DIAMOND AWARD 2011

1. Information

Company Name

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Representative of the company:

Full Name: **Tondin Tiziano**

Traveling Companion:

Departure Airport: Venice (Venezia)

Reinforced concrete cutting, logging, controlled and not controlled demolitions, consolidations and renewals.

Has been a member of the: AIDECO ; CSDA (Concrete Sawing & Drillings Associations)

Date: 15/10/2010

2. Description of your contribution

Workings in the ACF (Alta Capacità Ferroviaria) which connects Bologna city to Firenze city. Speed planning of the railway 300 km/h (186 mph).

Total development of the way km 78,500 (49 Mi) of which exclusively in tunnel km 73,200 (45 Mi)

Tunnels have a polycentric conformation with a useful section of mq 82 (883 sq ft), totally 11 tunnels, the longest one of 18,2 km (11 Mi)

Corporation for contract awarding CAVET: Consorzio Alta Velocità Emilia Toscana

Planning : working aim improve the “safety level” on the line.

Because of the frequent accidents happened in the tunnels it was decided to increase later on the safety in the new guide-lines created in Italy.
The concrete structures were already built but it was the quenching system to be highly modified, especially the existent concrete walls in order to permit the piping and systems housing. The other main technological systems were those of ventilation, fume control, emergency power tractor, lighting, emergency calling, television based on closed circuit, resonant diffusion, anti-intrusion. The modifications to the concrete conformation regarded especially the solution of new kinds of plant engineering. We had to achieve new lateral niches, cutting the tunnel hangings, sinking and recovering the hole with the concrete, other existent niches had to be modified in dimensions.
About what concerns the pipes against fire we had to create one space to put inside the walls one pipe, whose cables would cross the reinforce-concrete slab of the arch. In the lateral safety niches we had to create a lot of pits for the technologies and for the pipes position.

In the end the initial forecast works were:

- Modification in the base reinforced concrete slab of n° 2300 niches safety laterally placed;		
- Longitudinal cuttings in the upside down arch of the tunnel with an inclination of about 20° to the vertical depth of cm 70 (28 in)	ml	4200 (13775 ft)
- Cuttings in the walls both vertically and horizontally, forecasted	ml	4000 (13119 ft)
- Cuttings in the pier, forecasted	ml	5000 (16399 ft)
- Through tunnels, forecasted	n°	200
- Cutting for new niches building and modify old niches		
Type 1 forecasted	n°	148
Type 2 forecasted	n°	125
Type 3 forecasted	n°	51
Type 4 forecasted	n°	9

Work begun 37° week September 2005 through tunnels
Work finished December 2007

Cut surfaces about	mq	20000 (215285 ft)
Logging perforation done about	ml	6000 (19679 ft)

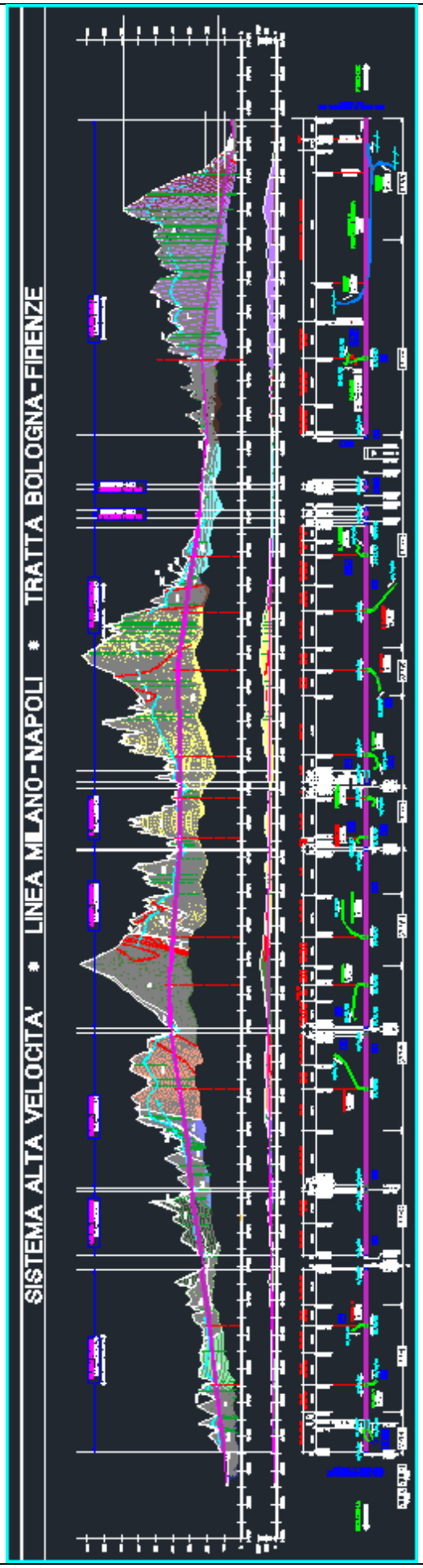
Used machines:

self-working machine with automatic positioners rdio-commanded	n°	3
Traditional machines	n°	4

Employers in the planning area

minimum n° 2 to a maximum n° 10

photo n° 1 - 2 ARMS SELF-MOVING MACHINE (JUMBO)



longitudinal profile of the railway

3. Complexity of planning and execution

Description of the particolar problems that would have been solved in the planning phases

The number of cuts to achieve was impressive and in a work like this it couldn't be defined and with lot of probability the entity of work could increased.
The kind of cutting and holes to do were experimented in the last years, in other yards, but numerically lower and we took more time.
To set up this project we could choose two different ways:

Planning A divide the production in many little yard, in each independent yard every operator equipped with cutting machines, planking, current generator, water tanks, means of transport.

