Introduction of Products

Bulldozer D71-24

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As the largest models in the "Super-Slant Nose + HST + ICT" series, which has become the brand image of Komatsu small and medium-sized bulldozers, new models D71EX/EXi and PX/PXi-24 have been developed and introduced to the market. Here is an introduction of these products.

Key Words: *Bulldozer, D71-24, HST, Super-slant nose, New ICT, IMC 2.0*

1. Introduction

The D71EX/EXi and PX/PXi-24 (hereinafter D71-24) were developed as alternatives to the D65-18 power angle power tilt dozer (hereinafter PAT), which is one of the main bulldozer products.

In recent years, this class of bulldozer has received a strong demand for the development of D65 class HST machines that are compatible with ICT specifications due to the increasing proportion of highly versatile PAT machines and the increasing demand for ICT specification machines. This paper introduces the outline of the new model "D71-24" that was born by inheriting the Komatsu's original DANTOTSU performance front visibility established with the D37-D61. (**Fig. 1**)

<Slant Nose + HST + ICT>

Fig. 1 D71PXi-24
(North American wide gauge specification)

2. Aims of development

Based on Komatsu's "quality and reliability," the D71-24 inherits the DANTOTSU front visibility and excellent operability of conventional HST machines. In addition to improving environmental friendliness, economy, safety, workability, operability, and maintainability, the merchandise power has been greatly improved by incorporating a more advanced "ICT."

The outline is introduced below.

(1) Environmental friendliness and economy
  1) Auto-deceleration function added
  2) Automatic "E" mode function added

(2) Safety
  1) Operator presence sensing system
  2) Anchor point for machine tie-off added

(3) Workability and operability
  1) Largest production in its class
  2) Increased steering speed
  3) Increased travel speed and gear shift speeds (Quick shift mode)
  4) Increased blade lowering speed
  5) Addition of working mode

(4) Maintainability
  1) Addition of sampling port
  2) Remote lubrication of equalizer bar side pin
  3) LED lights mounted
  4) Tool less operation for 3M blade folding

(5) ICT
1) Gateway controller mounted
2) New ICT system mounted
(Intelligent Machine Control 2.0)

3. Features of added functions

3.1 Environmental friendliness and economy

3.1.1 Auto-deceleration

When the machine remains stationary for a certain period of time, it will automatically become low idling to suppress wasteful fuel consumption.

The original engine speed is restored by operating the work equipment lever or the travel lever.

The auto-deceleration time can be set freely in the range from 3 seconds to 60 seconds.

3.1.2 Automatic "E" mode

Even when working in the "P" mode, it automatically switches to the "E" mode under light loads such as traveling to reduce fuel consumption. (**Fig. 2**)

