another important aspect of data accuracy is proper equipment coding. The equipment operators are responsible for inputting the appropriate code via the dispatch module in their mining equipment. The dispatcher is responsible for verifying that codes are correct and they must address issues with operators failing to input proper codes. Inaccurate codes affect the dispatcher's ability to operate dispatch and it creates erroneous data. It is important for this data to be accurate because of its use for performance benchmarking and mine planning.

Teck Coal dispatchers are required to coordinate activities between different departments such as engineering, processing and maintenance. Interpersonal skills are important for building relationships with people in these departments. The interactions with the engineering department typically involve updates to the dispatch system such as digging block locations for the shovels, dump or spoil locations for the waste material, KPI targets, road network updates and coal type identifiers. Interactions with the processing department mainly involve coordinating the blend or portions of coal fed to the process plant.

Coordination of activities with the maintenance department is very important because it affects the equipment resources available to achieve the production targets. It is the dispatcher's responsibility to coordinate work with maintenance while minimizing impacts to production. For example, if a truck requires maintenance work that does not affect safety or jeopardizes the truck's component life, the dispatcher needs to set up the maintenance work during planned non-operating time such as an operator's lunch break. This coordination is valuable because the maintenance work is complete without affecting production time. A repair completed during a thirty minutes lunch break will increase the truck's operating time by the equivalent amount. If the haul truck is averaging four loads per operating hour, the truck will be able to achieve two more loads due to the coordination with maintenance. At a payload of 80 BCM's per load and an 8 to 1 clean coal strip ratio, the truck will move an additional 160 BCMs of waste and release 20 clean tonnes of coal. At a coal price of $130 CAN/tonne, the truck will generate additional $2600 CAD revenue. There are many opportunities during a work shift where the dispatcher is expected to make decisions and coordinate activities to maximize production and minimize downtime during scheduled production time.

As part of optimizing equipment use, dispatchers are responsible for utilization of personnel on their crew, especially equipment operators. At shift start, dispatchers assign operators to mining equipment based on the shift requirements as per instructions from the senior pit supervisor. Appropriate use of personnel is required to achieve production targets. There are often non-production tasks that must be complete with limited personnel. Dispatchers often face the challenge of completing tasks with the minimum number of operators; therefore, they have to use the available personnel effectively. Dispatchers must minimize time that operators sit on equipment that breaks down during the shift. Timely relocation of operators from down to available equipment is expected and the dispatcher is typically responsible to coordinate the personnel moves. An operator sitting on equipment that is down or not operable reduces labour efficiency due to waiting time. According to Brandon-Jones, Johnston and Slack, waiting time is one of seven types of waste that Toyota identified in developing the lean philosophy (Brandon – Jones, Johnson and Stack, 2011 p.252).

Dispatchers have many role and responsibilities, which are focused on effective management of mine equipment and labour. They play a key part in achieving the production targets and their actions significantly affect the operating costs at the mine sites. It is important to have properly trained and proficient people in this role. There are many situations during the shift where a competent dispatcher can generate value; conversely, low competency can negatively affect the bottom line.

4: Dispatch Issues at Teck Coal

This section will explain the issues with dispatch at Teck Coal, focusing on the dispatcher role. The explanation will examine the issues of a lack of roles and responsibilities, dispatcher competency, training, turnover and performance monitoring. The effects of these issues on the dispatch function are discussed.

4.1 Lack of Roles and Responsibilities

Teck Coal's approach to the dispatch role over the years has changed but there are still inconsistencies with respect to the definition of the roles. Prior to 2012, most mine sites treated the dispatch role as a rotational position for the pit supervisors. The frequency and duration of the rotations varied depending on the pit supervisors desire and ability to perform the duties. Most pit supervisors were not interested in spending extended periods in the dispatch role because they desired the field operations component of their job. Based on an interview with Ross Wilson who worked in supervisory roles at FRO from 1996 to 2008, he commented that rotations occurred as frequent as every week up to six months and there was a cultural belief that the supervisor working in the field contributed higher value than the dispatcher who was managing the fleet. Many pit supervisors believed that the dispatcher role was more of an administrative role, a monitor of the fleet who followed the instructions of the senior pit supervisor. The detail of the interview is contained in Appendix A.

In 2012, Teck Coal started phasing out the rotation process for the dispatcher role because of the recognition that full time dispatchers would increase competency in the role. As noted in Craig Yeliga's interview in Appendix B, the largest Teck Coal site, FRO, made the transition to full time dispatchers in 2012. EVO, GHO and LCO also made the move to full time dispatchers but the smaller sites, CMO and CRO, kept the rotation process because they found it too restrictive due to their lower number of supervisors. With only three supervisors, including the supervisor in dispatcher, CRO and CMO wanted the ability to move the supervisor from dispatch to the field to cover the pit supervision vacancies. The issue of rotating supervisors into the pit supervision role to cover vacancies also exists at the mine sites with full time dispatchers. This typically occurs when the full time dispatcher is the most competency individual available to fill the vacancies. This decision to maintain the rotation process increases the risk of not capturing the value of fleet management through dispatch.

There are differences in dispatcher responsibilities across the business unit. It is consistent that dispatchers at all sites are responsible for managing the equipment fleets. However, there are responsibilities at some of the sites that add zero value to the dispatch function. A baseline study conducted by Teck Coal in 2013 identified some of the responsibilities that distracted dispatchers from their core function. Some of the tasks identified were administrative tasks such as compiling monthly safety minutes, approving employee vacations, performing warehouse transactions, generating numerous reports and leaving their workstation to complete field audits. During the study, personnel at two of the sites requested that there should be defined roles and responsibilities for the dispatch role. Appendix C contains an excerpt from the study titled "Mine Tracking and Improvement – MTI Operational Mapping". The study also identifies issues with distractions at the dispatch office for two of the mine sites.

Teck Coal made progress in recent years to improve dispatch, which is evident in the transition to full time dispatchers at the larger sites and the decision at the Five Year Planning Session in July 2014 to create a team focused on improving the dispatch function. The decision to appoint general managers as team leads helps to drive change by creating a powerful coalition (Kotter, 2007, p.4). The first task assigned to the group was development of standard dispatcher roles and responsibilities at Teck Coal. It enables the business unit to create standard training programs, which gives dispatchers clear direction and establishes minimum requirements for the sites to ensure consistency.

Development of the roles and responsibilities was complete and the roll out initiated at the end of March 2015. One of the challenges with trying to implement the roles and responsibilities across the business unit is the fact that each site operates independently. Without auditing the implementation process at each site, it is difficult to ensure full implementation and adherence to the roles and responsibilities.

4.2 Dispatcher Competency

The decision for the larger sites to hire full time dispatchers was a positive step towards strengthening Teck Coal's dispatch function. Purely based on increasing the time spent performing dispatch duties has a favourable effect on building knowledge and competency. However, the competency level of the dispatchers at Teck Coal is still a concern. The issue is attributable to training and turnover, not abilities of the individuals in the dispatch role.

In 2013, Teck Coal hired a dispatch specialist who is responsible for developing training programs and providing training to dispatchers. Shortly after starting the role, the dispatch specialist developed a training program that consists of three levels of training and competency that include basic, dynamic and advanced. Based on the November 2014 competency assessment shown in Figure 5 Dispatch System Competency by Site and Crew5, over 44% of the full time dispatchers had a ranking of basic level or lower. The CMO rotating dispatchers, not shown, had a maximum ranking of basic. Basic level competency means that the dispatcher has an elementary understanding of the dispatch system and can achieve an acceptable level of data integrity but cannot optimize the system. Dynamic level is required to operate the dispatch system in automatic dispatch mode, which is a fleet optimization tool.

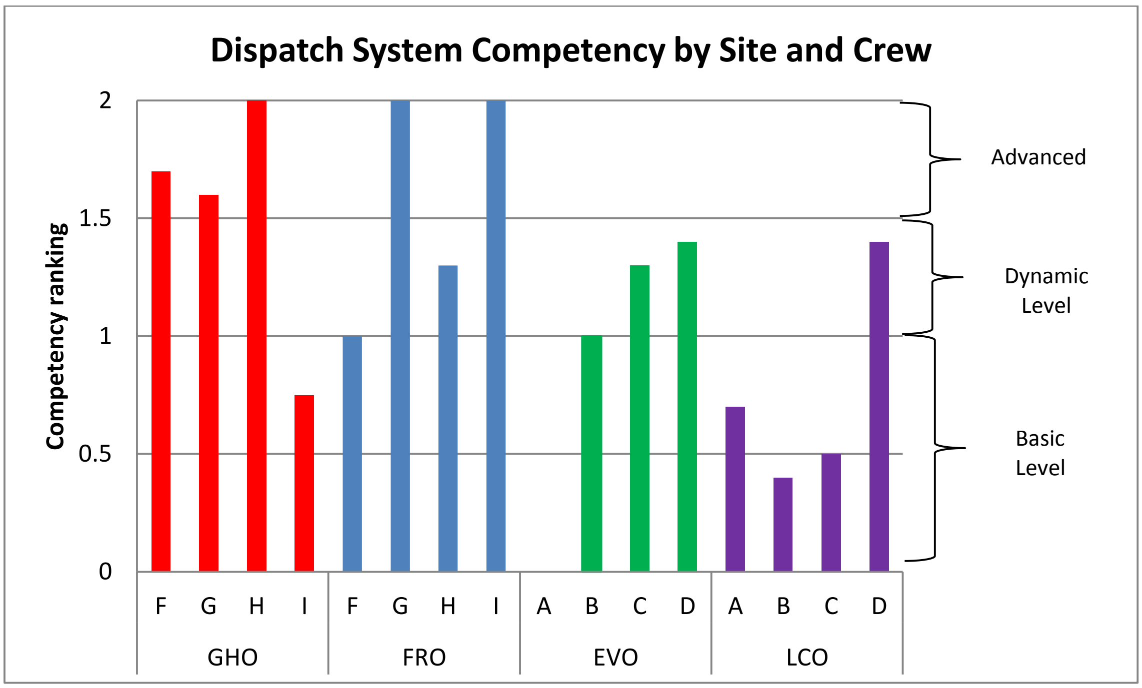

Figure 5 Dispatch System Competency by Site and Crew

Source: Created by the author using data from the Teck Coal November 2014 Haul Truck Cycle Report