Planning B use the automatic machines, build and fitted out on purpose in order to make some operations so to have elevated daily productions. So, the limited number of machines, of employers, of yards in which we have to operate contemporary and one huge hourly production.

The planning "A" could have requested the occupation of areas inside tunnel with the reduction of the carriageway in every working area with logistic problems of transit, that who operates in gallery know. Organizing and carrying out work in many yard dislocated in a lot of areas could have surely brought to an increase of costs and so to a reduction in probabilities to give out by contract the project.
To this planning credit we could avoid eventual problem of delay as concerns to the time–program, increasing the number of yards, of employers, of machines.
Using the planning "B" we could project and build specific machines in order to do definite workings that could permit to limit the contemporary number of yard inside the tunnel, to do hourly and elevated production and therefore propose more competitive prices. After many years of hard work in concrete sawing and perforating, where we wanted to optimize the operation of our employers in piloting the machines, this project could have been our unique life occasion to put into practice what we have day and night dreamed about the disposition of machine able to cut and perfore with the minimum physical employment.
You can't forget the fact that mounting and dismounting the traditional machines, that we use for this kind of operations, the diamond discs, used for progressively bigger diameters, operations that have to be done for every single alignment, cause an unusual physical effort of the operator.
Projecting , building, preparing the elevate automized machine to saw depths of 40÷50 cm (forty-fifty) (16÷20 in) it would have been not audacious because we had already some machinery used in yards , the long experience in development, so we just needed to create one particular machine that could suit in specific operations. In order to cut these depths it is not necessary to use a series of discs with progressive increase of the diameters like: the first saw depth with discs with a diameter of mm 800 (31 in), the second sinking with discs diameter of 1000 mm (39 in), the third and last sinking with discs diameter of 1200 mm (47 in), which are able to sink into 50 cm (20 in) like is normally expected in the machine utilize manuals for these case, but using a heavy machinery, discs with special cores . We have operated in this way, mounting in the machines only one with a diameter of maximum 1200 mm (47 in) which permitted to cut the expected depths without mounting or dismounting the discs, the machinery, and the guide rails. The biggest problem in this yard was the fact that almost all the cuttings needed one depth of 60÷100 cm (sixty-hundred) (24÷39 in), so bigger than the problems founded and solved for thicknesses at maximum 50 (fifty) cm deep.
It would have been necessary to build diamond disc machines to cut depths of cm 60-90 (sixty-ninety) (24÷35 in), mounting directly discs with 1800 mm (71 in) or 2000 mm (79 in) able to start the saw an the sinking into the requested depth without needing discs with a smaller diameter to do the rectilinear pre-cuttings. These machines would have had the possibility to be placed in the saw area and to start sawing works without the need of normally procedures:

guide rail fixing, protection carter mounting, disc mounting for the pre cutting,, the disc with bigger diameter oil-pressure mounting.
One machine to be placed and able to saw could have reduced the requested working time in comparison with the traditional machines, especially in situations where
An other important problem was the execution of cutting inside the n° 2300 niches, in which we had to use machines that could cut with diamond discs, and machines with diamond chains. The inter-axis, in each niche was 60 ml (197 ft) long so every 60 ml (197 ft) of the tunnel we had to unload the machines from the transport means, saw, dismount the machine, reload them again.
We had in warehouse an old jumbo with 2 arms , used to perforate the tunnels, we putted in one arm the saw machine with the disc and in the other the saw chain machine. We could place this jumbo in every niche and cut very fast both with chain machines and disc machines after we had located the self-moving machine (Jumbo) in the niche we had to work at. with this method we could earn a lot of time which normally is necessary to place the machines for the connection of electrical, water energy, and for their removal at the end of the work. All these components were part of the self-moving Jumbo.
Cuttings workings ,which normally are given out by contract don't permit to a little-medium firm, like ours to plan , build, amortize some particular machines and their costs. As a matter of fact this is typical of huge firms with annual big sales.
It was decided immediately to make one innovative choice to work with some particular machines for different cutting operations. Ours was one big opportunity and surely unrepeatable: we could automized some working processes with particular machines amortizing one consistent percentual of the costs of this work.
This machines could have given us the possibility in one eventual future to follow intervent with less costs and more competitiveness in the contract work.
Unfortunately in the market we concur and in the international market, because of the crisis, machines have to await better times……
Operators in saw, cutting, demolition, need of course more versatile machine, able to automize interesting workings, with less physical effort in order to increase faster the forecast working and to reduce the costs.
We can all think and build castles in the air, but to make machines building possible and use than so to permit the firm to have economic benefits, you can't have only the techniques and ideas but the opportunity to compete and award contract to special operations.