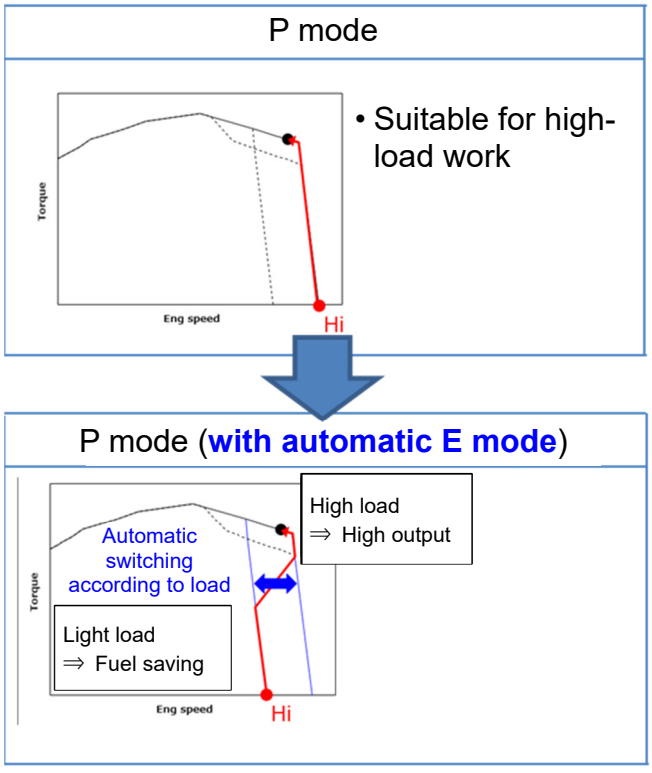

Fig. 2 Automatic "E" mode conceptual diagrams

3.2 Safety

3.2.1 Operator presence sensing system

This function detects whether the operator is seated to prevent unexpected operation of the machine while the operator is not seated, and thus strengthens the accident prevention function.

3.2.2 Anchor point for machine tie-off

An anchor point is installed to connect a safety belt to prevent falls during maintenance and cleaning work. (**Fig. 3**)

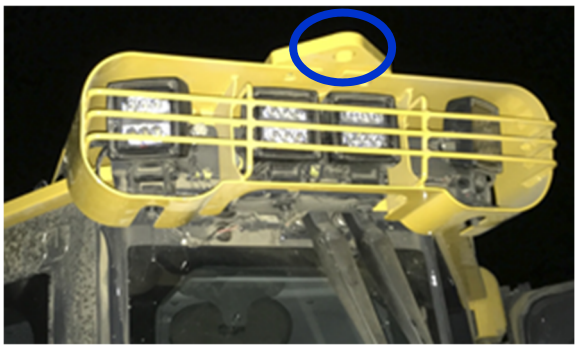

Fig. 3 Anchor point

3.3 Workability and operability

3.3.1 Largest production in its class

The engine rated horsepower and blade capacity have been increased to obtain a production 105%, compared to the D65-18. The largest production has been achieved in its class.

In addition to the automatic "E" mode mentioned above, the work efficiency has also been improved to 103% compared to the current model by adopting a variable charge pump and improving efficiency by making the LS pressure changeable. (**Fig. 4**, **Table 1**)

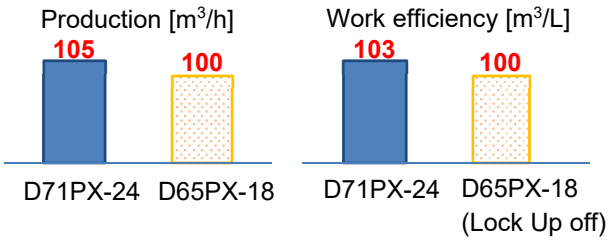

Fig. 4 Comparison of production and work efficiency

Table 1 Efficiency improvement list

<Efficiency improvement items>

Item	Function
Automatic “E” mode	Automatically switches to economy mode, when the load is light, to save energy
Variable charge pump adopted	Reduces loss by controlling the flow rate as needed
Variable LS pressure	Reduces differential pressure and loss when traveling backward

3.3.2 Increased steering speed

When steering, conventional HST machines slow down the inner side track, so the travel speed has decreased significantly. The D71 has added a function to increase the speed on the outer side track to minimize the decrease in travel speed.

It has greatly improved maneuverability. (**Fig. 5**)

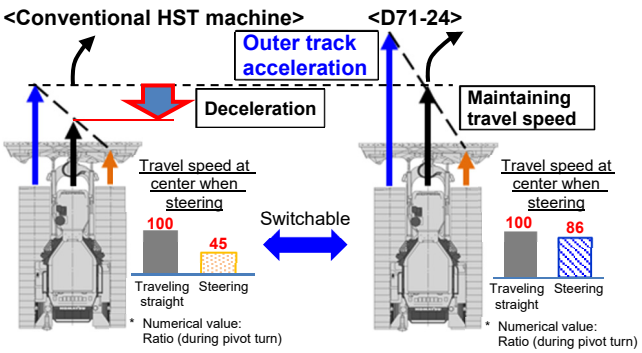

Fig. 5 Comparison of turning speeds

3.3.3 Increased travel speed and gear shift speeds

Changes in engine output, reduction ratio, and electronic HST control system have increased productivity by 10% to 22% over the entire speed range compared to conventional HST machines.