It is very important for the dispatchers are able to operate the dispatch system in automatic dispatch mode because this mode has a program algorithm that optimizes the fleet. In order to operate at this level, the dispatcher needs to understand all the inputs required to setup the system. Inputting the wrong data such as accurate road network information will result in poor fleet utilization in automatic mode. However, when the system is setup properly, the automatic mode will optimize the fleet and improve productivities compared to the dispatcher operating the system manually. Appendix D contains a case study provided by Wenco International Mining System that illustrates the productivity improvements associated with automatic dispatch. In this case, the diamond mine realized a one minute and fifty-two second or thirty-nine percent reductions in the average waiting time (wait time plus queue time) by using automatic dispatch. The waiting time is a component of a truck's cycle time. The cycle time is the time to complete a full cycle from the shovel or loading unit to the unloading area and back to the loading unit. Reducing any component of the cycle time increases the productivity of the truck. Being able to operate dispatch systems in automatic mode is a necessity for fleet optimization.

The competency level of backup dispatchers is another significant issue at Teck Coal. The backup dispatchers are the individuals who provide coverage during the absence of the full time dispatchers. The common practice is for pit supervisors or hourly employees (equipment operators) to provide the coverage. Typically, dispatch operation is not their core competency. According to the dispatch specialist's assessments, most of the backup dispatchers rank at or below the basic level dispatch competency.

With most dispatchers having a minimum of four weeks of vacation time, they are away at least seven percent of the work year. To gain an understanding of the utilization of backup dispatchers at Teck Coal, the information for the period January 1 to July 14, 2015 was gathered from the dispatch database. This information, presented in Table 1, indicates a significant use of backup dispatchers. There are various reasons for this usage such as training time for dispatchers, coverage for vacation or coverage for full time dispatcher who is providing field coverage. The fact remains that Teck Coal does have a significant use of backup dispatchers. These individuals typically have lower dispatch competency than the full time dispatchers and elevate the risk of not optimizing the dispatch system.

Table 1Dispatch Coverage at Teck Coal Sites with Full Time Dispatchers

Mine Site	Crew	% Time Full-Time Dispatcher	% Time Backup Dispatcher
Site 1	A	71	29
	B	83	17
	C	55	45
	D	41	59
Site 2	A	23	77
	B	48	52
	C	47	53
	D	42	58
Site 3	A	92	8
	B	92	8
	C	92	8
	D	78	22
Site 4	A	85	15
	B	43	57
	C	75	25
	D	70	30

Source: Table created by the author with information from Teck Coal dispatch database for period January 1 to July 14, 2015

4.2.1 Dispatcher Training

In 2008, Teck Coal started the transition to the current dispatch system; however, the development of a standard Teck Coal dispatcher-training program did not occur until late 2013. The dispatch specialist developed the training program shortly after starting in the role. Prior to 2013, the dispatch provider's technicians did provide some training sessions but most training involved existing dispatchers transferring knowledge to dispatch trainees. The training quality was highly variable as it was a function of the trainer's competency and their ability to communicate. Trainers that were not fully competent with the system and dispatcher role created risk of providing substandard training. A dispatcher providing training that disliked certain aspects of the dispatch system or role elevated the risk of transferring incorrect or bias information to the trainee. This type of occurrence negatively affected the trainee's competency.

Teck Coal developed a standard training program for dispatchers to provide a consistent approach to training, ensuring that dispatchers receive training in the key elements of the dispatch system. This standard approach enables sites to internally benchmark the training levels of dispatchers within the site and across the business unit as presented in Figure 4 (Brandon-Jones et al., 2011, p. 305).

Development of the training program did improve the consistency of training through standardization. However, there are still issues with training that need to be resolved. The dispatch specialist provides the standard dispatch training but it is not possible for this individual to train the twenty full time dispatchers plus forty backup dispatchers at Teck Coal. According to Craig Yeliga, his objective is to deliver training to the full time dispatchers, not backup dispatchers. Therefore, the backup dispatchers are receiving training from the full time dispatchers, which is similar to the historical approach to training. Without receiving the standard dispatch training, competency levels are below the acceptable level to operate the system properly, which increases the risk to data integrity and fleet optimization.

The logistics associated with the geographic separation of five mine sites affects the time available for the dispatch specialist to provide training. The dispatch specialist is not site based; his office is located in Sparwood, BC. The closest mine is EVO, which requires a thirty-minute drive to reach the dispatch office and the farthest is FRO, which requires a sixty-minute drive. Coordinating training sessions is challenging because front line operations at the mine sites are very dynamic. Sometimes training sessions are scheduled but personnel cancel on short notice due to operation issues. These cancellations result in wasted time for the dispatch specialist, especially cancellations that occur after travelling to a mine site. There is waste due to waiting time at the mine site that affects labour efficiency (Brandon-Jones et al., 2007) and the zero value added travel time to and from the mine site.

As part of the new roles and responsibilities developed by the dispatch-working group, there is a requirement for each mine sites to develop a dispatch expert. This expert will be responsible for providing the standard dispatch training to site dispatchers and backups, supplemented by the dispatch specialist. If sites adhere to this requirement, it will be a positive step for dispatcher training, thus improving dispatcher competencies. One of the challenges with this approach is the fact that the expert dispatcher is still responsible for providing full time dispatch duties as well as providing training. With this system, there is risk that competing mine site priorities could affect the dispatch expert’s availability to performed training tasks. During periods of high dispatcher vacancy such as summer vacation periods, there will be a tendency to utilize the expert dispatcher to backfill vacancies. Utilizing the dispatch expert for training also increases coverage required to backfill his/her position, which will remove an employee from their core role. If the four larger sites decided to make the expert role a full time position, it would increase overall labour levels by four people, one per site.

4.2.2 Dispatcher Turnover

Dispatcher turnover is one of the significant issues with building dispatcher talent at Teck Coal. Turnover is attributable to employee attrition, transfers to different roles or different mine site and departmental decision to use rotational process to fill the dispatcher role. The impacts of turnover are evident in the experience levels of the full time dispatchers. Figure 6 shows the number of years of dispatch experience for each of the full time dispatchers at FRO, EVO, GHO and LCO. The figure does not contain data for one crew at GHO due to a vacancy. Approximately forty-four percent of the full time dispatchers have two years or less experience in the role and twenty-five percent have one year or less. This turnover created challenges building competency in the dispatch function.

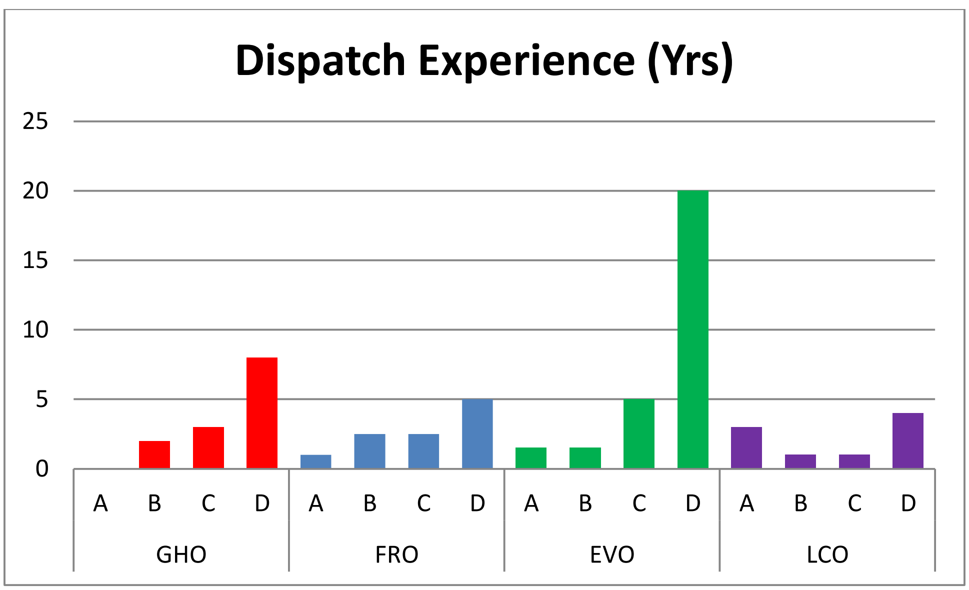

Figure 6Dispatcher Experience at Teck Coal

Source: Created by the author using data collected by Craig Yeliga May 2015

Turnover also increases the demands on training, as resources are required to train the incumbent and the talent loss affects the mine sites ability to operate their dispatch system. The loss of a dispatcher affects 25% of the mine sites dispatch capacity, which is a significant impact to the crew and operation. According to Craig Yeliga, to train an individual to the basic dispatcher level, it requires two training sessions at three to five hours per session plus practical training and testing. Training for the dynamic level requires a similar time line. During the training period, there is elevated risk of inefficiencies and production losses as part of the learning process.