4. Innovative elements

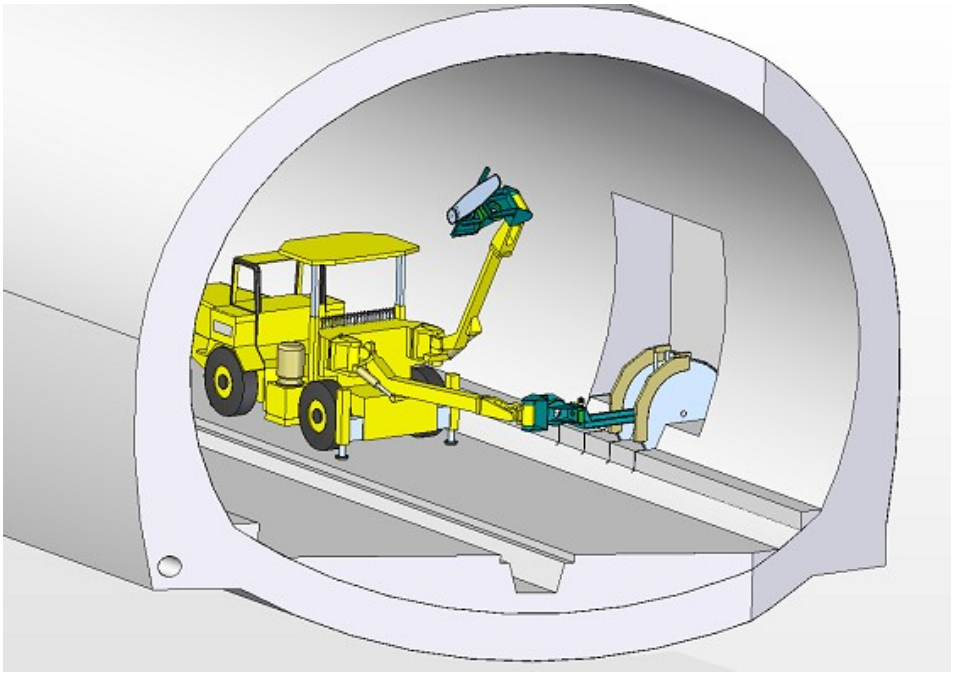
The innovative elements to point-out in this huge intervention are the methods used to automate the repetitive processes, which apparently are simple and quite common , but only if you operate in laboratory with very heavy and encumbering machines set in fixed areas. They become very difficult and complicated as soon as you have to conceive self-moved machines , which have to operate in building yards and are posted not only in a trampling plain , but also in vertical sides or curves like the usual railway or motorway tunnel arches.
The machine cutting zone with the guide rail must be quite light , should stay fixed and irremovable, because the diamond tool , during the process of cutting , doesn't stand any movement, and the self-moved machine , with the arm that sustains all the final equipment tool, has to stay steady and fixed in the space , in the original position , without suffering any lowering movements which can be caused both from the reactions of the tooling weight and the advanced movements , sinking, or as a consequence of the diamond tools extraction.
From many years, in laboratory , there are machines able to cut with their diamond discs of a 3000 mm (118 in) diameter and eventually of 4000 mm (157 in), which operate in a vertical axis and have a support frame with high weights. The idea of building a machine that can work in wall side with discs of 2000 mm (79 in) or 2500 mm (98 in) of diameter, provided with a horizontal axis ,with the guide rail of almost 5,00 ml (16 ft) which has to weight relatively not much, becomes difficult to make possible. In this intervention we were not able to resolve all that what we wanted and automate the process but we reached the resolution of many critical works; here is the list of the most significant:

A Self-moving machine provided with 2 arms used to cut with disc and diamond chain machines.

The management of automated working processes with only one self-moving machine , which requested the use of 2 kinds of different cuttings: one with a disc cutting and the other one with chain cutting. It was used an old drilling Jumbo with 2 arms (boom) ; in one arm was assembled one cutting head with a diamond chain working machine , and in the other arm were assembled 2 cutting heads with a diamond disc machine, which was able to cut in spaced parallel alignments , with a disc diameter that reaches at maximum 1600 mm (63 in).
The chain machine in this application was able to cut with a maximum deepness of 100 cm (39 in), the diamond disc machine with 70 cm (28 in).

photo n° 2

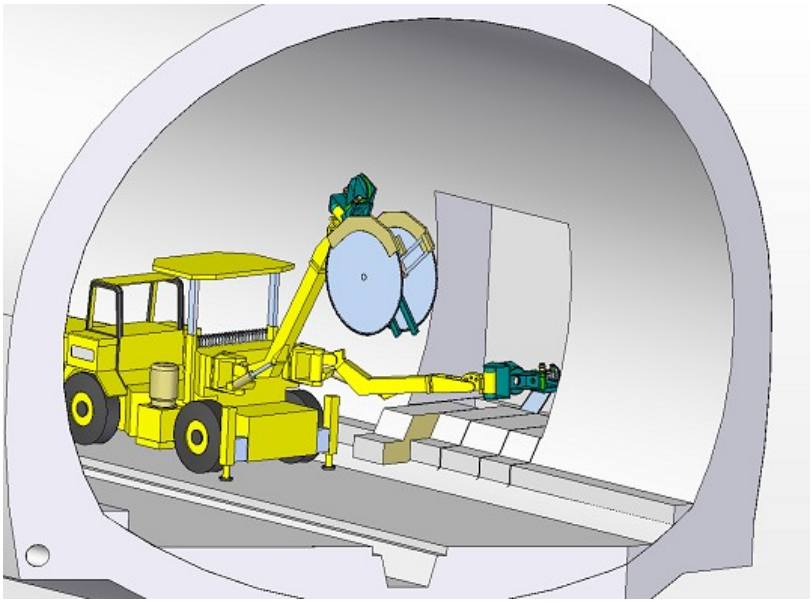
SELF-MOVING MACHINE WITH 2 ARMS WHICH IS BEING PLACED FOR 2 DISC CONTEMPORANEOUS CUTTINGS