In addition, the quick shift mode has been changed from the 3-speed to 4-speed gear shift, greatly improving maneuverability. (**Fig. 6**)

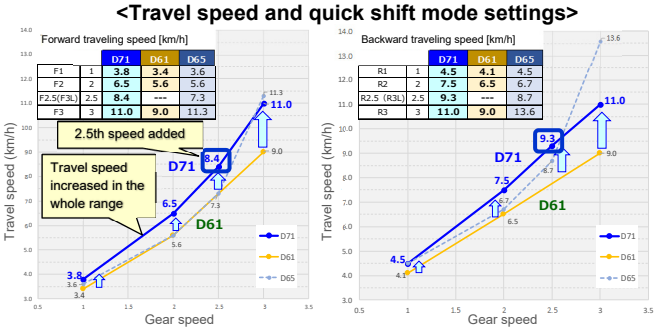

Fig. 6 Comparison of travel speed settings

3.3.4 Increased blade lowering speed

Electric controlled work equipment lever and quick drop valve (QDV) can increase lowering speeds and significantly improved the operability. (**Fig. 7**)

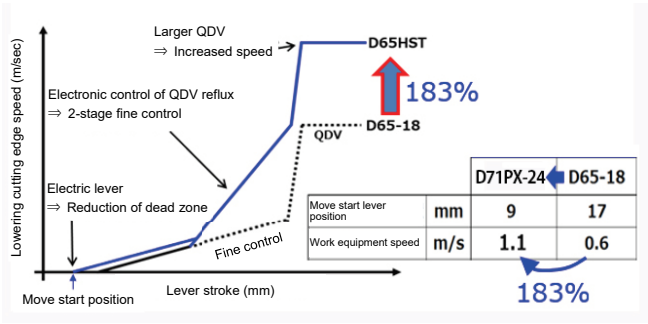

Fig. 7 Comparison of blade lowering speeds

3.3.5 Addition of working mode

A travel/work equipment mode has been added, making it easier to make setting according to the preference of the operator. (**Fig. 8**)

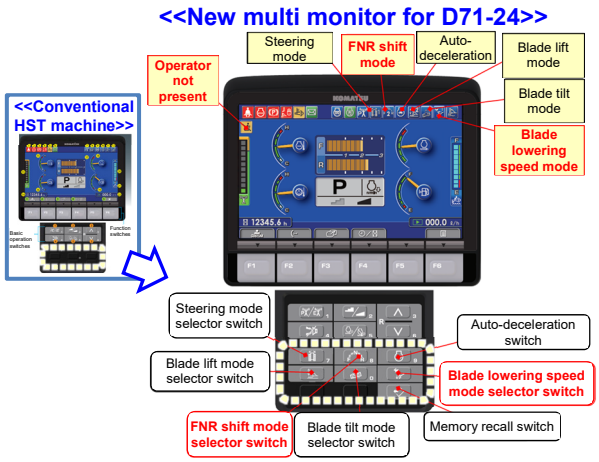

Fig. 8 Working modes

3.4 Maintainability

3.4.1 Addition of sampling port

Ports for collecting engine oil, coolant, and hydraulic oil have been added. This eliminates the hassle of opening the conventional tank caps. (**Fig. 9**)