Attrition does account for some of the dispatcher turnover. In the last three years, eight dispatchers left Teck Coal. Three dispatchers moved out of the dispatch to take pit supervisor positions. It is common for dispatchers to move to the pit supervisor role because most of them were pit supervisors and the dispatcher role does not align with their career objectives. Individuals wanting to advance to a senior level role are unable to in the dispatch role because Teck Coal does not have a senior dispatcher level. Therefore, some dispatchers transfer back to pit supervision for the opportunity to advance to the senior pit supervisor role. Another turnover issue is employee transfers between mine sites. Although these transfers are beneficial to the employee and Teck for talent development, it creates talent shortfalls at the site that loses the employee. There was one occurrence of this nature in 2014.

The process of rotating pit supervisors through the dispatch role is also a form of turnover. With CMO rotating upward to eight people in the role, it taxes the already scarce training resources. This is evident in the fact that the dispatch specialist has provided limited training to the CMO rotating dispatchers. These dispatchers have not received the formal training required to optimize the dispatch system.

4.3 Dispatcher Performance Monitoring

At the majority of the Teck Coal mine sites, the dispatchers report directly to the senior pit supervisor, except FRO where all dispatchers report to one dispatch supervisor. Dispatchers reporting to senior pit supervisors make sense from the perspective that the senior pit supervisors are responsible for achieving production targets.

One weakness with this organizational structure is that some senior pit supervisors lack the technical knowledge to monitor and evaluate dispatcher performance, particularly related to operating the dispatch system. Performing the role of monitor is important aspect of leadership and employee development. As explained by Robert Quinn, *As a monitor, a manager is required to know what is going on in the unit, to determine whether people are complying with the rules, and see if the unit is meeting its quotas. The monitor must have a passion for details and be good at rational analysis. Behaviors in this role include technical analysis, dealing with routine information and logical problem solving (Quinn, 1989)*.

The senior pit supervisors are very capable to monitor and evaluate the soft skills such as interactions with people, motivation, attitude and leadership skills. It is difficult for the senior supervisor to monitor performance with respect to the technical aspects such as data accuracy, fleet optimization, verification of data inputs for the dispatch system such as road networks and correcting equipment operator performance with respect to coding accuracy. It is relatively easy for the senior supervisor to determine whether production targets are achieved but measuring how the dispatcher's performance affected the production is difficult. It is important to monitor dispatcher performance, as it drives accountability.

Apart from the technical challenges of monitoring and evaluating is the issue of time to perform these aspects of the supervisory role. The senior pit supervisor role is highly demanding with many competing priorities. These individuals are responsible for the overall crew performance including crew safety, environmental performance, crew productivity, operator productivity, fleet management, safety and employee relations investigations, various audits, pit tours with supervisors and engineering. This is not a complete list of duties; however, its purpose is to illustrate the challenge for senior pit supervisors to find the time to complete regular evaluations of dispatcher performance against the operating metrics. Pit supervisors specialize in field operations, not the technical aspects of dispatch systems.

The dispatch-working group is developing KPI's for measuring dispatcher performance. These metrics will help define production related dispatcher responsibilities. For these metrics to drive performance there will need to be a robust monitoring and review process that includes an action plan to address any performance issues. It will be very difficult for the senior pit supervisor to allocate the necessary time to achieve the required dispatch performance monitoring and there may be additional training required to ensure that the senior pit supervisor has the required technical knowledge.

5: Central Dispatch

Many of the issues with dispatch at Teck Coal relate to the site-based model. This section will explain the concept of the central dispatch model and discuss applications of remote dispatch in the mining industry. The section will also explain the benefits created by centralizing dispatch and development of a functional group.

The basic concept of centralized dispatch is bringing together the dispatch function into a common location. It could involve centralizing dispatch for a small number of sites to large-scale projects involving integrated operations centres. The dispatch centre can be located on a mine site or be remote from the mine sites. Pooling the multiple dispatchers with a common knowledge and skillset creates a dispatch functional group (Mintzberg, 1979). This functional group working in close proximity produces benefits for learning, knowledge sharing and worker productivity improvements.

Teck’s competitors BHP Billiton and Rio Tinto have developed large-scale remote operations centres in Perth, Australia. These companies developed the operations centres to integrate several processes in their value chain such as mine fleet control, processing, mine planning and logistics. The BHP Billiton facility, called the Integrated Remote Operations Centre (IROC) coordinates the mine site-to-port activities of their Pilbara-based operations. According to the Step Change Global website, “The IROC will play an integral role in increasing the system-wide availability, utilisation and rate of our existing assets. It allows us to look at the ‘bigger picture’ of our operations and benefit from collaboration and coordination across the different functions in the IROC (Step Change Global, 2013, “Integrate Remote Operations Center”).” Similarly, the Rio Tinto facility manages its Pilbara-based operations, which consists of 15 mines, 31 pits and four port terminals located 1300 m north of Perth. With 15 mines managed from the centre, it would require a large number of dispatchers to operate mine fleet control. The remote centres improve communication across the various functions, knowledge share between representations from the different mine sites and improve the ability to develop and implement standard processes. Remote facilities established in preferred locations such as major cities or towns are favourable for employee recruitment and retention, especially when mine sites are located in isolated areas.

The two central dispatch examples discussed above involve remote operations; however, central dispatch can be site-based. In 2011, Teck Coal sent three people to tour a mine in the country of Colombia. One of the participants was Matt Cole who is the current CRO general manager. According to information presented and collected during Matt's visit, the mine operated two hundred and forty-three trucks and eighteen shovels. The mine spanned approximately forty kilometres and dispatch service was provided from a central location with six dispatchers, which included one spare dispatcher who rotated to relieve the fellow dispatchers for periodic work breaks. The organizational structure also included a dispatch supervisor who overseen the daily dispatch operations. The dispatchers and supervisor had an assigned workstation in an open office environment. The supervisor could easily monitor dispatch operations and provide prompt feedback to improve dispatcher operational efficiency. The scale of Colombian operation is comparable to Teck Coal with a mine fleet consisting of eighteen shovels and one hundred and ninety-nine haul trucks. Based on a comparable shovel and truck fleet, it indicates the Teck Coal could possibly manage its entire fleet from a central location.

5.1 Benefits of Central Dispatch Model

The central dispatch model utilizes the concept of functional groups. Functional groups are groups consisting of individuals with common knowledge and skills (Mintzberg, 1979, p.329). There are several advantages associated with establishing this functional group and centralizing the service.

5.1.1 Improved Knowledge Transfer

Dispatchers working in close proximity in the same workspace can produce positive impacts on knowledge transfer. A study completed by Annina Coradi, Marreike Heinzen and Roman Boutellier explored the effects of different office designs on knowledge exploitation and exploration. According to the study,

> The openness of the workspace was named as an important factor for the awareness of the expertise of others: *'My growing awareness of others' expertise helps me to deal with the highly dynamic requirements of my work tasks.'* On the one hand, being aware of other people's knowledge makes feedback cycles and working processes efficient, a rather exploitative learning. On the other hand, explorative learning is triggered through the extended expertise pool that is offered to everyone" (Coradi & et al., p64, 2014).

This research supports the positive effects on knowledge transfer associated with bringing dispatchers together in a common workspace that is conducive to open interactions.

Another organizational learning improvement associated with working in a common workplace is worker productivity improvements. A study by Alexandre Mas and Enrica Moretti examined peer effects in the workplace, with a particular focus on, how and why the productivity of workers had on impact to the productivity of peers. This research found that highly productive workers had a positive impact on the productivity of peers at work.

> We find evidence of strong peer effects associated with the introduction of high-productivity workers into work groups: a 10 percent increase in coworker productivity results in a 1.5 percent increase in individual productivity. This effect manifests itself at precisely the time of entry of more productive coworkers, and is persistent (Mas & et al, p. 143, 2009).

This study supports the benefits of centralized dispatch because highly productive dispatchers working adjacent to a new or lower productive dispatcher can produce productivity improvements that would potentially benefit multiple mines, not just the mine where the highly productive dispatcher is working.

5.1.2 Training Improvements

Centralizing the dispatch function reduces the number of training resources required and improves accessibility to training resources by creating a leaner operational process. With site-based dispatch, training resources are typically required at each of the operations or shared by multiple sites. Centralizing dispatch eliminates the need for trainers at each site, thus reducing labour requirements and operating costs. Reducing the number of trainers increases the ability to standardize the training process by lowering the risk that individuals will allow their biases to influence the training communications. Centralization enables closer monitoring of the training process and reduces the risk of that the sites might deviate from the standard training.

In situations where sites share training resources, similar to Teck Coal, the trainer wastes time traveling between sites. By centralizing, the training process improves by eliminating the zero value added time associated with traveling. This operational management improvement increases the available value added training time. “Layout changes which bring processes closer together, improvements in transport methods and workplace organization can all reduce waste” (Brandon-Jones et al., p.252, 2011). This operational change improves dispatch trainer efficiency.

The logistics of planning and organizing the activity of training dispatchers reduces in complexity by centralizing. Instead of coordinating activities with site personnel who are typically distracted with daily operational needs, the trainer can coordinate schedules through one person, not multiple. Overall, the training coordination process becomes more effective by eliminating activities in the process. Improved efficiency increases the ability of the trainers to meet the operational performance objective, dependability (Brandon-Jones, 2011) due to the increase in time available to train and simplifying the coordination process.