technical drawing n° 1

CUTTING WITH SELF-MOVING 2 ARMED MACHINE

It was necessary to use the disc cutting because it permitted to set 2 alignments of contemporary cutting, it was used where it was needed the execution of cuttings with limited surface and in some cases with a cutting of a small tract which moved simultaneously in vertical and horizontal way.
The chain machine cutting permitted to intervene in the areas where it wasn't possible to extend beyond the edges. Over-cuttings were not accepted–allowed in spaces where requested cutting deepness was elevated as regards the height to cut and in the limited space zones.



technical drawing n° 2

CUTTING WITH SELF-MOVING 2 ARMED MACHINE WITH CHAIN HEAD, IN THE INSIDE OF THE NICHE

In the original project it was expected a number of 2300 lateral niches of the tunnel, areas in which should have been placed to execute from a minimum of 3 to a maximum of 10 cutting alignments, with disc and chain machines.
With this machine fitting out we set in one determinate space, without doing any movement of the self-moving machine , we placed the disc or chain machine arm in the foreseen cutting alignment , then moved this arm and put the other arm ,which had a diamond chain, that completed all the other forecast cuttings.
The single arms were telescopic so it was not necessary to move the self-moving machine after it was placed in the proximity of the niche ,and they were articulated in many axis to permit the accurate position in the specific cutting alignments .
The most repetitive movements and the accurate settings were radio-commanded with proportional commands, the operator could liberally intervene in the working area and control very carefully what was happening.

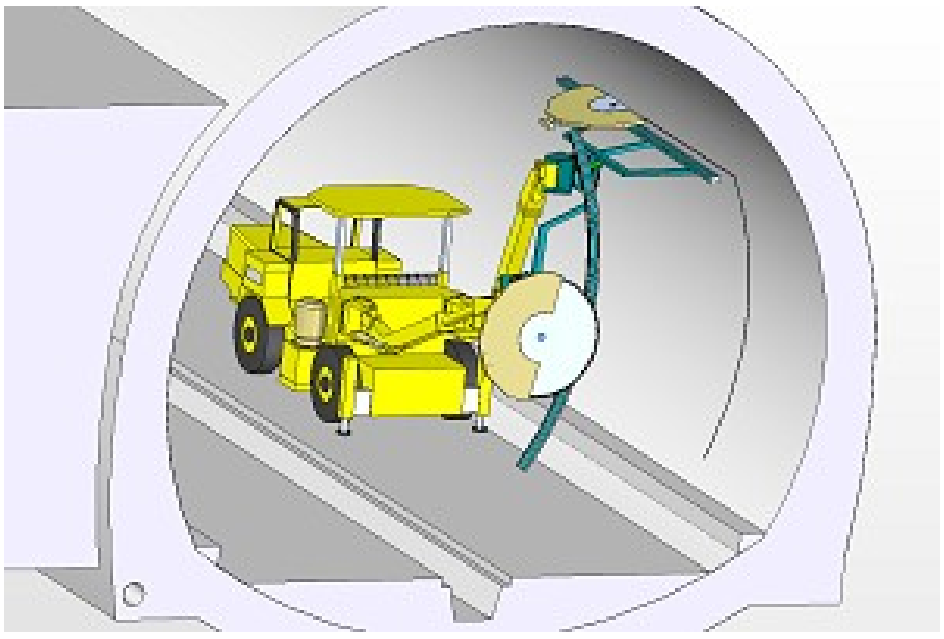
photo n° 3

CUTTING WITH SELF-MOVING 2 ARMED MACHINE WITH CHAIN HEAD, IN THE INSIDE OF THE NICHE

The self-moving machine (in this case the Jumbo) hauled a trailer, in some tracks where it was necessary to change often the way, inside the tunnel, instead of using the trailer we used a camion, these means of assistance transported one electric current generator, the beacon tower, the water-apply ship, the water pumps to pressurize the using, one escort traditional saw machine and the tooling up, when normally is necessary in these kind of workings, when the convoy stopped in the working area, we positioned the arm with the saw head in the forecast alignment, in the inside of the niche and it was possible to start immediately sawing and when the interventions ended, we could move it in one stop position, we positioned the other arm whit the chain head and completed the saw alignments in the depth and with the requested geometries. The daily production of this machine was impressive in comparison with the traditional machinery tooling.