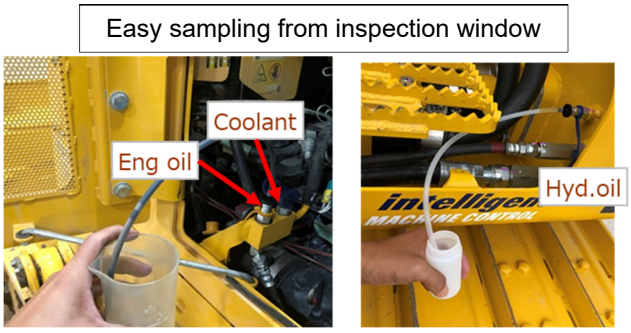

Fig. 9 Sampling ports

3.4.2 Remote lubrication of equalizer bar side pin

The greasing port of the equalizer bar side pin, which was conventionally buried in the accumulated materials and was extremely hard to grease, has been remoted to the outside of the track frame, making it possible to grease without cleaning materials. (**Fig. 10**)

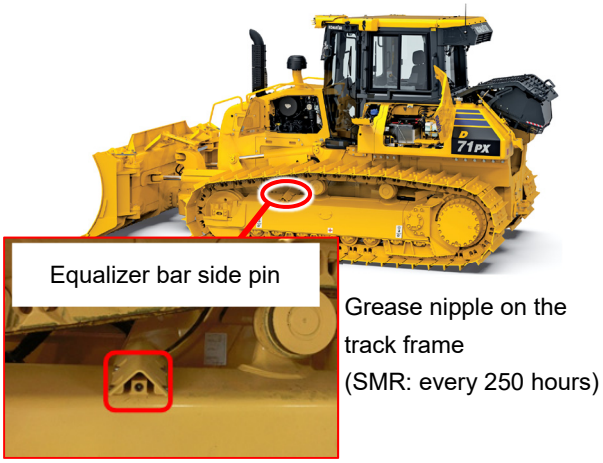

Fig. 10 Remote lubrication

3.4.3 LED lights mounted (Fig. 11)

Equipped with four energy saving and long life LED lights in front of the CAB and two in the rear as standard equipment, making it possible to perform night work more safely.

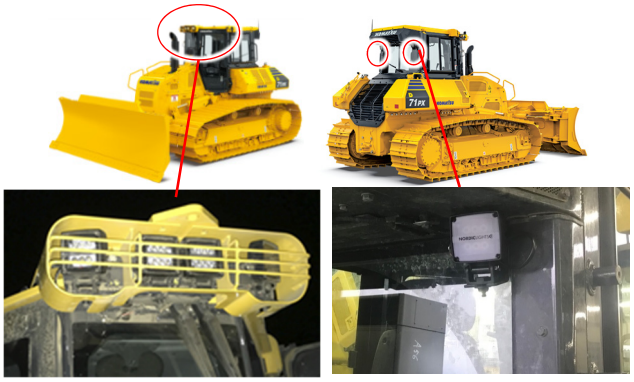

Fig. 11 LED lights

3.4.4 Tool less operation for 3M blade folding

No tools are required to fold the blade, making it easier to fold and eliminating the hassle of transportation. (**Fig. 12**)

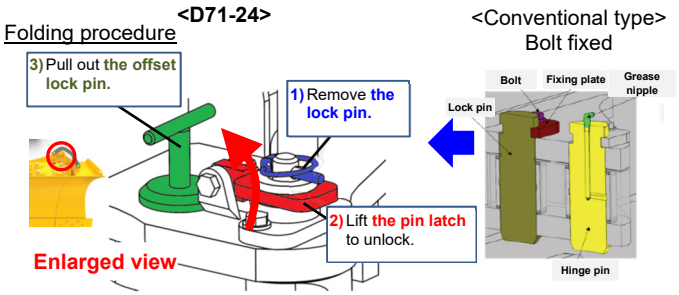

Fig. 12 Tool less operation structure

3.5 ICT

3.5.1 Gateway controller mounted

The “KOMTRAX” system that allows you to easily obtain information on machine positions and service meters on your office computer, has been updated to the latest version. Feeding of seatbelt non-fastening information has also been added newly. The system also supports the function of remotely rewriting engine controller software by utilizing communication technology and Internet technology.