5.1.3 Standardization

Many companies strive to standardize roles, procedures, processes and systems. Standardizing is particularly important for larger companies with multiple operations because it ensures the operations are operating in a similar manner and performance is measured using standard operating metrics, which enables internal benchmarking (Brandon-Jones et al, 2011) between sites. However, standardization is challenging to achieve, especially with cultural difference between mine sites.

With a centralized dispatch model, all dispatchers work in the same department; therefore, it is relatively easy to implement standard operating processes. Supervision responsible for overseeing dispatch can monitor performance and ensure that dispatchers adhere to the standard operating processes. Central dispatch also simplifies the implementation of standard roles and responsibilities. It eliminates the issue of dispatchers taking on responsibilities that add no value to the dispatch function. Standardization of roles and responsibilities has been a challenge for Teck Coal, mainly attributable to geographic distance between the site and different operating strategies. Centralizing dispatch helps to eliminate this challenge.

Implementing standardizing metrics for evaluating fleet control optimization and dispatcher performance is not difficult with central dispatch. The greatest challenge is consensus from the mine sites regarding the key metrics. The targets for the metrics can vary by site but the metrics should be standard across the sites. Once selected, they can be implemented by the dispatch managers and performance measured against these metrics. Management will have access to the metrics for all dispatchers so benchmarking against peers is possible.

5.1.4 Competent Dispatcher Backups

It is necessary to provide backup coverage for the dispatchers during their absence. It is critical that competent backups are providing an appropriate level of dispatch service that optimizes fleet control. Backfilling with inadequately trained personnel can result in fleet mismanagement, inaccurate data and elevated operating costs. Appendix E contains an example of the type of error that can occur when competency levels are low. The appendix contains a production shift report from CRO that illustrates the impact of miscoding on truck productivities. The haul truck stopped empty for one hundred and seventy-one minutes and the time was miscoded to operating time but should have been coded as delayed time. The additional one hundred and seventy-one minutes inflated the hauling empty time to just over two hundred minutes, which was not consistent the other trucks hauling from the same shovel. This mistake significantly underreported the productivity for this truck. The dispatcher should have detected this issue.

The central dispatch model will have multiple dispatchers working together to provide dispatch service. With this organizational structure, the need for dispatcher coverage is concentrated in one location, not distributed across multiple sites; therefore, one spare dispatcher per crew can provide backup coverage. The primary role of these individuals would be dispatching and their utilization would be high thus maintaining their competency level. This system is effective for maintaining competent dispatchers and significantly reduces the number of required backup dispatchers and the associated training.

5.1.5 Recruitment and Retention

One of the concerns for mining companies in future years is recruitment and retention of skilled workers. Teck identified this concern in the Our People section of the 2014 Teck Sustainability Report.

> Over one-third of our current North American workforce is over the age of 50, and we estimate that over 150 of our current front-line leaders will retire in the next five years. We need to both accelerate the development of our current workforce and attract new talent to replace our retiring employees and to fill new positions (2014 Teck Sustainability Report, p.71, 2014).

A central dispatch model can be located remote from the operating mines, in areas that appeal to a greater mass of people. The BHP Billiton and Rio Tinto remote operations centres are located near the airport in Perth, Australia. The location of these facilities increases access to human talent due to population density and attracts skilled people who favour the amenities available in urban centres.

There are issues with recruiting and retaining people in Teck Coal. It is difficult for CRO to attract employees to their operation from within Teck Coal because employees do not want to relocate their families from southeast, BC to Hinton, AB. Even within the five southeast BC operations, it is common for employees to prefer working at EVO because of its proximity to Fernie and Sparwood, BC.

Teck Coal could set up a remote dispatch office in Sparwood or Fernie, BC, which is a preferred location relative to the mine sites. The shorter work commute, non-industrial office setting and opportunity to work in a functional team could be a marketing strategy for attracting and retaining people to the dispatch role. A central dispatch office in Sparwood would shorten a FRO dispatchers commute by approximately one hundred and twenty kilometres (return) each day. This reduction would be a benefit for the existing dispatchers and future employees in this role.

5.2 Teck Coal Remote Dispatch Project

This section will discuss Teck Coal's remote dispatch project that provides dispatch service for CRO. It will identify the reasons that CRO moved to the remote dispatch model from site-based, discuss the technology that supports the remote systems as well as the benefits and challenges associated with the project.

A benefit of being part of a business unit with multiple operations is the ability to take advantage of synergies. In November 2014, CRO transferred their dispatch services to CMO due to CRO's inability to support the dispatch function. CRO operated site-based dispatch starting in April 2010 but it operated ineffectively due to labour restrictions imposed to reduce site-operating costs. Initially there were no dispatchers. The pit supervisors managed the dispatch system utilizing laptops in their vehicle. Managing the system was not a high priority for the supervisors because their primary role was managing field operations. This combined with an ineffective communications system for the laptops resulted in the provision of inadequate dispatch service.

In 2013, CRO added two full time dispatchers to the mine operations department to improve dispatch management. These individuals were site-based dispatchers located in a mine site office where they provided dayshift only dispatch service. Pit supervisors and unionized backup supervisors provided nightshift coverage. This organizational structure change was an improvement from the pit supervisors managing the system from the field; however, the dispatch system was still underutilized and dispatcher competency was only at basic level as noted by Craig Yeliga (personal communication, July 8, 2015).

In the second quarter of 2014, CRO needed to reduce operating costs due to challenging coal market conditions. The site made the decision to eliminate the dispatcher positions and cease management of the dispatch system because the system was underutilized and appropriate value was not returned. Teck Coal management realized that operating without dispatch limits the ability to optimize fleet control and affects the sites ability to benchmark performance against other sites due to data accuracy issues. At the Teck Coal 2014 Five Year Planning Session, participants identified remote dispatch as an opportunity for CRO. In September, CMO agreed to provide remote dispatch service and implementation occurred in November.

Remote dispatch would not be possible without technological innovation. Teck Coal was able to use its existing technological innovation (NBS, 2012) capabilities to implement dispatch operations from remote locations. Communications were possible using cellular networks, Wi-Fi, fibre optics, Voice over Internet Protocol (VoIP) and Radio over Internet Protocol (RoIP) technology. Closed circuit cameras enabled CMO remote dispatchers to gain visibility into the CRO mine areas. The camera system combined with the dispatch systems graphic display provides the dispatchers with the visual aids required to understand the mine site and manage the equipment fleet.

The remote dispatch project is in the early stages but CRO has realized benefit from moving to the remote dispatch model. Prior to remote dispatch, CRO did not have adequate personnel dedicated to dispatch; however, with remote dispatch, CMO provides office based service every shift. The most notable improvement is the increased accuracy of the shovel and truck fleet data, specifically productivity data. During the period between CRO terminating dispatch and migrating to CMO remote service, Teck Coal removed CRO's truck productivity data from the internal benchmarking due to data accuracy issues. Within three months of implementing remote dispatch, the data quality significantly improved to the point where it was accepted for internal benchmarking. The project has also enabled CRO supervisors to focus on their core functions in the field while supporting CMO dispatchers to optimize fleet utilization.

The project experienced some challenges through the execution stages; one technology issue and the others relate to change management. The technology issue was attributable to an ineffective communications system during the initial three months of the project. This issue was resolved with the implementation of the RoIP communications system, which enabled two-way radio communications between the mine sites. The change management issues were a lack of defined roles and responsibilities for CRO supervisors, dispatchers and supporting groups, poor communication between mine sites regarding work schedules and lack of process for CRO and CMO to review performance (personnel and production). There are cultural differences that cause uses between the sites such difference in operating strategy with dispatch such as rotating versus full time dispatchers. If improperly managed, these issues could affect the success of this project and the potential to expand this model to a larger scale within Teck. A good change management process could have avoided these issues. As explained by John Kotter (2007, p3), “the change process goes through a series of stages that, in total, usually require a considerable length of time. Skipping stages creates only the illusion of speed and never produces a satisfying result.” Building a change management plan at the beginning of a project is a proactive approach to addressing potential issues. Taking an alternative approach to dealing with issues as they arise creates frustration and demotivation for involved parties. Proactive planning is the best approach.

6: Recommendations

This section will provide recommendations for Teck Coal to optimize the dispatch function. It will summarize the issues with the current site-based dispatch model utilized at Teck Coal and explain how the central dispatch model will address these issues. This transformational change to central dispatch will require a robust change management process to manage the challenges associated with this transition.

6.1 Benefits of Central Dispatch at Teck Coal

The dispatch function at Teck is vital for managing and optimizing the equipment fleet. A significant portion of the operating cost at the Teck Coal mine sites is attributable to loading and hauling material (coal and waste/overburden). In 2014, the loading and hauling costs at CRO accounted for 48% of the total mine site cost on a $/BCMTM basis. The dispatchers are responsible for managing the fleets that generate these costs; therefore, Teck Coal’s dispatch function needs to achieve operational effectiveness, which means performing this activity better than rivals (Porter, 1996, p.1). Optimizing fleet control will enable Teck Coal to improve its cost position by doing more with fewer assets.