B Perimetral sawing of the new lateral niches with 2 kinds of guide rails of the saw heads

When you have to make vertical and horizontal axis cuttings, in the arch's intrados of the tunnels pier you have to use 2 kinds of rails, in the horizontal running length wise cuts, the rail has to be rectilinear, in the vertical alignments it should have one arch conformation with a geometry similar to the tunnel hangings because in case it was rectilinear, to saw the concrete with constant depth in the central zone, where arrow raises progressive way, you have to use diamond discs with a huge diameter. In our case, in which was foreseen to saw with a depth of 70 cm (28 in) for vertical sawing of about 5,00 ml (five/00) (17 ft) of length the theoretic arrow was 75 long, so the disc should have cut one length of 70 (28 in) +75 (30 in)=145 cm (58 in). To saw in this depths it was necessary the use of a disc with a diameter of ø 3300 mm (130 in) which is for the time being impossible for a yard machine.
In this situation we used some rectilinear guide frames, about 6,00 ml (20 ft) long, to make horizontal sawing and with an arched conformation so to cut vertically.



technical drawing n° 3

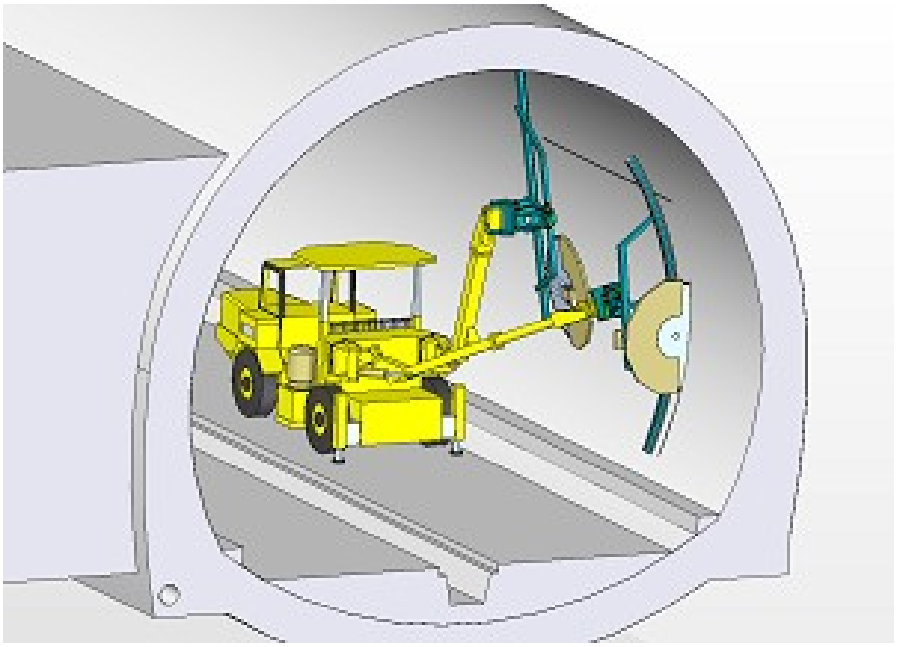
CUTTING WITH SELF-MOVING 2 ARMED MACHINE RECTILINEAR GUIDE RAIL SAW

These frames were moved and positioned in the sawing alignments by a self-moving machine.
The self-moving machine positioned the arched rail, when it was necessary to saw vertically and the rectilinear rail for horizontal sawing movements . In some case, when the niches had not to be used in a continuative way, we operated with traditional machinery.

The operating time which was necessary to carry out the same typology of work was much longer , and the difficulties for the operator to fix the single guide rails in the tunnels, both vertically and horizontally was evident. In the vertical ways we had to proceed, using traditional machinery, 1,50 ml (5 ft) along; so to avoid excessive arrows, mount the head , use at first a disc with a diameter of 800 mm (31 in) for the pre-sawing ,then with a diameter of 1200 mm (47 in) and after that with a 1600 mm (63 in) of diameter. Finally we had to dismantle the head and the rail and position them for another alignment process of 1,50 ml (5 ft) repeating all the previous workings. These phases had been repeated continuously to cover all the length of the forecast sawing alignment.

technical drawing n° 4

CUTTING WITH SELF-MOVING 2 ARMED MACHINE CURVED GUIDE RAIL



C Rectilinear cuttings with vertical, horizontal or inclined axis, longitudinal to the tunnel, using only one diamond disc, for a saw depth of cm 70 (seventy) (28 in), to cm 100 (a hundred) (39 in)

When you have to carry out rectilinear cuttings into consistent lengths , for example longer than ml 20 (twenty) (66 ft) and deeper than cm 40 (forty) (16 in), so to speed up the working process , we fixed the saw head guide rails and proceeded contemporaneously with at least 2 (two) saw heads , even 3 (three) in some cases , which work along the same alignments, up to different depths , to avoid the continuous replacement of the diamond disc for the usual sinking movements: with the 1000 mm (39 in) diameter up to cm 40 (16 in),with the 1200 mm (47 in) up to 50 cm (20 in),with the 1500 mm (59 in) up to 65 cm (26 in), with the blade diameter of 1800 mm (71 in) we could reach a depth of cm 80 (31 in).
This method is valid for very long sawing alignments and in cases when the concrete surface, where rails have to be fixed , is regular.
When we had to saw in limited alignments that could request sawing axis movements it became a very complicated work both because of the continuous assembly and disassembly of blades with different diameter and because of the huge number of components that had to be moved manually and that can have a weigh and particular dimensions that needed at last 2 (two) operators.
In our operation , the rail fastening surface was not always regular , the rectilinear sawing alignments varied from few linear meters into a maximum of 50÷100 (fifty-hundred) (164÷328 ft), because of the presence of curves, because of the execution of particular and not continuative tracts requested by the client owing to static problems or to the necessity to fractionize the working phases in conformity with definite technics.