3.5.2 New ICT system mounted (Intelligent Machine Control 2.0)

The Intelligent Machine Control system that automatically controls the blade based on the blade cutting edge position and construction design data obtained from the GNSS antenna and GNSS correction information has been upgraded (**Fig. 13**) and expanded to all HST bulldozer models (D37/D39/D51/D61/D71). The evolved Intelligent Machine Control 2.0 has added six new functions. It has greatly expanded the scope of application of automatic control, facilitating construction and reducing operator fatigue in various bulldozer operations. (**Fig. 14**) In addition, by adopting two antennas compatible with multi-GNSS, it has improved the reliability of construction accuracy, which contributes to construction time reduction and efficiency. Moreover, the monitor display and cutting edge calibration method have been reviewed to improve usability.

Fig. 13 Equipment with new ICT system

	Additional function (New! : Industry's first)	New ICT bulldozer system	Current ICT bulldozer
Leveling work	• Grade breaks ⇒ 50% reduction in over-digging when traveling on steps	◎	◎
Dozing	• Proactive dozing control ⇒ Achievement of work efficiency comparable to that of skilled operators (40% up of current ICT) • Manual coordination control ⇒ Operator operation possible during automatic control • Tilt steering control (New!) ⇒ Reduction of operator fatigue	◎	◎
Lift	• Lift layer control (New!) ⇒ Traveling time -50%	◎	×
Auxiliary work	• Quick surface creation (NEW) ⇒ Expand the versatility of automatic control with easy work anytime, anywhere	○	×

Fig. 14 Working range in which automatic construction is available

(1) Lift layer control function (**Fig. 15**)

A function to create a design surface used for blade control based on the existing data or construction result data obtained during traveling (as-built data) has been added. By pressing the shortcut button on the touch panel, an intermediate design surface is automatically created between the design drawing and the as-built data. After that, pressing the cut/fill offset switch at the operator's hand to offset the design surface makes it possible to perform earth and sand lift and leveling work with constant thickness. Compared to manual operation, the construction time for lift layer control can be reduced by up to half.

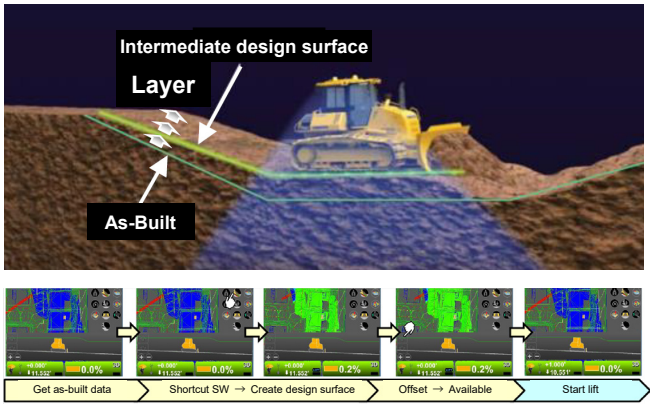

Fig. 15 Lift layer control function

(2) Quick surface creation function (**Fig. 16**)

The operator can prepare an appropriate plane design surface according to the work in the field at the required timing. In addition, the controls have been greatly simplified compared to the conventional machine to improve usability.

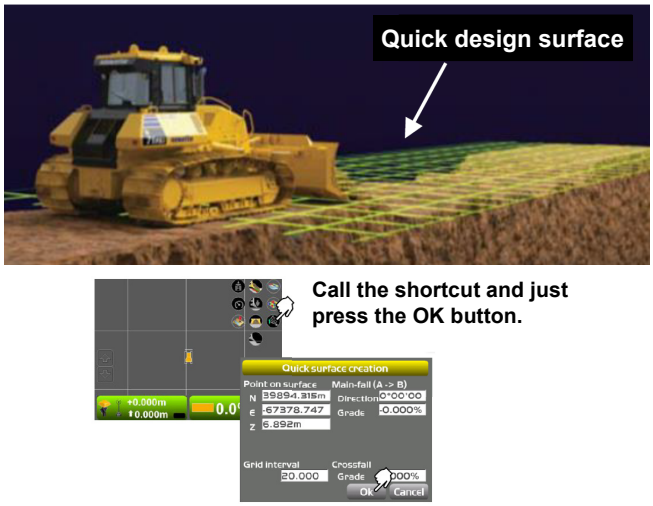

Fig. 16 Quick surface creation function

(3) Proactive Dozing control (**Fig. 17**)