The site-based dispatch model utilized at Teck Coal has issues that negatively affect the dispatch function. At the Teck Coal 2014 Five Year Planning Session, representatives from all mine sites identified dispatch as an opportunity for improvement. Some of the issues previously mentioned in this document are:

- Dispatch system competency levels for dispatchers and backups
- Dispatchers performing zero value added tasks
- Dispatcher turnover, rotational programs
- Limited training resources
- Lack of standardization of roles and responsibilities
- Dispatcher performance monitoring

The creation of a central dispatch centre for Teck Coal in the town of Sparwood, BC, would address the identified issues and strengthen the dispatch function. Bringing the site dispatchers to a central facility will create a functional group whose primary focus is provision of dispatch services to the Teck Coal mine sites. This group will benefit from peer effect productivity improvements (Mas et al, 2009) and increased learning rate due to knowledge exploitation and exploration (Coradi & et al., 2014). Centralizing will reduce the requirement for the dispatch specialist to waste time traveling to the mine sites; therefore increasing time available for performing the value added task of training and evaluating dispatchers. With respect to standardizing roles and responsibilities plus standardizing KPI's for dispatch and dispatcher performance, it will be easier to implement in a central group reporting working in the same department compared to implementing across all mine sites.

The issue of competent backup dispatchers is resolved by addition a spare dispatcher to each crew. This structure would be similar to the structure observed by Teck Coal representatives at the Colombian operation in 2011. The spare dispatcher can cover the regular vacation time for his/her peers, assuming only one dispatcher per crew takes vacation at any given time. This organizational structure change reduces the backup dispatches from forty to only four backups/spares. The primary function of the backup dispatcher will be dispatch; therefore, their competency level will be high due to the constant exposure. When all dispatchers report to work, one dispatcher can travel to a mine site to observe increase familiarity with the mining areas.

Removing the dispatchers from the mine sites reduces the risk that the dispatcher will be required non-dispatch tasks that distract from their ability to monitor and manage fleet control. It eliminates the possibility of dispatcher transfers into the field to cover pit supervisor shortages. It also eliminates the issue of dispatcher being distracted due to social gatherings in the work area as noted in the Teck dispatch baseline study conducted in 2013.

Dispatchers reporting to dispatch supervisor that have technical knowledge of the system will improve performance monitoring and provide mentorship for the dispatchers. Monitoring and mentorship are two of the eight managerial leadership roles discussed by Gary Wagenheim in the Business 557 Leadership course (personal communication, September 16, 2010). In a balanced approach, these roles are important to provide effective leadership.

By establishing a central dispatch centre in a preferred location, it will improve the marketability of the dispatch role. A location with a short commute for dispatchers will be favourable due to reduced workday. This benefit should aid in the retention of existing and future dispatcher. With respect to recruitment, the human resources group will use the preferred location to attract more people to vacancies in the role.

6.2 Proposal

Based on the analysis performed in this paper, it shows that a central dispatch model can strengthen the dispatch function at Teck Coal. Teck Coal should pursue the option of establishing a central dispatch centre in the town of Sparwood, BC where it has access to two office facilities. The dispatch centre should provide dispatch service to the six active operations.

Transferring the dispatch function to the central location will require organizational structure changes because the dispatchers move from the sites to the business unit. It is important to keep the dispatch function within the organizational structure of the operations group, under the direction of the VP of operations. This maintains alignment in responsibilities because the operations group is accountable for achieving production targets. The proposed organizational is shown in Figure 7.

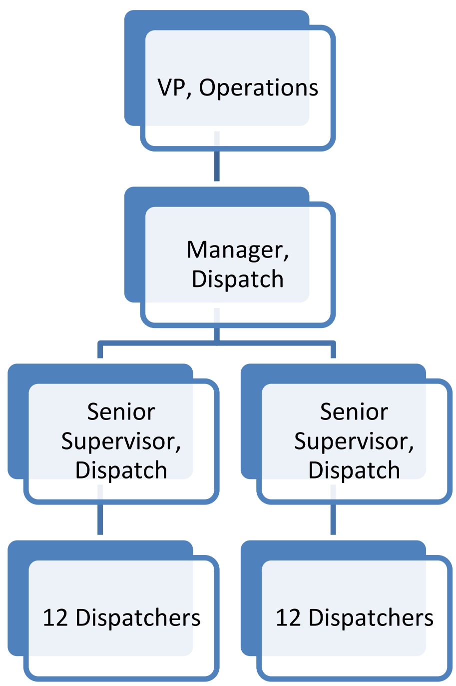

Figure 7 Recommended Dispatch Organizational Structure

Source: Created by the author

The transition to the business unit will require the creation of three new roles: a manager and two senior dispatch supervisors. The manager will be accountable for the dispatch group and report to the VP of operations. Reporting to the manager will be two senior dispatch supervisors, who will provide direct supervision to the dispatchers. The creation of the senior supervisor roles will opens career advancement opportunities for the dispatchers, which is an issue with the current site-based system. These supervisors will work on opposite shifts and provide supervision for dayshifts only. Their schedule will be four days on and four days off, working twelve hours per day.

The core of the dispatch functional group will consist of twenty-four dispatchers with six dispatchers working on each of the four crews. The recommended allocation of dispatchers is two for FRO, one for EVO, one shared for GHO and CMO, one shared for LCO and CRO plus one spare. FRO will require two dispatchers given that scale of the operation, this is consistent with the current arrangement. These individuals will work a four on and four off schedule consisting of two dayshifts followed by two nightshifts, which is consistent with the work schedule at most of the mine sites. Overall, this structure will require less people involve in the provision of dispatch duties. As shown in Table 2, the site-based system requires six-four and centralized only twenty-four people to be competent in the dispatch role. This is a significant reduction in people performing dispatch duties. By eliminating the requirement for the forty dispatch backups at site, it enables these individuals to focus on their core function, which is typically performing in a production role such as operating equipment. It also significantly reduces the training requirements, time and resources at the sites. The proposed model does require the addition of three roles but transferring the existing dispatch supervisor from FRO to the central dispatch centre will fill one of the roles.

Table 2Personnel Performing Dispatch

	Site Based	Centralized
Dispatchers	24	20
Back Ups	40	4
Total	64	24

Source: Table created by the author

The dispatch function consists of multiple groups working together to provide the dispatch service; the dispatchers do not work in isolation. As explained by Mintzberg, a typical structural configuration consists of five components; operating core, administrative, strategic apex, technostructure and support staff (Bolman & Deal, 2008, p.79). The operating core consists of the dispatchers and equipment operators. The administrative component is the dispatch and site mine operations pit supervisors. The strategic apex consists of the senior managers, which includes the manager of dispatch and VP of operations. The technostructure component has dispatch technicians and engineers who are responsible for the technical aspects, and the support staff consists of the maintenance personnel such as electricians and information technology personnel that support the system. The proposed central dispatch model only relocates the dispatchers, dispatch specialist and dispatch senior supervisors to the central dispatch facility. The remaining groups will stay at the mine sites and work with the dispatchers remotely.

The transition from site-based to central dispatch would be a transformational change for Teck Coal as it would affect every mine site. The organizational change from site control to business unit control may meet some resistance from the mine sites because it is a foreign concept to many of people working at the sites. It will be very important to established roles and responsibilities for all individuals involved in the new model. The successful implementation of central dispatch will be dependent on the development of a robust change management plan.

7: Implementing Change

This section will identify the challenges that Teck Coal will face implementing the transformational change from site-based to centralized dispatch. These challenges are manageable utilizing a change management process. The eight-step change management process developed by John Kotter (2007) would be an effective process for implementing the transition to central dispatch. This section will discuss the application of this process for Teck Coal's transformation to central dispatch.

Teck has a long history operating site-based dispatch systems. Adopting a central dispatch model will be a transformational change for Teck. The greatest challenge will not be the technological aspects but the cultural aspects of change. The pilot project between CMO and CRO shows that the innovative technical capacity exists to implement central dispatch (NBS, 2012). Mine sites may be resistant to relinquishing control of dispatch, especially the mine operations departments and site general managers. The mine operations departments are currently accountable for dispatch operations, dispatchers are members of their department. Similarly, general managers may struggle with removing the dispatch from the mine site because an external group will assume responsibility for managing and optimizing the fleet that operates on his/her mine site. The general manager has been and will continue to be responsible for achieving production targets and controlling operating costs. The perception may be that he/she is giving up control of an important part of the business that is his/her ultimate responsibility

An effective change management process is vitally important to implementing the change. According to John Kotter (2007), the change process goes through a series of phases. He developed an eight-step process that will be valuable for implementing the change to central dispatch. His eight steps for transforming an organization are: establishing a sense of urgency, forming a powerful coalition, creating a vision, communicating the vision, empowering others to act on the vision, planning for and creating the short-term wins, consolidating improvements and producing more change, and institutionalizing new approaches. Many change initiatives in business fail due to lack of or poorly executed change management. Going forward, extensive planning will be required to develop the eight steps.

7.1 Create Sense of Urgency

To begin the change process, it is critical to create a sense of urgency to motivate people to embark on the change journey. As explained by Kotter (2007, p.3), "the first step is essential because just getting a transformational program started requires the aggressive cooperation of many individuals. Without motivation, people won't help, and the effort goes nowhere".

The continual coal price decline since 2011 is a concern for Teck Coal. The business unit strives to achieve operational effectiveness and reduce operating costs to maintain a positive cash position. The lack of uncertainty of future coal prices can be a motivator to drive the need for change. It will be important to show the key players in the business unit the issues with the current dispatch system and identify the benefits of creating a dispatch functional group working in a centralized location. Helping people understand the percentage of total site costs, $/BCMTM, that is attributable to the shovel and haul truck fleets will provide knowledge on the importance of effective fleet control. This information combined with the dispatch competency issues, and coal price trends should motivate people to make a change.