photo n° 4

SAW WITH VERTICAL AXIS INTO A 70 CM (28 in) DEPTH, USING ONLY ONE DISC DIAMETER

To carry out these workings we decided to project and build one machine able to saw with the constant use of diamond circular blades, whose diameter goes from 1800 mm (71 in) to a maximum of 2500 mm (98 in), which permitted to operate from the beginning of the sawing process till the maximum requested depth, which varied from cm 70 (28 in) to cm 100 (39 in), with the same disc diameter , without using different diameters. This machine was provided by one guide rail 6,00 ml (20 ft) long, by one strong head able to set in motion the diamond discs with a big diameter , a silver core 5÷10 mm (0,20÷0,39 in) thick so to have a bigger rigidity (the thickness of the discs cores we used with traditional machinery was 3,5 mm (0,14 in)).
The rail and the head were moved by one self-moving machine which positioned with preciseness the discs along the sawing alignments and was able to maintain the same fixed and rigid position during all the sawing operation.
Even in this case there was a convoy which followed the self-moving machine with the current , water generator and all the necessary tooling; the machine was set and ready to saw and complete the sinking into the requested depth. To proceed along the saw alignments for rail lengths longer than 6,00 ml (20 ft) we used laser rays which located the correct alignments.

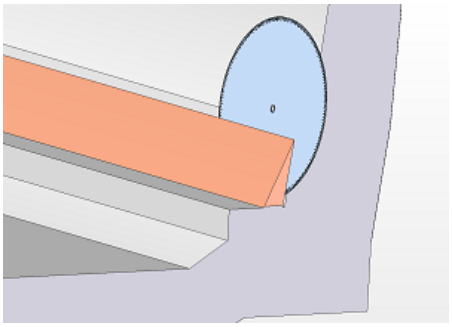
photo n° 5

horizontal cut

In this machine too the disc drives and the accuracy movements in the rail placement were set in motion by the radio-command which permitted the operator to manage the machine in the proximity of the working zone. Who doesn't belong to this sector is not able to imagine how difficult is to prepare one machine that can permit to saw till the foreseen depth without replacing the circular blade to cut in progressive way into greater depths.
With all the machines into circulation in the mechanics sector, marble sector, etc, it seems usual to this kind of machines at our disposal also in yard for concrete saw, but it's not exactly thus. The diamond blades with the core thick 5÷10 mm (0,20÷0,39 in) and a diameter long 1800÷2500 mm (71÷98 in) are very heavy and the operator can't move them manually. The saw head which set in motion these discs and the guide rail has to be robust and weigh relatively not much, in order to get moved and placed automatically by the self-moving machine. During the saw workings, the supporting framework placement in space, has to be fixed and rigid.
I've never seen machines like these actually produced and put on market, probably because the application and utility field are few, because the machine as a whole is very heavy and expensive as an investment.
The setting of the machine was grasped fully at once after we reached a first good but eventful point we reached in yard a production of huge sizes: in one 8 hour shift the production measured in saw surface varied from 80 to 100 mq (861 to 1076 sd ft) depending on the working shift.

D Sow with angle smaller than 30° measured between the disc axis and the concrete surface

In many areas of the tunnel we should do rectilinear cuttings with a disc axis almost vertically in the pier zone of the tunnel arch. As you can see in the photos and plans, in the first part of cutting, the diamond disc has to carve in concrete with an angle, witch should be in favour of the later deviation for the slipping and therefore for continue deviation as to the forecast rectilinear axis.
In cutting operations is very important to do the pre-saw perfectly in axis with the disc so to avoid during the sinking, that the steel core scrape against the concrete surface wearing and tearing because of the friction causing so the stop of the disc or absorbing power, power this that can't be available in the diamond sector removal area but that can be absorbed by the friction, provoking heat that can bring into the immediate core overheating and into its breaking.
In order to avoid these problems normally we start the saw process with a circular blade that has a little diameter with higher lateral rigidity and a steel core higher thickness and sometimes also with one width bigger than the diamond sector in order to obtain one initial saw that could permit a higher tolerance to the misalignments. In our case , the disc assembly and disassembly should have been laborious and practically hard to make: the space between the concrete wall and the central disc fixing flange was minimal and with discs with big diameters it could have been hard to execute these continuous diamond discs replacements; the difficulties furthermore could have been even higher because using a ml 6,00 (20 ft) rail they could recur continuously for any replacement of ml 6,00 (20 ft).