A control function that can achieve dozing, and cutting & carry by utilizing the latest as-built data which machine has already traveled. Generating the target cutting edge locus by offsetting the acquired as-built data surface downward can prevent waviness and missing that have occurred in conventional control. In addition, the blade response just before the machine slips is optimized so that the machine can shift the timing from dozing to cutting & carry smoothly and efficiently like done by a skilled operator. To confirm the effect of the new function, the comparison data obtained by automatic dozing work tests is shown below. The amount of dozed soil per hour has increased significantly compared to the conventional control, realizing dozing performance close to that of manual operation by a skilled operator. (**Fig. 18**)

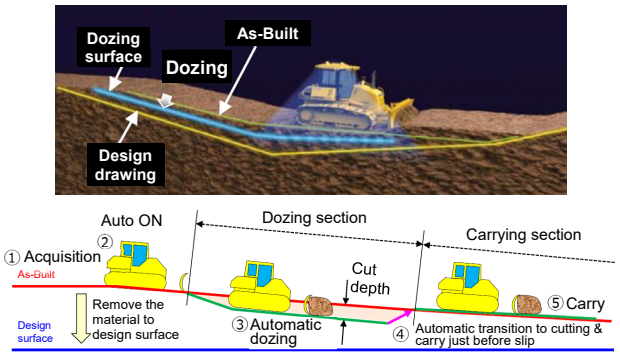

Fig. 17 Overview of proactive Dozing control function

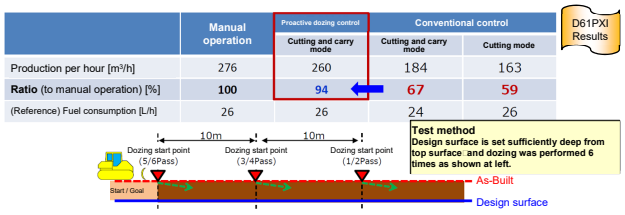

Fig. 18 Comparison of automatic dozing work efficiency

(4) Manual coordination control (**Fig. 19**)

Manual coordination control has been added that allows, even during automatic blade control, the blade to be temporarily raised or lowered (cut depth) and the tilt angle to be fixed to an arbitrary amount if the operator operates the work equipment control lever. This function enables the operator to finely adjust the cut depth or partially thinly spread and grade on his/her own initiative even during automatic control. Further, in the slope traversing work, the blade can run in parallel to the slope, which enables the work in which the operator's preference is prioritized.

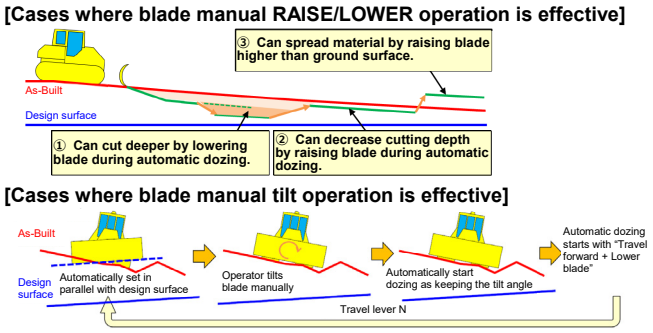

Fig. 19 Manual coordination control

(5) Tilt steering control (**Fig. 20**)

When the direction of travel of the machine changes due to resistance by the unbalanced load of the blade, blade tilt is used to automatically apply tilt steering control. It eliminates the need for the operator to operate the steering wheel to correct the direction of machine travel.