7.2 Form Powerful Guiding Coalition

Teck Coal is a large business unit in the corporation with six operations spread between BC and AB. Instituting the dispatch change across the business unit will require the formation of a powerful coalition that represents the main groups affected. According to Kotter (2007, p.5), "most successful cases, the coalition is always pretty powerful – in terms of titles, information and expertise, reputation, and relationships".

The probability of successful implementation will increase with the participation of the Teck Coal VP of Operations because this role oversees all the operating mines. The executive VP of Teck will also need to part of the coalition. A project of this scale will not proceed without buy in from these executives. A significant benefit of the executive VP participating is that all business units in Teck report to this position. This role will be instrumental in transferring learnings to the other business units, as there are potential applications outside Teck Coal. The other key players will be the general managers, mine operations superintendents, engineering director, mine engineering superintendents and senior information technology (IT) representative. It is not critical for all general managers and mine operations superintendents to participate but at least one of these individuals from each site because they are relinquishing ownership. The dispatch manager is essential because in the new structure, the dispatchers will transfer to his/her group. The engineering group should be represented by at least superintendents from the three larger sites consisting of FRO, EVO and GHO. Given the technological aspects associated with remote dispatching, senior level IT representation will be essential. It is important that the right people, from various levels of the business unit, are participating because they will lead the change.

7.3 Creating a Vision

The guiding coalition needs to create a vision that clearly captures where the business unit wants to move with dispatch. It is important to keep the vison simple and appealing for the people working to achieve the vision. Kotter (2007) believes that the vision should be communicable in five minutes or less and produce a reaction that indicates understanding and interest. The vision should incorporate elements of operating excellence in fleet control, dispatcher competency/expertise building and the pursuit of optimizing asset utilization to achieve operational effectiveness. Development of the vision is important because it guides the change.

7.4 Communicate the vision

Maintaining frequent and credible communication will be important as the business units transforms the dispatch function. Companies fail at this stage because communication only occurs at the start of the journey, communications only conducted by senior management so interactions are low with the workforce, and failures occur when influential members of management act in a manner that contradicts the vision (Kotter, 2007).

Teck Coal has many forums for communicating information to employees. Communications can occur through the internal website, quarterly mine site meetings, weekly and monthly crew meetings, business unit monthly dispatch competency reports for senior management, personal interactions and display screens placed through the mine sites.

The general managers will be essential for leading the change. One approach to communicate and reinforce the vision will be the regularly scheduled quarterly crew meetings. To supplement, the mine operations superintendents will have to maintain frequent communications with their people because they are key players to making the change, especially the mine supervisors who constantly interact with the dispatchers and equipment operators. The equipment operators are the frontline users of the dispatch system so the actions and behaviours of their supervisors need to align with the vision for the change to be successful. It will be important that all mine sites effectively communicate the vision because success will be dependent on alignment between sites.

7.5 Empower others to act

This stage of the change management process has two components, empowering people to act on the vison and removing obstacles or barriers to change. To drive change, leaders need to empower people who are proponents for the project. People need to be encouraged to generate ideas that help move the change forward. There may be opportunity to reward positive contributions to the cause by granting promotions or monetary compensation through Teck Coal's benefits programs.

The removal of obstacles or barriers to change is equally important to empowerment. Changing the dispatch model is complex because it spans across the business unit; therefore, many individuals at various levels of Teck Coal will be involved in the change process. It is imperative that critical members, especially senior managers, needed to generate the change push the initiative forward. Individuals resisting or blocking the change need prompt attention. If attempts fail to gain support, their removal may be required to advance the transition to central dispatch. A mine site refusing to migrate to central dispatch would be a major obstacle for the project.

7.6 Plan short-term wins

The central dispatch project will be a significant undertaking for Teck Coal. Implementing a project of this scale will take time, probably in the order of four years. A challenge with a project requiring this kind of timeline is keeping people engaged and motivated. An effective means of generating engagement is planning short-term wins along the way. According to Kotter (2007, p.7), "without short-term wins, too many people give up or actively join the ranks of those people who have been resisting change. It is proactive to plan for wins, not hope for wins to occur. The transition to central dispatch will be a staged approach with mine sites migrating to the central dispatch centre over a period of several years. As the mine sites transition, it will be important to demonstrate the realized benefits. Celebrating the ability of one dispatcher to provide service to multiple sites is an example of improved labour efficiency. Planning and celebrating these short-term wins will help generate a sense of accomplishment and recognition for the individuals who are leading the change.

7.7 Consolidate improvements

The strategy of creating early wins will help move change forward. Incorporating improvements identified as the project advances will be important for driving future change. Teck Coal has the benefit of experience with smaller scale remote operations with the implementation of the remote dispatch project between CMO and CRO. This project identified the need for a robust communication system. The project had a setback in the early stages due to utilization of an inadequate communication system (VoIP) that limited communication between the CMO dispatchers and CRO supervisors. The communications issue was a significant source of frustration for both CRO and CMO personnel, which created demotivation and lack of confidence in the ability to implement remote dispatch. Another key learning was defining the role and responsibilities of all parties involved in the dispatch function. The lack of clarity in the CRO-CMO project did generate frustration. Making the same mistakes on future projects will create unnecessary delays and produce resistance.

By implementing central dispatch in a phased approach, Teck Coal will identify opportunities for improvement. Incorporating improvements and learnings will future risk to the project, build confidence in the project team and increase the probability of success.

7.8 Institutionalize new approaches

The objective of moving to centralized dispatch is to improve the dispatch function at Teck Coal. Centralization will create a dispatch function that operates at a high competency level, which will translate into improved fleet control. To engrain the benefits of the change, it will be important to communicate the realized improvements. The communication could include presentation of dispatch KPI improvements compared to existing baseline data. Shovel and truck productivity improvements are a key driver for change, it will be important to communicate performance improvements for these fleets to the sites and senior executives.

Once central dispatch becomes the way Teck Coal manages fleet control, there may be opportunity to implement this model in other business units of Teck. For instance, provision of dispatch service for the Quebrada Blanca Phase 2 project might be possible through the existing Quebrada Blanc mine. Participation of the executive vice president in the guiding coalition is a great strategy for transferring the learnings across the corporation.

8: Conclusion

The commodities industry is cyclic in nature with significant fluctuations in prices. Teck Coal, similar to the other business units, strives to maximize profit margins by achieving operating effectiveness to reduce costs. Two significant cost drivers at the mine sites are the shovel and truck fleets so operating these fleets efficiently is a key focus. High fleet productivity translates into lower cost as fewer assets are required to achieve production targets. Site-based dispatchers manage these assets utilizing a dispatch system. To optimize the efficiency of these fleets, it is important to have a strong dispatch function.

This paper identifies the issues with dispatch operations at Teck, specifically Teck Coal and evaluates the possibility of centralized dispatch addressing these issues. The primary issues identified were:

- Dispatch system competency levels for dispatchers and backups
- Dispatchers performing zero value added tasks
- Dispatcher turnover, rotational programs
- Limited training resources
- Lack of standardization of roles and responsibilities
- Dispatcher performance monitoring

The evaluation indicates that creating a functional group of dispatcher operating in a common workspace can address these issues. It can create a positive work environment that promotes learning through peer effects, increase dispatcher productivity associated with knowledge exploitation and exploration and remove site-based distractions that lead to dispatchers performing zero value added tasks. Centralizing will increase accessibility to training resources due to elimination of travel time for the existing dispatch specialist. The backup dispatcher competency issue will no longer exist with the addition of one spare dispatcher per crew. There will be a significant reduction in people required to perform dispatch duties due to the reduction in required backups. Centralization also increases the ease for standardization for KPI’s as well as roles and responsibilities.

I propose that Teck Coal should pursue the creation of central dispatch centre that will provide dispatch service for the business unit. Creating a centralized dispatch function group will pool the dispatcher talent and create an environment that will be conducive to building knowledge and competency. The challenging aspect to making the transformational change from site-based to central dispatch will not be technological; it will be the cultural aspects. A robust change management process such as John Kotter's (2007) eight-step process will help to implement the project.

Appendices

Appendix A – Ross Wilson Interview

This appendix contains information (paraphrased) from an interview with Ross Wilson and the information has been review with Mr. Wilson for accuracy.

1. How long have you worked with Teck/Fording?
    - I've been with the company over 34 years, started at Fording River on Oct 8 1981.

2. What operations have you worked at with the company?
    - I worked at Fording River until June 2008, and transferred to Cardinal River where I'm currently employed.

3. How long did you work in the mine operations department at FRO?
    - I worked in the mine operations department for almost 16 years.
    - I worked as pit utility from October 1981until December 1981, then truck driver until Feb 1986. I transferred out of the department for 10 years and transferred back in January 1996. After transferring back, I held various supervision roles until June 2008.

4. What roles did you perform at FRO? Please provide the years that you were in each role.
    - Pit Utility — October 1981 – December 1981
    - Haulage Truck Driver — December 1981 – February 1986
    - Process Operator Trainee — February 1986 – March 1987
    - Senior Process Operator — March 1987 – May 1989
    - Heavy Duty Mechanic Apprentice — May 1989 – December 1993
    - Journeyman Heavy Duty Mechanic — December 1993 - January 1996
    - Pit Foreman, Mine Operations — January 1996 – May 1999
    - Training Foreman, Mine Operations — May 1999 – May 2000
    - Senior Foreman, Mine Operations — May 2000 – July 2004
    - General Foreman, Mine Operations — July 2004 – June 2008

5. During your time at FRO, how was the dispatch function managed? Did you run full time dispatchers or rotate people through dispatch? If you rotated dispatchers, how often did people rotate?
    - Dispatch started up at FRO approximately March 1997, we started with four primary dispatchers of which I was one. Once the initial training was completed, we started to train some of the other pit foremen. The first four dispatchers were the primary but we were not full time dispatchers, our position was pit foreman. There were three pit foremen on each shift and we rotated through the three pit foremen roles, the other two foremen were looking after areas in the field. The rotation schedule was different on each shift and was developed by the foremen and approved by

senior foreman. Some of the crews changed every shift; others went as much as 4 to 6 months with a month or so in the field for what we called a “sanity break”.