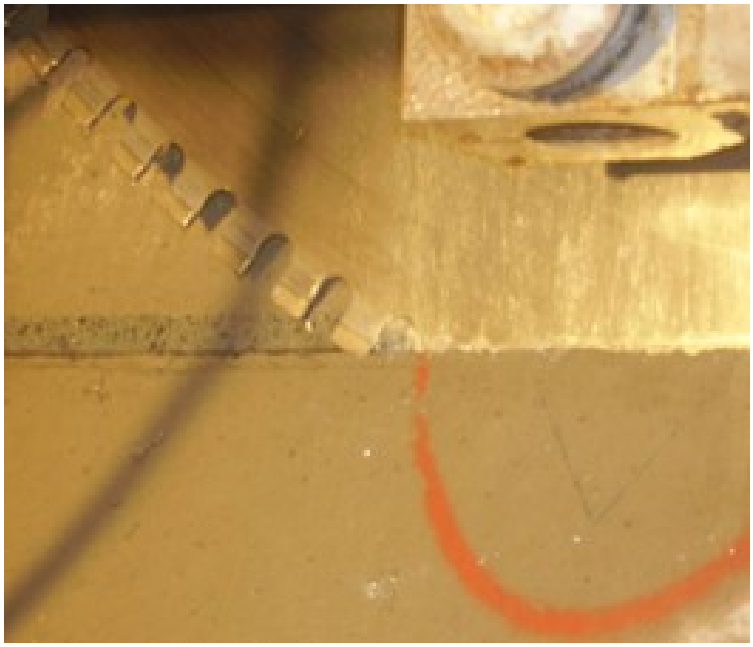
technical drawing n° 5

VERY INCLINED SURFACE CUT WITH DIAMOND DISC

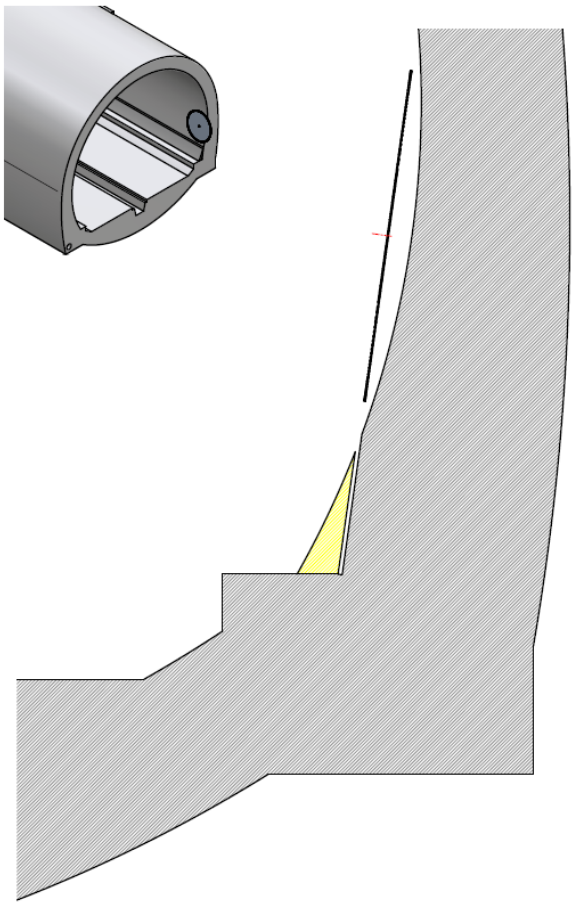
It was extremely important to individualize one method that could permit the saw using only one disc ,which should have a big diameter able to do the definite pre-cutting without sustaining any deviation, remaining so rectilinear cut able to the sinking movements into the projected depths, always with the same disc without we needed replacements that could have slowed down the saw production pro-hour.

photo n° 6

VERY INCLINED SURFACE CUT WITH DIAMOND DISC



We never threw ourselves into similar situation, even because we have never used machines that were able to cut thicknesses of cm 80÷100 (31÷39 in), starting the saw completing it with the same diameter. We were sure that during the saw working it was possible that deviations of the saw optimal axis turned up and so we had to find an other solution in order to be able to do these workings. With our project aim to realize one self-moving machine able to set the rail with the saw head in the intervention area , it could have been very important the possibility to execute these kinds of works using only one diamond disc diameter, but we were not sure to afford it and go over the problems we singled.