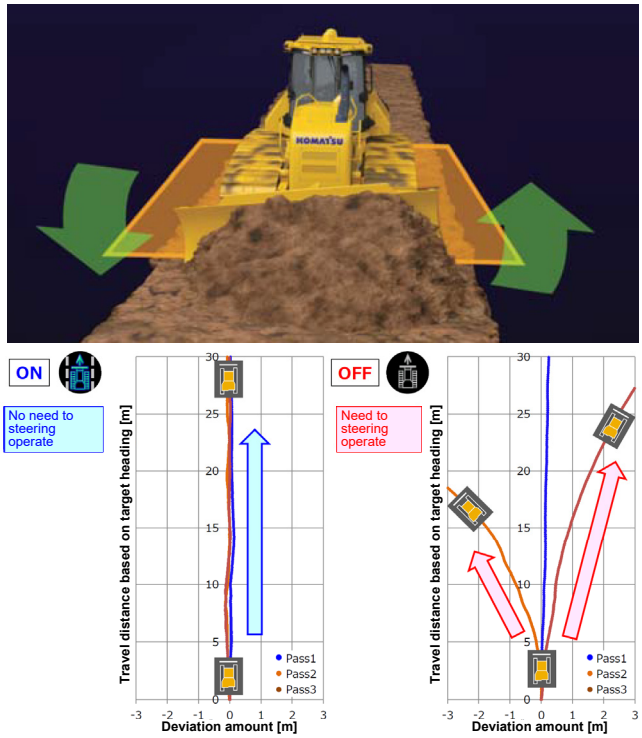

Fig. 20 Tilt steering control

(6) Higher blade response on grade breaks (**Fig. 21**)

At residential land development jobsites in North America, there is a lot of work to level the ground while passing through grade breaks, but there were cases where the blade response was delayed when passing the slope resulting in cutting in, and it was necessary to reduce the travel speed sufficiently. When passing through convex grade breaks, the new control system momentarily increases the response of the blade raising control so that the ground can be leveled without slowing down the travel speed.

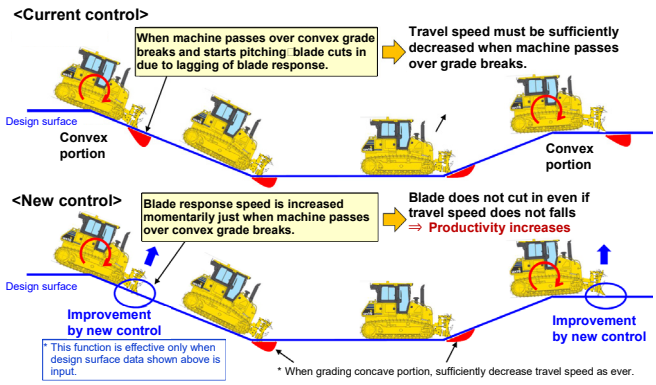

Fig. 21 Higher blade response on grade breaks

4. Conclusion

D71-24 has been introduced to the market in response to the strong expectations of the market. We are proud that we have finished the best bulldozer that combines the smoothness of the D37-D61HST, which has been highly evaluated by the market, with strength and mobility, and we are confident that this product will deeply satisfy our customers.

Introduction of the authors

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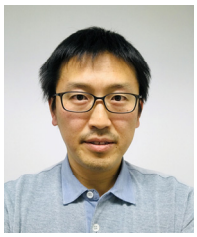

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[A comment from the authors]

We still remember the excitement of having a surprise exhibition of the prototype machine at CONEXPO 2020 before the completion of development and receiving favorable reviews from many people. We are grateful for the good luck of witnessing the new development of Komatsu HST Bulldozer's flagship machine, and we would like to express our sincere gratitude to all those involved in the development. Thank you very much.