6. Was dispatch considered to be a preferred role?
   - No, we had a hard time in the beginning to earn respect and prove the value. Most of the foremen hated the time they had to spend in dispatch**.**
   - There was a feeling that working in the field was higher value than the dispatcher. The dispatcher role was considered an administrative role, follow instruction of senior foreman.

7. Who fulfilled the dispatcher backup role?
   - The other pit foremen on the shift. We did not use backup foremen (unionized workers) to run dispatch in the beginning, mostly due to the fact that we displaced unionized dispatchers and replaced them with staff when we brought the current dispatch system in.

8. What were your role(s) at CRO?
   - Superintendent, Mine Operations

9. How did you manage dispatchers at CRO? Did you have full time dispatchers or rotate people?
   - We started with the pit foremen attempting to operate dispatch remotely with laptop computers while they were overseeing a pit. We ran into a lot of technology and communication issues which resulted in the foreman having to park in an area that had good service and try to watch dispatch with limited ability to see or adjust in real time. We then tried to operate with two full time dispatchers; the idea was to have two foremen who would run dispatch full time on steady dayshift and use backups on nightshift. The two dayshift foremen were assigned to dispatch with the thought of keeping them there for at least a year so they could become on site “experts” and then train the other foremen to operate dispatch. On nightshift we had other foremen or backup foremen (unionized workers) fill the role but did not have anyone assigned as a permanent dispatcher on nightshift. The shift foremen assigned people as they saw fit.

10. Who fulfilled the backup role?
    - Pit foremen or backup foremen (unionized workers), at times even light duty people if they had the ability to learn the system.

11. Why did you eliminate the site-based dispatch role?
    - When CRO was faced with lowering coal prices and high cost we needed to make changes. Dispatch was seen as something that was a benefit but not a necessity for

production. The chance we took was that the data we received was going to deteriorate, which it did.

12. Who provides dispatch service for CRO?
    - CRO is now dispatched remotely from CMO, using the existing CMO dispatchers

13. What are some of the benefits of remote dispatch service?
    - Utilizing a resource that was underutilized by dispatching a small site, interacting with another operation on a daily bases helps in the transfer and sharing of ideas.

14. What are the challenges with remote dispatch services?
    - Communication and building trust, seeing a dispatcher who is a long distance away as part of the crew is a challenge.
    - The Foremen at CRO struggle with giving the truck shovel “reins” up to someone they don’t know and can’t talk to face to face.
    - The dispatchers also struggle with maintaining a vested interest in CRO when they are so removed from the day to day conversations and challenges.
15. Any suggestions for implementing change from site-based dispatch to remote or central dispatch?
    - Training, remote dispatching is different than on site dispatching, dispatch training becomes even more important as well as training for the site pit foremen.
    - As the operations involved become bigger, the interaction and roles of each will need to be better defined.
    - I think it would be easier to transition with two mines that are closer together; this would give the feeling of remote dispatching coupled with the ability to stop in and have face to face discussions regularly and would help with team building and buy in.

Appendix B – Craig Yeliga Interview

This appendix contains information (paraphrased) from an interview on July 8, 2015 with Craig Yeliga and the information has been review with Mr. Yeliga for accuracy.

1. How long have you been employed with Teck?
   - 5 Years

2. What is your current role? How long have you been in the role?
   - Specialist Dispatch Training
   - Since 2013/02/18

3. When did Teck Coal and Highland Valley Copper start producing the truck productivity benchmark report?
   - The evolution of the report started in 2011

4. Do you know how many years Teck Coal and predecessors have been using dispatch systems?
   - QCO - 1985
   - EVO - 1992
   - GHO – 1994

5. When did Teck Coal start utilizing the current dispatch system?
   - It was first installed at EVO in January of 2008

6. Why do FRO and GHO have a low utilization of automatic dispatch?
   - FRO generally has isolated pits and a mixture of 797 and 930E hauling units so creates challenges with running automatic.
   - GHO has the highest use of automatic dispatch, but also has a mixed fleet of 930s and 830s which creates some issues with operating trucks of different size.
   - EVO has a higher utilization because all trucks are the same (930E) and larger pits and shared dumps make it easier.
   - There is opportunity to improve the time operating in automatic mode at the sites. One of the challenges is that a few dispatchers and the backup dispatchers have not been adequately trained to operate in automatic mode.

7. Have backup dispatchers at the sites received the formal dispatch training that is provided by you, the dispatch specialist?
   - I have provided limited training to the backup dispatchers because the primary focus is training full time dispatchers. The training that I have provided to the backup dispatchers has not been adequate for them to achieve the competency level required to operate the dispatch system in automatic mode.
8. What Teck Coal sites have you trained people on the new dispatch roles and responsibilities?

- Roll out progress seems to be slow as I've only been to provide training at LCO

9. Are the backup dispatchers adequately trained to operate the dispatch system in dynamic or automatic mode? If no, why?
   - No because I don't have the available time to provide training to 8 backups at each site. The present objective, as part of the new roles and responsibilities, is to develop a dispatch expert at each site who will provide training to backup dispatchers. This objective is in the early stages and dependent on the each sites timing of roll out and implementation.

10. When did Teck Coal make the decision to move to full time dispatchers?
    - The initiative started in 2012 with FRO.
    - The only sites that did not move to full time dispatchers were CMO and CRO

11. Was there any formal dispatch system training at any of the sites prior to you creating the training program in 2013?
    - The mine sites did not have a formal dispatch training program. The majority of the training was performed by dispatchers training new dispatchers or backup. However, each site is allotted 80 hours of support by our dispatch provider, which usually translates into 8 days of training with an external technician per year. This training was highly ineffective as it was conducted in the dispatch office while trying to dispatch. Also, there was no formal process. It is more question and answer session where dispatchers asked questions and technician answers.
    - As a dispatcher for two years, my training consisted of two nightshifts with another lead hand. After a year dispatching, I spent one day with the external technician. I believe this is a fair representation of the previous training method.

12. Did you have any issues with schedule commitments with site dispatchers? Ie sessions cancelled frequently or a short notice?
    - Not frequently, but it does happen. I figure about 10% of the time there would be last minute cancellations or showing up to site with them not being prepared.

13. Is it difficult to gain access to dispatchers for training purposes?
    - Most sites are very receptive to wanting training. Some sites have difficulty setting up training days due to a lack of field foreman/vacation requirements because sites need to backfill the dispatcher while they are training.

14. Have you ever traveled to a mine site for training session and training session was cancelled after you got to the mine site?
    - Yes, it has happened a few times. Most of the time, it was due to someone calling in sick and not having coverage for the dispatcher. A small portion of the time it was due to poor communication at the site.

15. How much time required to train and sign off a dispatcher for each level of competency? (Basic, Dynamic and Advanced).

- Basic – Usually 2 sessions at 3-5 hours per session
- Dynamic – Usually 2 sessions at 3-5 hours per session
- Advanced – Usually 1 at 3-5 hours per session
- Expert – I have not trained anyone to this level yet. Expert dispatchers need to understand the material well enough to effectively train others, so having them learn the training program is part of being an expert.

16. Do you know how many full time dispatchers left the dispatch role in Teck Coal in the last 3 years?
    - Resigned – 4
    - Transferred to pit – 3
    - Transferred to dispatch at another Teck Coal mine – 1

17. What was the dispatcher competency level of the CRO supervisors before implementing the two full time dispatchers? If below basic, why?
    - The average competency level of CRO supervisors was below basic (around 0.2). This was due to lack of training, and a lack of support. Supervisors were expected to maintain all their normal duties as wells as dispatch out of their vehicles with a laptop.

18. What was the competency level of the two full time dispatchers? If below basic, why?
    - Their dispatch competency was below base level due to lack of training.

19. Do you have a list of inputs that are required to run dynamic dispatch? Ie accurate road network, dig blocks, dump locations….
    - To run automatic dispatch you need the following information. The system cannot operate properly is this information is not accurate.
        - Accurate shovel information
            - Elevation
            - Dig block
            - material
            - dump
        - Correct operator usage of system (badge in, delays)
        - Accurate road network
            - Run position playback
            - RTE mode to fix:
                - beacons
                - roads
                - dumps
                - stockpiles
                - wait/load radius
            - Route highlights
                - both ways from shovel to dump and dump to shovel

        - if setting up for dynamic, from all dumps to all possible shovels
    - Convert Wait radius to polygon
- Fix road network
    - Configure access beacons
    - Add/remove roads/dumps/stockpiles/beacons with Graphical Database Editor
    - Add/remove local/global constraints on routes
- Make sure dispatch Wi-Fi/GPS is working on all equipment
    - Run a Position Elapsed Time report
- Configure dispatch beacons
- Configure Lock/Bar utilization of trucks
- Ensure accurate travel times
    - Visual check in Fleet Control
    - Change segment travel times
    - Change virtual segment travel times
    - Adjust load/spot times (especially for loaders)
- Group together shovels
    - Configuration
    - Prioritization
    - Calculate and view report
- Monitor
    - Event monitor
    - Empty dispatch viewer

Appendix C – Teck Dispatch Baseline Study

The following information is an excerpt from the Teck "Mine Tracking and Improvement – Operations Process Map" report prepared on October 28, 2013. To protect the identity of the mine sites, the author changed the names.