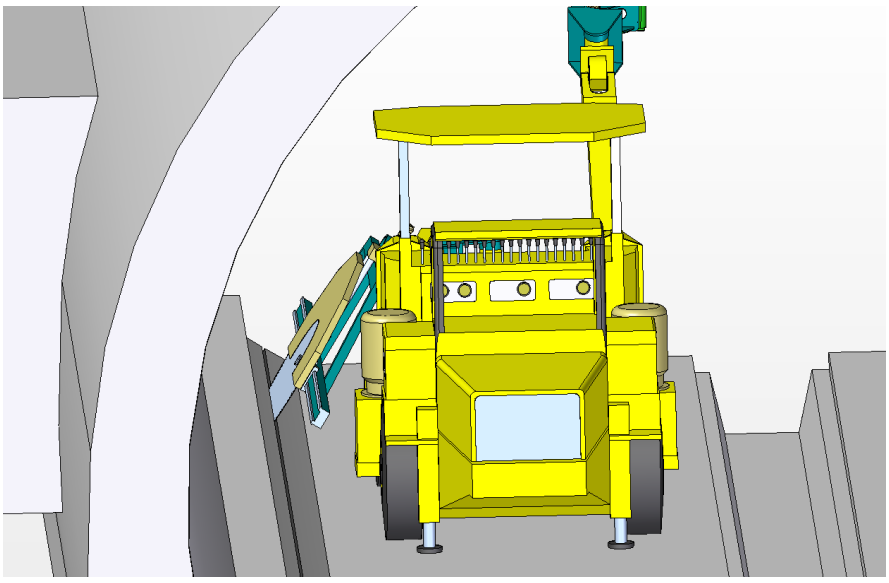


technical drawing n° 6

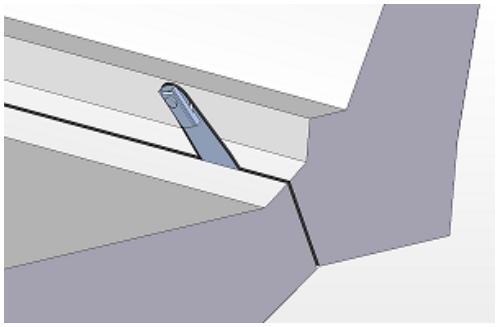
It was expected to place one orthogonal wheel to the disc axis so it could maintain it in position during the first millimetre of cut, in order to avoid deviations.
The forecast method worked perfectly ,the cuts turned out rectilinear and the sinking into cm 80 (31 in) of depth was possible even in these situations without proceeding with the discs replacement but using only one disc, in same case with a diameter of 1800 mm (71 in) and in others of 2000 mm (79 in).
The saw surfaces that we could execute for every work shift were huge and in this case 80 mq (861 sq ft) long per shift.

5. Quality specifications

In this project we had decided initially to prepare machines provided with automatical settings to obtain elevated production per work shift in order to deliver the requested works as expected in time plans.
In the initial phase the operation could have been done with traditional machines and methods in order to permit the planning, the building and the setting up of the machineries that were only ideas, sketches (project proof) and were only along the experience result (vulgarly experience is considered as the amount of all the mistakes done in the past) but that we were not sure could be really build and functional in productivity.
We come to an agreement with others firms in our sector that in case of difficulty respecting the forecast time could have collaborate in this process with their employers and their tooling.
Not everything we proposed to build worked and/or was produced, but the machines dedicated to the most dense working ,the most important as operative entities have given a result of a huge production pro-hour and worked perfectly.
For the whole period of intervention we didn't need to operate with other outer firms in order to increase the production.
The machine with 2 arms, which initially seemed one unreal project, should have done one work of massive dimensions (2300 niches) and it worked immediately superbly.
With this machine it was reached about 80% of the forecast production in the inside of the niches, the remaining 20% was manually done because they could not be produced in progressive sequence, owing to the presence of one obstacle, one drawback.
If the niches where we should have operated were numerically limited and/or were displaced into considerable distances it was expensive the project to use the self-moving machine in the operative area; in these situation was used the traditional machinery.



In the longitudinal cuts of the upside down arch, which should done with the axis that was inclined of circa 20° to the vertical. Some light sloughs occurred in the saw area ,and these blocked the diamond disc in the crack obtained with the saw. When these situations occurred we proceeded with the cutting using diamond chain machine which better stands these kind of problems, because the bar inserted in the sawed zone took up one smaller area than one diamond disc with 1000 mm÷2000 mm (39 in÷79 in) could do. So it was possible to insert some wheel wedges inside the crack, which blocked the closing of the cut. The geometrical bar conformation permitted to place the wedges with a short distance between in comparison with the area which was being cut and which was still integral, while when we worked with the diamond these distances were higher and the problem is even bigger because the disc saw is done in following sinking rubs; therefore the wedges can be insert only during the execution of the last sinking rub.



In the cutting of the new lateral niches of the tunnel that should have been done in the reinforced tract of the pier along the trampling plane long ml 6,00 (20 ft) we couldn't work with one machine that used one only diameter of the diamond disc; so we have used 2 kinds of guide rails, arched, with the same ray of the tunnel for verticals saws and rectilinear for horizontal, longitudinal saws.
The depth to cut was 70 (seventy) cm (28 in), to do this cutting we used 2 (two) different diameters and in some case 3 (three) to replace the discs in the horizontal cuttings because we were using one self-moving platform .
The number of the new niches to cut in the perimeter was about 70 (seventy). During the execution of this operation we couldn't build one saw head, moved by one automatic positioner able to saw the perimeter of niches inside one tunnel face, using only one diameter of a diamond disc to cut vertically and horizontally.
The niches that had to be worked out were not so much but the technical problems we had to go over were demanding.
With our acquired experience we hope to resolve this work with machines able to saw using only one kind of diameter, like it was possible to do in other operations.
We will try to achieve this technical aim in our next important construction for whom we want to award a contract, crisis permitting.....

6. Documents to submit

Name of the file	Description / content
Tondin-DiamondAward.2011	Workings in the ACF (Alta Capacità Ferroviaria) which connects Bologna city to Firenze city.