Mine 1

- A clear defined roles and responsibilities for the Dispatchers and Operators is required to be standardize across the sites

Mine 2

- There is an excessive amount of paperwork and distraction for the Dispatcher(s) to perform his work. Dispatcher role and responsibilities need to be revised and standardized across Teck. The workload for the Dispatcher at MINE 3 includes:
    - Vacation list – keep an updated record on the white board
    - Sick list follow up
    - Idle policy enforcement
    - Fatigue monitoring system
    - Main gate keeper (several times a month)
    - OHSE report – Follow up and update the issues
    - Responsible for training sessions (start-up computers, setting the operators in a computer, monitor time, material completion, facing the challenges of lack of computer knowledge of new operators, etc. (54 people has to go through this every 6 months)
- Feedback was given that approximately 30% of the Dispatcher(s) time he/ she is performing clerk routine jobs rather than focusing on the system
- Find parts at the warehouse during night shifts in order to keep inventory updated and materials properly sign-off & maintain and update software (inventory). It takes approximately 10-15 min (Loads opportunity Lost)
- Maintain run & Repairs notes
- Shift production report (Excel and FMS data)
- Update payroll sheet (10-15 min each shift)
- Maintain and update incident book (1-3 channels including: Activity log, incident command, emergencies and at the same time run the equipment
- Plant production information at the beginning and end of the shift is required to be updated and provided to the foreman
- Update truck fleet odometers once a month (59 trucks)
- Frequency at shovels (printout & distribution at the end of the shift)
- KPIs report printout (Developed by an internal engineer)
- It was noticeable the excessive personnel traffic into the Dispatch room. A secured door or isolated area is required. Processes need to put in place from the different departments to identify who requested information from the Dispatcher to avoid extra-distractions o i.e. - 5 different maintenance personnel dropping by to ask the same questions to the Dispatcher during the first period of the shift

Mine 3

- Further development is recommended to identify how much time Dispatchers are running dynamic versus the opportunities for running dynamic throughout the shift
- There are a lot of distraction/visitors to the Dispatcher(s) during regular office lunch due that the coffee machine is next to the Dispatch room. Dispatcher would benefit from having a "lockable" area in which no visitors no visitors are allowed unless is Dispatch related in order to avoid the "chit-chat" and distractions

Mine 4

- There is a requirement not only at Mine 5 but across all the other Teck sites to formalize and document the roles and responsibilities of the Dispatcher
- Dispatcher is responsible for the following reports throughout the shift:
    - Payroll information – Delivered to payroll
    - Shift summary report – Sent to Operations
    - Breaks sheet(similar to Lineup but includes sick and vacation time
    - Vacation – Sent to Foreman and payroll
    - Overtime request – Sent to Foreman and payroll
    - Time cards – Collect and process
    - Contractor equipment hours
    - Cross over Notes (ups and downs)
    - Tire failure reports
    - Cable report (only if there is any damages)
    - Contract equipment hours (only if there is any damages)
    - Hardware follow-up
    - Ensure targets for the shifts are met (based on the given monthly targets)

Appendix D – Automatic Dispatch

Greg Trainor,VP Marketing and Sales, for Wenco International Mining System approved the use of this information via email on July 8, 2015.

BENEFITS OF WENCO'S AUTOMATIC DISPATCHING AT DIAMOND MINE

A Diamond Mine located in Russia, has Wenco's Fleet Management System installed on a fleet of 11 shovels and loaders and 57 haul trucks. The system was implemented to help optimize the operation through increased efficiencies of fleet utilization. Monthly production of each truck varied according to their assignments and length of hauls. Individual tonnage ranges from 102,000 to 109,000 per month and unit productivity ranges between 350,000-570,000 ton-km.

During a four month period the mine alternated between manual or locked assignments of trucks to shovels and automatic dispatching of trucks to shovels. When using the automated dispatch decision making, the mine used the flexibility within the dispatch configuration design to create multiple groups of loading units. Using anywhere from 2 to 4 groups, splitting the shovels within those groups depending on their location and/or material type, and then allowing the system to freely assign the trucks within the group to the appropriate shovel that would best meet the mine's predetermined targets.

To analyze the effectiveness of these dispatch decisions the mine tracked key parameters of the load and haul process; truck wait time to load, cycle time, haul cycles per net operating hour, haul cycles per shift, and shift productivity per shovel and per truck.

The following table characterizes the average waiting time in minutes and seconds for a haul truck at the loading unit. "Wait Time" refers to a truck waiting next in line for the loading unit. "Queue Time" refers to a truck behind at least one other truck while waiting for a loading unit.

Month						
	Wait Time	Queue Time	**Total**	Wait Time	Queue Time	**Total**
1	1:58	2:34	**4:32**	1:27	2:04	**3:31**
2	3:11	5:33	**8:44**	1:45	2:00	**3:44**
3	1:27	2:28	**3:55**	1:19	1:49	**3:08**
4	1:55	3:20	**5:15**	1:24	2:03	**3:27**
	Manual or Locked Assignments			Automatic Dispatch		
Average	**5:36**			**3:44**		

Using automatic dispatching the average total wait time (Wait + Queue) time dropped by 1 minute and 52 seconds or an average of 7.5%

Based on this decreased cycle time an additional 13,000 loads were achieved during the same period. With an average weight of 110.7 tons per load the additional volume of mined and hauled material amounted to 1.43 million tons.

The increased productivity meant an ROI for the Wenco Fleet Management System in less than one year.

Appendix E – Dispatch Coding Errors

The information in the appendix is an excerpt from the “CRO Detailed Production Report” generated on June 18, 2015.

The yellow highlighted number 200.63 is the empty time for truck 142 hauling from shovel 12. The empty time is significantly higher than the empty time for the other trucks hauling off shovel 12 as they range from 4.02 minutes to 5.85 minutes. Upon investigation, it was determined that truck 142 accumulated 171 minutes of operating time (empty time) while the truck was stopped. This time recorded as operating time but should have been a delay time code. The equipment operators are required to enter the proper code and the dispatchers have to monitor to ensure proper entering of codes. This miscoding produces inaccurate productivity data. In this case, the productivity recorded as 23.14 BCMs/operating hour, which is much lower than the other trucks hauling off shovel 12.

L.Unit	H.Unit	Dig	Dump	EFH	Load	BCM	NOH	Empty Time (AVG mins)	Wait at LU (Avg mins)	Queue at LU (Avg mins)	Spotting Time (Avg mins)	Loading Time (Avg	Hauling Time (Avg mins)	Wait at Dump (Avg mins)	Queue at Dump (Avg mins)	Dumping Time (Avg mins)	Total AVG Cycle Time	Productivity
					Total Weighted Average:			9.08	0.00	0.58	0.00	35.37	6.70	0.31	0.00	0.84	52.88	
					Total NOH of HU at LU:			12.34		Total BCM of HU at LU: 1,127.00					Weighted Average Productivity:			91.34
S212			*Total:*		*173*	*13,926.50*	*10.37*											*1,343.39*
	T142		*Total:*		*5*	*517.78*	*8.40*											*61.64*
		H1-1760																
			HA-1775	1.90	1	80.50	3.48	200.63	0.00	1.00	0.28	1.65	4.40	0.00	0.00	0.75	208.72	23.14
	T143		*Total:*		*43*	*3,461.50*	*9.42*											*367.65*
		H1-1760																
			HA-1775	1.90	43	3,461.50	9.38	4.68	0.00	0.43	0.48	1.96	4.40	0.41	0.00	0.71	13.08	369.20
	T144		*Total:*		*18*	*1,477.82*	*5.49*											*269.02*
		H1-1760																
			HA-1775	1.90	17	1,368.50	3.58	4.00	0.00	1.60	0.55	1.75	3.96	0.14	0.00	0.63	12.63	382.44
	T145		*Total:*		*33*	*2,714.14*	*9.97*											*272.25*
		H1-1760																
			HA-1775	1.90	27	2,173.50	5.86	4.66	0.00	1.21	0.59	2.02	3.57	0.30	0.00	0.67	13.03	370.69
	T147		*Total:*		*29*	*2,392.14*	*8.76*											*273.17*
		H1-1760																
			HA-1775	1.90	27	2,173.50	6.37	5.85	0.00	0.40	0.38	2.07	4.20	0.49	0.00	0.78	14.17	340.96
	T149		*Total:*		*29*	*2,392.14*	*9.35*											*255.82*
		H1-1760																
			HA-1775	1.90	27	2,173.50	7.15	5.48	0.00	2.10	0.72	1.94	4.77	0.20	0.00	0.67	15.89	304.03
	T150		*Total:*		*33*	*2,714.14*	*7.47*											*363.50*
		H1-1760																
			HA-1775	1.90	31	2,495.50	5.31	4.02	0.00	0.27	0.14	1.33	3.46	0.40	0.00	0.68	10.29	469.59
					Total Weighted Average:			5.93	0.00	0.90	0.47	1.85	4.08	0.34	0.00	0.69	14.27	
					Total NOH of HU at LU:			41.13		Total BCM of HU at LU: 13,926.50					Weighted Average Productivity:			338.57

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